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7 octombrie 1885 – 125 de ani de la nașterea lui NIELS HENRIK DAVID BOHR, fizician danez, laureat al Premiului Nobel (7 oct. 1885 – 18 noiemb. 1952).

16 octombrie 1940 – 70 de ani de la nașterea arhitectului ALEXEI PALADI (16 oct. 1940).

- **5 noiembrie 1880** 130 de ani de la nașterea nuvelistului și romancierului român MIHAIL SADOVEANU (5 noiemb. 1880 19 oct. 1961).
- **14 noiembrie 1840** 170 de ani de la nașterea pictorului francez CLAUDE MONET (14 noiemb. 1840 26 dec. 1926).
- **17 noiembrie 1935** 75 de ani de la nașterea lui ANATOLIE CASIAN, doctor habilitat în fizică și matematică (17 noiemb. 1935).
- **24 noiembrie 1925** 85 de ani de la nașterea lui SIMON VAN DER MEER, fizician olandez, Laureat al Premiului Nobel (24 noiemb. 1925).
- **27 noiembrie 1885** 125 de ani de la nașterea prozatorului și dramaturgului român LIVIU REBREANU (27 noiemb. 1885 1 sept. 1944).
- 27 noiembrie 1940 70 de ani de la stingerea din viață a lui NICOLAE IORGA, istoric, publicist, critic literar și de artă, memoralist, dramaturg, prozator, poet și om politic român (17 iun. 1871 27 noiemb. 1940).
- **30 noiembrie 1835** 175 de ani de la nașterea prozatorului american MARK TWAIN (Samuel Langhorne Clemens) (30 noiemb. 1835 21 apr. 1910).
- 2 decembrie 1935 75 de ani de la nașterea poetului român NICOLAE LABIȘ (2 dec. 1935 – 22 dec. 1956).
- **4 decembrie 1670** 340 de ani de la nașterea lui ANTIOH-VODĂ CANTEMIR, Domn al Moldovei (4 dec. 1670 1726).
- 7 decembrie 1900 110 ani de la nașterea lui ȘTEFAN NEAGA, compozitor, dirijor și pianist (7 dec. 1900 – 29 mai 1951).
- 24 decembrie 1910 100 de ani de la nașterea fizicianului și profesorului universitar american WILLIAM HAYWARD PICKERING (24 dec. 1910). A realizat primul satelit artificial american.

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Bugaian L. Ciclul III, studii doctorale: oportunități și provocări. Studiile doctorale în Europa au simțit o schimbare majoră în ultima decadă. În Uniunea Europeană studiile doctorale creează platforma principală de formare a cercetătorilor de excelență, care dau vizibilitate și impact internațional cercetărilor europene. Valoarea și importanța studiilor doctorale reprezintă o problemă cheie pentru crearea spațiului european al cunoștințelor. Implementarea durabilă a ciclului III studii doctorale la universitățile moldovenești necesită o pregătire esențială atât la nivel național, cît și la nivel instituțional. Elaborarea cadrului instituțional a Școlii doctorale este o precondiție de implementare a studiilor superioare de doctorat de format nou.

Sajin T., Craciun A., Culea G. Noi tehnologii de descompunere a apei în hidrogen și oxigen sub acțiunea radiației solare. Această lucrare se referă la sistemele electrochimice pentru descompunerea apei în hidrogen și oxigen, cu care se realizează ciclul ecologic pur de conversie a radiației solare. Au fost brevetate două instalații realizate în schema celulelor fotoelectrochimice tandem. Performanța acestora constă în creșterea randamentului de conversie a energiei solare în energia de la 8-10% la 30%.

Chiorsac M., Codreanu C. Armonice de curent în rețelele trifazate cu elemente neliniare. În prezenta lucrare a fost abordată problema analizei corecte a spectrului armonic a rețelei trifazate cu elemente neliniare.

Livinț G., Lucache D. D., Dănilă E. Controlul suspensiei magnetice a unui sistem de volant. Lucrarea tratează stabilitatea unui sistem de stocare a energiei cu volant magnetic, cu ajutorul unui controller polinomial RST. Comportamentul sistemului este analizat pe baza variației parametrilor constructivi și a perturbațiilor, utilizând programe de simulare.

Musteață Gr., Popov V., Ursu S., Costețchi T. Variația potențialului oxido-reducător în vinurile roșii. În lucrarea dată sunt prezentate rezultatele experiențelor în care s-a stabilit influența zonei vinicole și a tratărilor tehnologice în vinurile roșii asupra valorilor potențialului oxido-reducător. Datele obținute indică faptul că vinurile roșii de Cahul s-au caracterizat prin cele mai mari valori ale potențialului redox. La tratările tehnologice cel mai puternic au influențat administrarea acidului ascorbic și tratarea cu frig.

Dorogan A. Dispersia ordinară și extraordinară în cristalele ZnAs₂ și CuGaS₂. În lucrare sunt cercetate proprietățile anizotropiei absorbției și reflexiei în regiunea excitonică a cristalelor $ZnAs_2$ și $CuGaS_2$. A fost observată o structură fină a spectrelor de interferență

Fabry-Perot, interferența undelor ordinare și extraordinare. Au fost calculate constantele optice ε_{1} , ε_{2} , n, k și determinate ramurile dispersiei ordinare și extraordinare în regiunea absorbției fundamentale.

Buzdugă R., Aniței F., Sajin T., Olaru D. Studiul stabilității emulsiei apă-păcură și a suspensiei apăpraf cărbune. Această lucrare prezintă caracteristici generale legate de stabilitatea emulsiilor precum și modelarea procesului de sedimentare a particulelor la curgerea emulsiilor apă-păcură (EAP) sau a suspensiilor apă-praf de cărbune (SAPC) printr-o conductă orizontală. Este prezentată instalația și metodologia de determinare a stabilității EAP sau SAPC și în final rezultatele experimentale ce validează relațiile teoretice și modelul sedimentării particulelor în lungul conductei de transport.

Ojegov A. Acțiunea plasmei descărcărilor electrice în impuls asupra structurii și proprietăților straturilor de suprafață a oțelului 45. Se prezintă rezultatele analizei structurale și a proprietăților straturilor de suprafață a oțelului 45 prelucrat în condiții normale cu aplicarea descărcărilor electrice în impuls. Se observă fenomenele de microcălire și formare a peliculelor de oxizi și hidrooxizi în stare amorfă pe suprafețele prelucrate și, ca consecință, sporirea rezistenței electrice de suprafață și a rezistenței la coroziune.

Oprea D. Calculul factorului de emisie al gazelor cu efect de seră. Producția de energie este în mod inevitabil însoțită de poluare a mediului cu gaze cu efect de sera si alți poluanți, ce sunt emanați în timpul procesului de producție și datorita tehnologiilor utilizate. În articol dat am dori să arătăm metodologia ce ar putea fi utilizată pentru a calcula emisiile cu efect de seră pentru producerea energia regenerabilă.

Sclifos A. Dinamica schimbării conținutului de antociani în macerate hidro – alcoolice din pomuşoare înghețate. În această lucrare a fost studiată dinamica schimbării conținutului de antociani în macerate hidro – alcoolice din zmeură, coacăză neagră și mure înghețate. A fost stabilit conținutul maximal de antociani pentru fiecare pomuşoară analizată în parte și parametrii de extracție.

Rotari E. Formele și modelele procesului de creație și ale personalității creative. Lucrarea este consacrată formelor și modelelor procesului de creație și ale personalității creative. Noțiunea de creativitate este pe cît de intuită, pe atât de controversată. Fiecare din utilizatorii acestui termen, prioritar oamenii de știință, pedagogi, artiști, ingineri au o reprezentare proprie a acestei noțiuni. Aceste reprezentări au și trăsături comune cel puțin la nivel psihologic, dar se diferă prin caracterizarea produsului final, adică forma de realizare. Din acest considerent, am realizat o sinteză a opțiunilor diferitor cercetători în acest domeniu și un studiu detaliat a acestor opțiuni.

Poroseatcovschi, V., Ambrosi, Gh. Optimizarea regimului de deservire a rutei de transport public de În lucrare este argumentată teoretic pasageri. metodologia de optimizare a regimului de deservire a rutei de transport public de pasageri. În rezultatul elaborării metodologiei, a fost stabilit că aplicarea teoriei fenomenelor de așteptare pentru rationalizarea regimurilor de deservire asigură soluții optime reale. Totodată, a fost formulat următorul principiu de optimizare: minimizarea numărului de autobuze la rută poate fi asigurată prin majorarea valorii coeficientului de valorificare a fluxului de pasageri din stație și a duratei de acumulare a pasagerilor în stație până la valori acceptabile pentru publicul călător.

Cheşcă V. Politici și modalități de management în prevenirea fraudelor maritime internaționale. Metodele de gestiune a politicilor de management în prevederea fraudelor maritime internaționale include modalități de ordin economic, social, comercial și de drept. O atenție sporită se acordă fraudelor documentare, financiar-bancare, contractuale, de risc naval și activități specific de prevenire a lor.

Poroseatcovschii V., Plămădeală V. Influenta regimurilor de circulație și acumularea fluxurilor de transport la creșterea toxicității emisiilor gazelor de evacuare pe magistralele orașelor. În lucrare se propune indicatorul sumar al emisiilor ecologice a transportului auto, sunt stabilite legăturile analitice a indicatorilor emisiilor ecologice cu condițiile rutiere, regimurile de circulație ale automobilelor și densitatea fluxului de transport. Se examinează următoarele regimuri de circulație: regimul de accelerare; regimul circulației uniforme și regimul de frânare. La regimul circulației uniforme se examinează trei tipuri de circulație caracteristice: circulația cu viteză constantă a unui vehicul solitar în cazul intensității reduse a fluxului de transport; într-un flux dens de transport cu intensitate variabilă și în flux după lider.

Turcanu C. Generarea ideilor în procesul de inovare a afacerii. Procesul inovațional în cadrul unei întreprinderi reprezintă unul din cele mai complexe activități, care îmbină anumite etape: de la generarea ideilor până la implementarea lor. Este foarte importantă calitatea ideilor lansate și acceptul lor din partea conducerii întreprinderii. Sursele generării ideilor pot fi diverse: angajații, clienții companiei și concurenții. Controlul procesului de implementare constituie o etapă importantă, care hotărăște calitatea procesului inovational.

Dragancea V. Biosenzor de tip getabil pentru detecția de compuși fenolici în matrici complexe. Prezenta lucrare se referă la pregătirea și studiul electrozilor serigrafiați modificați cu tirosinază. În același timp a fost elaborat un electrod de carbon tip serigrafiat modificat la suprafață cu tirosinază. Compoziția electrodului Tyr / Paa / Glut a fost optimizată pentru funcționare în mod de analiză prin injecția în flux continuu (IFC) la 0 V vs Ag / AgCl. Rezultatele obținute cu biosenzor în modul IFC au fost comparate cu rezultatele obținute prin metoda cromatografie în stare gazoasă.

Ursu S. Compușii fenolici din struguri. În lucrarea dată este propus un studiu referitor la structura, proprietățile și conținutul complexului fenolic din struguri. Datorită structurii moleculare foarte complexe, compușii fenolici posedă proprietăți de oxidare, condensare, polimerizare și precipitare. Fixează oxigenul care pătrunde în vin și must, protejându-l astfel de oxidare. Puterea antioxidantă a compușilor fenolici este superioară vitaminelor C și E, datorită acestui fapt în lucrare s-a pus drept scop de a studia structura și proprietățile antioxidante ale complexului fenolic.

Cârstea C. Proiectarea unui sistem de evaluare flexibil pentru managementul sistemelor informatice complexe. Este cunoscut faptul ca luarea deciziilor fără a avea posibilitatea de a le controla este de cele mai multe ori ineficienta. Acelaș lucru se poate spune si despre planificarea activităților sistemelor informatice complexe, care aduc puține beneficii daca nu sunt controlate si supervizate. Controlul este o activitate continua a progresului realizat in administrarea projectelor sistemelor informatice complexe. pe nivele de conducere. Gradul de complexitate al unui sistem informatic este un factor major ce determina metodele de control si raportare. De asemenea se impune aplicarea lor pe nivele de conducere, ceea ce impune utilizarea unui software performant.

Cîrnu C., Bălan G., Dumitraş P. Oxidabilitatea, aluminiul și sulfații la tratarea apei brute în regim sonic. În prezenta lucrare se analizează efectele câmpului sonic asupra indicatorilor fizico-chimici in procesul de tratare al apei in vederea potabilizării. S-a constatat micșorarea conținutului ionilor de aluminiu din apa tratata. Acest lucru este benefic sistemelor ecologice si sănătății consumatorilor de apa potabila.

Bostan I., Dulgheru V., Bostan V., Ciobanu O. Microhidrocentrale pentru conversia energiei cinetice a apei râurilor fără construirea barajelor. Conversia eficientă a energiei cinetice a apei râului în energie mecanică sau electrică este asigurată de microhidrocentrale fără construirea barajelor. Majorarea eficientei de conversie este realizată prin poziționarea optimă a paletelor cu profil hidrodinamic față de curenții de apă și utilizarea efectului hidrodinamic.

L., Cycle III, Bugaian Doctoral studies: opportunities and challenges. Doctoral Studies in Europe have felt a major change in the last decade. Doctoral studies in the European Union are the main platforms for the training of researchers of excellence, which give the international visibility and impact of the European research. The value and importance of the doctoral studies is a key issue for the creation of the European area of knowledge. Implementation of sustainable cycle III studies at Moldovan universities doctoral requires essential preparation at both the national level, and at the institutional level. The development of the institutional framework of the doctoral School is a precondition for the implementtation of higher doctoral studies of new format.

Sajin T., Craciun A., Culea G. New technologies for water cleavage into hydrogen and oxygen by solar radiation. This paper is referring to photoelectrochemical systems for water cleavage into hydrogen and oxygen, wherewith it is realized the pure ecologic cycle of solar energy conversion. It was obtained the patents for two installation realized in scheme of tandem photo-electrochemical cells. Its performances consist in increasing yield of solar energy conversion in chemical energy of the water decomposition components which can amount from 8-10% to 30% values.

Chiorsac M., Codreanu C. Higher harmonics in three phase circuits. In this paper the problem correctly analyze the harmonic spectrum of three-phase circuit with nonlinear elements.

Livinț G., Lucache D. D., Dănilă E. On controlling the magnetic suspension of a flywheel system. The paper deals with the synthesizing of a polynomial RST controller to insure the stability of a flywheel energy-storage system. Considering variations of the constructive parameters and perturbation, by means of simulation programs the system behavior analyses is performed.

Musteață Gr., Popov V., Ursu S., Costețchi T. Variation of oxidation-reduction potential in red wines. This article present result of influence wine region and technological treatment in red wines on oxidation-reduction potential values. Data obtained indicate that red wines from Cahul were characterized by the highest values of red-ox potential. The technological treatments highly have influence the administration of ascorbic acid and cold treatment.

Dorogan A. Ordinary and extraordinary dispersion in ZnAs₂ and CuGaS₂ crystals. The properties of absorption and reflection anisotropy in the excitonic region of $ZnAs_2$ and $CuGaS_2$ crystals are researched in the work. A thin structure of the Fabry-Perot interference spectra was observed and the interference of ordinary and extraordinary waves has been revealed. Optical constants ε_{l_1} , ε_{2_2} *n* and *k* have been calculated and the branches of ordinary and extraordinary dispersion in the region of the fundamental absorption were determined.

Buzduga R., Anitei F., Sajin T., Olaru D. Study of wateroil emulsion stability and coal dust-water suspension. This paper presents the general features about the stability of emulsions and modeling particle sedimentation process at the flow of water-oil emulsion (WOE) or coal dust-water suspension (CDWS) through a horizontal pipe. Are presented a plant and the methodology for determining the stability of WOE or CDWS and, finally, the experimental results that validates the theoretical equations and particle sedimentation model along the pipeline.

Ojegov A. The action of electrical discharges in impulse plasma on structure and properties of steel 45 surface strata. The result of structural analysis and of surface strata properties of steel 45 machined in ordinary conditions by applying electrical discharges in impulse are presented. The phenomena of micro-tempering and formation of oxide and hydroxide pellicles in amorphous state on the machined surfaces were observed, and, as consequence, surface electrical resistance and resistance to corrosion have been increased.

Oprea D. Calculation of emission factor. Energy production is inevitably accompanied by environmental pollution with waste and waste materials from production processes and technology of energy conversion. In the article I would like to characterize a given of methods that could be used to calculate the greenhouse emissions for renewable energy.

Sclifos A. The dynamic of changing anthocyanin content in hydro – alcoholic macerated made from frozen berries. It has been studied the dynamic of changing anthocyanin content in hydro – alcoholic macerated from frozen berries: raspberry, blackberry and black currant in this work. A maximum content of anthocyanins and extraction parameters was determined for each analyzed barrie.

Rotari E. Forms and patterns of the creation process and the creative individuality. The present article deals with forms and patterns of the creation process and of the creative individuality. The notion of creativity is both intuitive and controversial. Every user of this term, mainly researchers, educators, artists, engineers, has a personal representation of this notion. These representations have common features at least at the psychological level; however they differ in characterizing the final product, the form of realization. Starting from these considerations, we have done a synthesis of various researchers' options, regarding this domain, as well as a study of these options.

Poroseatcovschi, V., Ambrosi, Gh. Schedule of optimization on routes services of public passenger transport. The paper theoretically argues the methodology of schedule optimization on route of the public passenger transport. As a result of developing the methodology, it has been established that the application of queuing theory for schedule rationalization provides real optimal solutions. Also, it was formulated the following principle of optimization: minimization of the number of buses on the route may be achieved by increasing, to acceptable levels for the passengers, the value of the coefficient of passenger flow revaluation in station and the period of passenger's accumulation in the station.

Cheşcă V. The policies and management's methods for international maritime frauds prevention. The management methods of management's policies for international maritime frauds prevention include some ways of economic, social, commercial and legal. A big attention is paid to documentary fraud, banking, contractual, naval risk prevention and their specific activities.

Poroseatcovschii V., Plamadeala V. Influence of flow regimes of movement and accumulation of transportation to increase toxicity of exhaust gas emissions by cities lines. This paper proposes summary indicator of environmental emissions of established vehicles. are analytical links of environmental emissions indicators with road conditions, traffic schemes and flux density of automotive transportation. It examines the following traffic arrangements: the regime of acceleration, uniform traffic rules and braking system. The uniform traffic rules are being examined three types of movement characteristic: constant speed movement of a vehicle alone for low intensity, flow transport in a dense flow of transport and flow variable intensity after leading.

Turcanu C. Idea generation in the process of business innovation. The innovational process in a company represents one of the most complexes activities who raise certain stages: from idea generation till their implementation. A very important aspect is the quality of launched ideas and their acceptance from company's management. The sources of idea generation could be various: the employees, company's clients and concurrent. The control of process of implementation is an important stage that decides the quality of innovational process.

Dragancea V. A disposable type of biosensors for detection of phenolic compounds in complex matrices. This work concerns the preparation and study of screen-printed electrode modified by tyrosinase. However, a carbon electrode type surface-modified screen-printed by tyrosinase (SPCE-Tyr/Paa/Glut) was developed. The composition of Tyre electrode / Paa / Glut has been optimized for operation mode of flow injection analysis (FIA) at 0 V vs. Ag / AgCl. The results obtained with the biosensor in FIA mode were compared with results obtained by gas chromatography method.

Ursu S. Phenolic compounds from grapes. The paper is proposed a study on the structure, properties and phenolic compound content in grapes. Due to very complex molecular structure, phenolic compounds possess oxidation, condensation, precipitation and polymerization proprieties. They protect wine and must from oxidation. Antioxidant power of phenolic compounds is higher than vitamins C and E, due this in the paper was put the aims to study the structure and antioxidant properties of phenolic compounds.

Cârstea C. Design of a flexible and generic system of evaluation for complex informatics systems. It is a well - known fact that making the decisions without having the target to make them work, is usually without effect. The same can be said about the planning activity, which will bring lesser benefits if it is not controlled and supervised. The control is a continuous evaluation of the progresses made in the making of the project, in relationship with certain criteria divided on targets levels. The degree of complexity of the project is a major factor, which determines the method of control and report. A complex project strictly implies intermediate levels of leadership and report. The major problem, which appears is that of assuring the quality of the software.

Cirnu C., Balan G., Dumitras P. Oxidability, Aluminum and Sulphates at the Raw Water Sonic Regime Treatment. In this paper we analyze sonic field effects on physico-chemical indicators process water treatment of drinking waters. Found to decrease content of aluminum ions in treated water. this is good health and ecological systems of drinking water consumers.

Bostan I., Dulgheru V., Bostan V., Ciobanu O. Microhydropower stations for conversion of kinetic energy of river water without building barrages. An efficient conversion of kinetic energy of river water into mechanical or electrical energy without building barrages is provided by micro-hydropower stations. Increased efficiency is achieved by an optimum position of the blades with hydrodynamic profile towards flowing water currents and using hydrodynimc effect.

SOMMAIRE

Bugaian L. Cycle III, études doctorales: opportunités et provocations. Les études doctorales en Europe ont changées essentiellement pendent la dernière décade. Dans l'Union Européenne les études doctorales sont les plateformes de base pour la formation des chercheurs d'excellence, qui donnent de visibilité et un impact international aux recherches européennes. La valeur et l'importance des études doctorales représentent un problème clé pour la création d'espace européenne des connaissances. L'implémentation durable du III-ieme Cycle, études doctorales, dans les Universités moldaves nécessite une préparation essentielle au niveau locale et au niveau institutionnelle. Elaboration du cadre institutionnelle de l'école doctorale est une pré-condition d'implémentation des études supérieures de doctorat dans un nouvel format.

Sajin T., A. Craciun, Culea G. Les nouvelles technologies pour le clivage de l'eau en hydrogène et en oxygène par le rayonnement solaire. Le présent document fait référence aux systèmes photoélectrochimiques pour le clivage de l'eau en hydrogène et oxygène, avec quoi on se rend compte du cycle écologique pour de conversion d'énergie solaire. Il a été obtenu des brevets pour deux installations réalisées dans le schéma de cellules photo-électrochimique tandem. Ses performances consistent à accroître le rendement de conversion d'énergie solaire en énergie chimique des composants de la décomposition de l'eau qui peut atteindre 8 à 10% à 30% des valeurs.

Chiorsac M., Codreanu C. Supérieur harmoniques circuits triphasés c éléments non linéaires. Dans cet article le problème correctement analyser le spectre harmonique du circuit triphasé avec des éléments non linéaires.

Livinț G., Lucache D. D., Dănilă E. Le contrôle de la suspension magnétique d'un système de volant d'inertie. L'article traite de la stabilité d'un système de stockage d'énergie avec volant magnétique, en utilisant un contrôleur RST polynôme. Le comportement du système est analysé sur la base de la variation des paramètres constructifs et de troubles, à l'aide des programmes de simulation.

Musteață Gr., Popov V., Ursu S., Costetchi T. La variation de potentielle oxydoréduction dans les vins rouges. Dans ce travail sont présenté les résultats des expériences dans quel on établi l'influence de la zone vinicole et des traitements technologiques dans les vins rouge à la valeur potentiel oxydoréduction. Les résultats indiquent que les vins rouges de Cahul sont caractérisés par les plus grandes valeurs du potentiel d'oxydoréduction. Aux traitements technologiques ont influencé plus fortement l'administration d'acide ascorbique et le traitement avec froid.

Dorogan A. Dispersion ordinaires et extraordinaires dans des cristaux de ZnAs₂ et CuGaS₂. Dans ce travail

on a recherché les propriétés de l'anisotropie d'absorbation et de reflex dans la région excitonique des cristaux $ZnAs_2$ et $CuGaS_2$. On a observé une structure fine des spectres d'interférence Fabry-Perot et l'interférence des ondes ordinaires et extraordinaires. On a calculé les constantes optiques ε_1 , ε_2 , n, k et on a déterminé les branches de dispersion ordinaires et extraordinaires dans la région d'absorbation fondamentale.

Buzduga R., F. Anitei, Sajin T., Olaru D. Etude de stabilité de l'émulsion huile-eau et la poussière de charbon-eau de suspension. Cet article présente les caractéristiques générales de la stabilité des émulsions et des processus de sédimentation des particules de modélisation à l'écoulement de l'émulsion huile-eau (EHE) ou la poussière de charbon-eau de suspension (CES) à travers un tuyau horizontal. Sont présentés une plante et la méthodologie pour déterminer la stabilité des EHE ou CES, et, enfin, les résultats expérimentaux qui valide les équations théoriques et le modèle de sédimentation des particules le long du pipeline.

Ojegov Al. Action du plasma des décharges électriques impulsions sur la structure et des propriétés des couches superficielles de l'acier 45. Sont présentés les résultats de l'analyse structurale et les propriétés des couches superficielles de l'acier 45 traités dans les conditions normales avec l'application des décharges électriques impulsions. On remarque les phénomènes de la micro trempe et la formation sur les surfaces traitées des oxydes et hydroxydes pellicules dans l'état amorphe, et, comme la conséquence, l'augmentation de la résistance superficielle électrique et la résistance corrosive.

Oprea D. Calcul du facteur d'émission. La production d'énergie s'accompagne inévitablement d'une pollution de l'environnement avec des matériaux de déchets et des procédés de production et de la technologie de conversion de l'énergie. Dans l'article je tiens à caractériser une donnée de méthodes qui pourraient être utilisés pour calculer les émissions à effet de serre pour les énergies renouvelables.

Sclifos A. La dynamique du changement de la teneur en anthocyanes dans les macérâtes hydro- alcoolique dans les baies congelés. Dans ce travail on a étudié la dynamique du changement de la teneur en anthocyanes dans les macérâtes hydro- alcoolique de framboises, de cassis et de mures congelés. On a établi les teneurs maximales d'anthocyanes pour chaque type de baie analysée et les paramètres d 'extraction.

Rotari E. Formés et aux modèles du procès de création et aux personnalités créatives. Le travail est consacré aux formés et aux modèles du procès de création et aux personnalités créatives. La notion de créativité est tant intuitive que controversée. Chacun des utilisateurs de ce terme, spécifique aux hommes de science, pédagogues, artistes, ingénieurs on tune

représentation propre de cette notion. Cette représentations ont aussi des traits communes, au moins au niveau psychologique, mais se diffère par la caractérisation du produit final, c'est-á-dire la forme de réalisation. Du cet point de vue, j'ai réalise une synthèse des options des différent chercheurs dans ce domaine et un étude détaillé de cette option.

Poroseatcovschi, V., Ambrosi, Gh. Optimisation du régime de fonctionnement de la route de transport public de passagers. Le travail fonde théoriquement la méthodologie d'optimisation régime du de fonctionnement de la route de transport public de passagers. En conséquence de l'élaboration de la méthodologie, on a établi que l'application de la théorie des files d'attente pour la rationalisation du régime de fonctionnement de la route de transport public offre de vraies solutions optimales. Toutefois, on a formulé un principe d'optimisation: la minimisation du nombre d'autobus à la route peut être assurée par l'augmentation du coefficient de valorisation du flux des passagers en station et de la durée d'accumulation des passagers dans la station à un niveau acceptable pour les passagers.

Cheşcă V. Les politiques et les modalités de management pour prévenir la fraude dans le transport maritime international. Les méthodes de gestion des politiques de gestion des fraudes de transporte maritime inclure les modalités économique, social, commercial et juridique. Une attention particulière est accordée à la fraude documentaire, de banking, contractuels, de prévention des risques navales et de leurs activités spécifiques.

Poroseatcovschii V., Plamadeala V. L'influence des régimes de circulation et l'accumulation des flux de transport pour augmenter la toxicité des gaz d'échappement sur les rues de la ville. Le document propose indicateur synthétique des émissions environnementales des véhicules, les relations analytiques sont établies les indicateurs de l'environnement des émissions de l'état des routes, les systèmes de circulation et la densité de flux de transport automobile. Examiner les modalités de circulation suivantes: le régime de l'accélération, règles uniformes de circulation et système de freinage. Les règles uniformes de circulation sont examiné trois types de mouvement caractéristique: le mouvement à vitesse constante d'un véhicule seul pour le transport d'intensité faible, débit dans un flux dense d'intensité variable et des flux de transport, après le leader.

Țurcanu C. La génération des idées dans l'innovation des processus d'affaires. Le processus d'innovation dans une entreprise représente une des activités les plus complexes, qui combine certaines étapes: à partir de générer des idées à leur mise en œuvre. La qualité des idées est très importante et leur acceptation par la direction. Les sources de l'engendrement peuvent être diverses: les employés, les clients de l'entreprise et les concurrents. Le contrôle de processus de mise en œuvre est une étape importante, qui décide la qualité du processus d'innovation.

Dragancea V. Une biocapteurs de type jetable pour la détection des composés phénoliques dans des matrices complexes. Ce travail porte sur la préparation et l'étude d'électrode sérigraphies modifiées par la tyrosinase. Cependant une électrode de carbone de type sérigraphie modifié en surface par la tyrosinase (SPCE-Tyr/Paa/Glut) a été élaboré. La composition de l'électrode Tyr/Paa/ Glut a été optimisée pour un fonctionnement en mode d'analyse par injection en flux continu (FIA) à 0 V vs. Ag/AgCl. Les résultats obtenus avec le biocapteur en mode FIA ont été comparés avec les résultats obtenus par la méthode chromatographie en phase gazeuse.

Ursu S. Les composés phénoliques des raisins. Le travail est consacré aux études sur la structure, les propriétés et contenu de composé phénolique des raisins. En raison de la structure moléculaire très complexe, de composés phénoliques possèdent propriétés d'oxydation, de la condensation, les précipitations et la polymérisation. Ils protègent les vins et de moûts de l'oxydation. Pouvoir antioxydant des composés phénoliques est plus élevé que les vitamines C et E, en raison de cela dans le document a été présenté l'objectif d'étudier la structure et les propriétés antioxydants des composés phénoliques.

Cârstea C. Le Design D'un Système Flexible Et D'évaluation Pour Les Systèmes Générique D'informatique Complexes. Il est bien - le fait connu que le fait de prendre les décisions sans avoir la cible pour les faire le travail, est d'habitude sans effet. On peut dire le même de l'activité de planification, qui apportera des avantages moindres s'il n'est pas contrôlé et supervisé. Le contrôle est une évaluation continue des progrès faits dans la réalisation du projet, dans le rapport avec de certains critères divisés sur les niveaux de cibles. Le degré de complexité du projet est un facteur important, qui détermine la méthode pour le contrôle et le rapport. Un projet complexe implique sévèrement des niveaux intermédiaires de direction et de rapport. Le problème important, qui apparaît est ce d'assurer la qualité du logiciel.

Cirnu C., Balan G., Dumitras P. Oxydabilité, Aluminium et les sulfates au traitement de l'eau brute régime sonique. Dans cet article, nous analysons les effets de champ sonore dans les indicateurs physicochimiques processus de traitement des eaux potable. Ions ont été trouvés à diminuer la teneur en aluminium dans l'eau traitée. Il s'agit d'avantages écologiques et la santé des consommateurs d'eau potable.

Bostan I., Dulgheru V., Bostan V., Ciobanu O. Station micro-hydroélectrique pour conversion d'énergie cinétique d'eau de rivière sans construire des barrages. Une conversion efficace de l'énergie cinétique de l'eau du fleuve en énergie mécanique ou électrique sans construction des barrages est assurée par les stations micro-hydroélectrique. Augmentation de l'efficacité est obtenue par position optimale des pales à profil hydrodynamique par rapport aux courants d'eau.

Бугаян Л. Ш цикл, докторское образование: возможности и вызовы. За прошлое десятилетие в образовании произошли Европы докторском существенные изменения. В Европейском союзе докторское образование является главной платформой для формирования исследователей высокого ранга, которые оказывают воздействие на европейские исследования и придают им мировую значимость. Ценность и важность докторского образования составляют ключевые вопросы создания единого европейского поля знаний. Внедрение жизнеспособного III цикла докторского образования в молдавских университетах требует существенной подготовки, как на национальном, так и на институциональном уровне. Развитие рамочного институционального докторской школы законодательства является предусловием для внедрения высшего образования нового типа.

Сажин Т., Крачун А., Куля Ж. Новые технологии для расщепления воды на водород и кислород солнечным излучением. Эта статья относится к фотоэлектрохимическим системам для расщепления воды на водород и кислород, при помощи которых то реализуется чистый экологический цикла преобразования солнечной энергии. Были запатентованы две установки, реализованные в схеме фото-электрохимических спаренных ячеек. Иx преимущество состоит в повышении кпл преобразования солнечной энергии в химическую энергию компонентов разложения воды, который может составлять от 8-10% до 30%.

Киорсак М., Кодряну К. Высшие гармоники в трехфазных цепях с нелинейными элементами. В работе представлена проблема корректного анализа гармонического спектра трехфазной цепи с нелинейными элементами.

Ливинц Г., Лукаке Д.Д., Дэнилэ Е. Об управлении магнитной подвеской маховика. Работа посвящена синтезу полиноминального контроллера RST для обеспечения стабильности системы хранения энергии с маховиком. Поведение системы анализировано на базе изменения конструктивных параметров и возмущений, используя программы моделирования.

Мустяцэ Г, Попов В., Урсу С., Костецки Т. Изменения окислительно - восстановительного потенциала в красных винах. В работе представлены результаты экспериментов, в ходе которых было выявлено влияние области и технологических обработок красного вина на значений окислительновосстановительного потенциала. Полученные данные свидетельствуют, на то, что красные вина Кагула характеризуется высокими значениями окислительновосстановительного потенциала. Из технологических обработок наиболее высокое влияние имеет обработка холодом и администрация аскорбиновой кислоты. Дороган А. Нормальная и аномальная дисперсия в кристаллах ZnAs₂ и CuGaS₂. В работе исследованы свойства анизотропии поглощения и отражения в экситонной области кристаллов $ZnAs_2$ и $CuGaS_2$. Обнаружена тонкая структура спектров интерференции Фабри – Перро, интерференция обыкновенных и необыкновенных волн. Рассчитаны оптические константы ε_1 , ε_2 , n, k и определены ветви нормальной и аномальной дисперсии в области фундаментального поглощения.

Буздугэ Р. Ш, Аницей Ф., Сажин Т., Олару Д. Исслелование стабильности водно-мазутной эмульсии и водно-угольной суспензии. В настоящей статьи приведены общие характеристики стабильности эмульсии и моделирования процесса оседания частиц в потоке водно-мазутной эмульсии (ВМЭ) или водноугольной суспензии (ВУС) при течении через горизонтальную трубу. Представлены основные методологии определения стабильности ВМЭ или ВУС, экспериментальные результаты, которые и подтверждают теоретические уравнения и модели оседания частиц вдоль трубопровода

Ожегов А. Действие плазмы электроимпульсных разрядов на структуру и свойства поверхностных слоев стали 45. Представлены результаты структурного анализа и свойств поверхностных слоев стали 45, обработанной в нормальных условиях с применением электроимпульсных разрядов. Замечены явления микрозакалки и формирования на обработанных поверхностях оксидных и гидроксидных пленок в аморфном состоянии, и, как следствие, увеличение поверхностного электрического сопротивления и коррозионной стойкости.

Опря D. Расчет коэффициента выброса газов с парниковым эффектом. Производство энергии неизбежно сопровождается загрязнением окружающей среды отходами от производственных процессов и технологий преобразования энергии. В статье я хотела бы охарактеризовать методы, которые могут быть использованы для расчета выбросов парниковых газов для возобновляемых источников энергии.

Склифос А. Динамика изменений содержания антоцианов в водно-спиртовых растворах в замороженных ягодах. В данной работе была изучена динамика изменений содержания антоцианов в водноспиртовых растворах в замороженных ягодах: малине, черной смородине и ежевике. Были установлены параметры экстракции и максимальные содержания антоцианов в каждой ягоде.

Ротарь Е. Формы и модели творческого процесса и творческого личности. Работа посвящена формам и моделям творческого процесса и творческой личности. Концепция творчества как вывод, так неизвестно. Каждый из пользователей этого термина, прежде всего ученых, педагогов, художников, инженеров, имеют свои

собственные представления этой концепции. Эти представления имеют общие черты крайней мере, на психологическом уровне, но различаются характеристики конечного продукта, т. е. форма достижения. По этой причине, мы провели исследования синтеза различных вариантов в этой области и детальное изучение этих вариантов.

Поросятковски В., Амброси Г. Оптимизации режима обслуживания пассажирских маршрутов общественного транспорта. В работе теоретически обоснованна методология оптимизации режима обслуживания маршрутов пассажирского общественного транспорта. В результате разработки методологии было установлено, что применение теории массового обслуживания для рационализации режимов обслуживания предоставляет реальные оптимальные решения. Одновременно, был сформулирован следующий принцип оптимизации: свеление к минимуму количества автобусов на маршруте может достигнуто путем увеличения быть значения коэффициента использования пассажиропотока на станции и периода скопления пассажиров на станции, до приемлемого для пассажиров уровня.

Кешкэ В. Политики и процедуры управления по предотвращению международных морских мошенничеств. Методы управления в обеспечении политики борьбы с международном морским мошенничеством включают в себя экономические, социальные, коммерческие и юридические средства. Внимание уделяется документального мошенничества, кредитно-финансовых, договорных, морские риски и разные деятельности которые могут предотвратить их.

Поросятковский В., Плэмэдялэ В. Влияние режимов движения и накопления транспортных потоков на повышение токсичности выбросов отработавших газов на транспортных магистралях. В работе предлагается суммарный показатель экологических выбросов автотранспортом, установлены аналитические отношения показателей экологических выбросов с дорожными условиями, режимами движения автомобилей и плотностью транспортного потока. Рассматриваются следующие режимы движения: режим ускорения, режим равномерного движения и режим торможения. На режиме равномерного движения рассматриваются три характерные виды движения: движение с постоянной скоростью одиночного автомобиля при малой интенсивностью транспортного потока, в плотном транспортном потоке с переменой интенсивностью и в потоке за лидером.

К. Цуркану Формирование идей в процессе инновации бизнеса. Инновационный процесс в предприятие является одним из наиболее сложных видов деятельности, которая сочетает в себе определенные этапы: от генерации идей до их воплощения. Качество идей очень важна, как и их принятия со стороны руководство компании. Источники образования идей могут быть разными: от сотрудников, клиентов и конкурентов компании. Контроль осуществления процесса внедрения является важным

этапом, который решает качество инновационного процесса.

Драганча В. Одноразовые биосенсоры лля обнаружения фенольных соединений в сложных матрицах. Эта работа касается подготовки и изучения модифицированных трафаретной электродов, тирозиназой. Был разработан угольный электрод с поверхностью экрана модифицированной тирозиназой (SPCE-Tyr/Paa/Glut). Состав электрода Tyr / Paa / Glut был оптимизирован для анализа инжектированием в поточном режиме при 0 V vs Ag / AgCl. Полученные результаты с биосенсора в режиме FIA были сопоставлены с результатами, полученными методом газовой хроматографии.

Урсу С. Фенольный комплекс из винограда. В работе предлагается исследование структуры, свойства и содержание фенольных соединений. В связи с очень сложной молекулярной структурой, фенолы обладают следующими свойствами: окисления, конденсация, полимеризация и осаждение. Защищает вино от окисления, а антиоксидантная активность фенольных соединений выше, чем у витамин С и Е, по этому в работе была поставлена цель на изучение структуры и антиоксидантных свойства фенольных соединений.

Кырстя К. Проект Гибкой И Родовой Системы Оценки Для Сложных Систем Информатики Это хорошо - известный факт, что принятие решений, не имея цель, чтобы сделать их работой, является обычно без эффекта. То же самое может быть сказано о деятельности планирования, которая принесет меньшие выгоды, если этим не будут управлять и контролируется. Контроль - непрерывная оценка успехов, делаемых в создании из проекта, в отношениях с определенными критериями, разделенными на целевых уровнях.

Кырну К., Бэлан Дж., Думитраш П. Окисляемость, алюминий и сульфаты при звуковой обработке проточной воды. В настоящей работе представлены результаты исследований влияния акустического поля на физико-химические показатели проточной воды при ее обработке с целью получения питьевой воды. Экспериментально установлено снижение содержания ионов алюминия в воде. Полученный результат имеет важное позитивное значение для экологической системы и здоровья потребителей.

Бостан И., Дулгеру В., Бостан В., Чобану О. Микрогидроцентрали для конверсии кинетической воды рек без построения энергии плотин. Эффективное преобразование кинетической энергии воды рек в механическую или электрическую энергию без строительства плотин осуществляется микро-ГЭС. Повышение эффективности достигается за счет оптимального положения лопастей с гидродинамическим профилем относительно водного течения и использования гидродинамического эффекта.

CYCLE III, DOCTORAL STUDIES: OPPORTUNITIES AND CHALLENGES

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Doctoral Studies in Europe have felt a major change in the last decade. Doctoral studies in the European Union are the main platforms for the training of researchers of excellence, which give the international visibility and impact of the European research.

The value and importance of the doctoral studies is a key issue for the creation of the European area of knowledge. Radical changes in education have emerged in response to the environmental European challenges, determined by the following moments:

- the process of globalization and regionalization has formed a new structure of the labour market, which requires a more special professional qualification;
- the launch of the agenda of the European Community with regard to education and research, that pretends to transform Europe into the most competitive world economy based on knowledge;
- implementation of the European initiative for the development of the educational system by launching the process of Bologna, which aims to create a European area of higher education through targeted reforms to more effective cooperation between European universities in order to increase the quality of studies, to promote the mobility of students and teachers and to enhance the level of graduates employment.

The Bologna process is implemented by most European countries, including countries with extensive experience in development of higher education as well as those that are in line with the principles of European education.

Often through the implementation of the Bologna process means standardization of the educational systems throughout the European space. This process impeaches, even frightens many academics, which see in this process a risk for the diversification of types and the university educational models. Looks that this process quickly appears as a process of harmonization, taking into account the diversity of cultural and educational richness, the traditions of the European research, that being active effective attract the best students. In the global fight for the conquest of contemporary talent will come out winning and it will be successful only those European universities, which find the best ways of communication and collaboration with the environmental educational and economic entities.

The process of Bologna recognizes doctoral studies as University cycle III. In Europe today, these studies are recognized as postgraduate research and targeted to applicants from these studies are appointed doctoral students, who, as a rule, are those who wish to make a career of professor within the educational system.

The European University Association (EUA), an independent organization, located in Brussels, has begun discussions about the directions of development of doctoral studies since 2003. The main purpose was to make a clarification in the complex series of approaches in the field of European doctoral education. On the basis of the on-going research it was the necessity to activate efforts to reform the doctoral studies in order to improve quality and increase the attractiveness of the European doctoral studies through radical changes in the organization of doctoral education, but taking into account their wealth diversification.

Research has shown that diversity is a key moment in the organization of doctoral education in Europe. In the majority of European universities up not long ago doctoral studies were organized in format of individual studies, based on collaboration between PhD candidate and advisor of the doctoral thesis. Phase of studies did not include a structure of studies, based on the theoretical and practical hours. But this model of studies increasingly was questioned by the academic world. Recent changes have designated in many countries a trend towards European establish a structured programs in two phases, one focused on studies and other on research, organized in the format of the Doctoral School or research school. Research Association of EUA shows that over 30% of universities have introduced alongside the traditional models of individual study also Doctoral Schools. In the opinion of those who argue the traditional format of doctorate organizing is the view that this form is more efficient in social research, humanities and art.

Approach and opinions about what is a doctoral or research school is different. The

diversity of names, models often brings confusion even in the academic world. The opinion that increasingly prevails in Europe is that the Doctoral School is an organizational independent unit (a structure) organized in the framework of a university or the few universities with an administration and clear management, and specific funding support. In the United Kingdom the corresponding studies are organized in University structures intended for doctoral students and, sometimes for trainers of master's degree which manages the admission, offers courses and seminars, trainings on generic domains, are responsible for the supervision of the doctoral students and ensure the quality of doctoral theses.

In Nederland, Germany, and Turkey so structures are organized just for doctoral students in the University structure, organized for interuniversity or a particular disciplinary domain (Doctoral School in Economics) or interdisciplinary (Doctoral School in the environmental research), research unit, or a research group, project or network (an example is the Doctoral School based on the project in the field of the history of Central Europe). Such a model, typically involves a University (it is the case of Finland, Norway, Denmark and Nederland), but may be based on close cooperation between several universities (if encountered in France) or on the cooperation between universities and research units (case met in Germany).

None of these models is not pure. Countries or even some private universities may adopt more models, which rely on the educational and research traditions, national legislation and financing conditions.

Many European universities, by implementing new models of organization of doctoral studies want to preserve diversity. From the point of view external diversity of the education doctoral structures can be confusing, but their motto is "a goal can be achieved through different ways".

According to new modern research structures listed have many advantages. They bring the environmental research incentives, creates a critical mass and helps young researchers to overcome isolation, forms a symbiosis between young researchers and those with experience, assist and improve the management, make the process of admission more transparent through the use of clearly defined procedures, ensure reading and generic skills training, ensures the monitoring and quality assurance, increases the opportunities for collaboration between universities, increases the mobility of interdisciplinary. Universities which have introduced so Schools in the last decade already seeing good results in systematic and structured evaluation of the quality, implementation of the monitoring process, which include the use of the individual development plans with well-defined training schemes, tasks and deadlines, and halfyearly reports, regular independent reviews of advisors, log sites and Web pages where students postgraduate students and display the results and performance of digital platforms in the studies, which facilitates the next communication between the doctoral student and advisor. and communication between postgraduate students themselves and the research community.

Creating Doctoral Schools, structuring programmes, improving the monitoring of the management, the determination of the funding schemes led to decreasing the period of development and support of the thesis. Duration of official doctoral studies recommended by the process of Bologna is 3-4 years, even if getting the final degree of doctor takes from 4 to 5 years.

New organizational structure brings together with the innovation and other aspects of doctoral education, particularly in the activity of the advisors. More national evaluations in Europe, assessments carried out by doctoral students themselves, show a strict necessity to improve the quality standards of the guidance by the head of doctoral studies and to develop practical effective methods for training and advisor's support. One of the best practices introduced in some European universities is the introduction of a contract, which includes a clear plan of studies and research and determines responsibilities and rights of the parties, signed by the doctoral student, the head of the doctoral studies and the University.

Success has a new model and the use of management, when the doctoral student is guided by several advisors (consultants), one of which is primary. A model is used when an advisor is responsible for the administrative phase and studies, the other one by the phase of research. The last is often in research or in the industry. The collaborative aspect of PhD and doctoral advisor is a very important moment which should not be underestimated. Advisorship by many advisors of the doctoral theses may prevent some problems which may arise in the case when the theme of the research is at the boundaries of areas of research or the case when the advisor can absence on a longer period than usual.

Professional development of advisors is also a thing very much discussed. Finding optimal variants of achieving such activities would lead to the improvement of assistance for doctoral student. Some European countries put special emphasis on the training of advisors thus the professional development representing a requirement especially for those who want to become the advisor of the doctoral thesis.

In the vast majority of universities just teachers or university professors with a long career research and excellent results in research entitled leading the doctoral students. The idea of training for potential advisors is accepted by many countries. Such countries like the United Kingdom, Sweden, Denmark and Finland have already introduced practices of doctoral training for advisors and some universities such training is a precondition to receive the right of the doctorate advisorship. To attract experienced advisors and for improving the quality of education some universities organize interactive seminars to discuss good practices to be followed.

Diversity of doctoral education in Europe can be confusing at first sight, but it reflects the diversity that exists on the entire continent. After hundreds of years of development, Europe represents the different cultures and identities, as well as different approaches to education and research. In the era of globalization, Europe cannot rely on the distinguished academic and research history. The reform of doctoral education in Europe is just a response to the national and global development. The European Universities have to deal with these challenges by working and cooperating together, exchanging experience, learning from one another, cooperating with and thus becoming more powerful.

Universities in the Republic of Moldova render the fact of need reorientation of doctoral studies towards a process of knowledge and innovation, the educational way put on sustainable principles, to ensure the quality and efficiency based on the educational structures, allowing the sustainable intensification of the process of preparing, enhancing the responsibility of organizing and scientific cooperation for doctoral students. Implementation of sustainable cycle III doctoral studies at Moldovan universities requires essential preparation at both the national level, and at the institutional level. Effective and efficient implementation of cycle III doctoral studies requires, first, to adjust the legal framework of the Republic of Moldova to European educational criteria.

The necessity of reforming doctorates is justified and by the conclusions of the study compared carried out within the project TEMPUS SCM-T002A06-2006, attended by leading universities in the country, which are jointly shared by all members of the Council of Rectors and are the following:

- Doctoral education is an integral part of the process of training performed staff, which must be directed towards the needs of the national economy.
- Doctoral training is a form of learning priority through individual scientific research.
- Multidisciplinary preparation constitutes a basic concept of the postgraduate training. It must contain obligatory component parts to ensure the generic skills training – management, communication, training and subsequent career development.
- In order to provide coherent objectives needed to raise the responsibilities of the advisors of the doctoral thesis and to diversify forms of doctorate management.
- University and interuniversity Doctoral Schools should constitute today the basic trend in doctoral training both in terms of ensuring quality of multidisciplinarities doctorates studies and optimization considering the costs.
- The European Qualifications Framework (EQF FILE) is seen as one integral on the areas of training for all three cycles of higher education (L-M-D) with a gradual diversification with the advancement of the level of preparedness.
- Changing methods of selection and training of PhD advisors requires enhancing motivation for their work.
- Enhancing the accountability of parties involved in the studies of PhD through the conclusion of the agreements concerned the tripartite (PhD student, advisor, university).

Thus, the organizational development of the institutional framework of the Doctoral School is a precondition for the implementation of higher doctoral studies of new format. The implementation of the Doctoral Schools should give a required additional code to increase the autonomy of the universities conducting doctoral programmes.

As the measures of adjustment is necessary to divide the doctoral programme in two distinct parts: scientific and general training evaluated with 60 credits (ECTS) and research, which is completed with the support of dissertation. Thus, it requires the preparation of plans and educational programs of studies, which provide training courses mandatory and optional, which can be quantified with a certain number of credits and intended to provide general, transferable skills recognized in Europe. Other activities as the development of scientific articles, participation in the national and international conferences, the involvement in the teaching activity, organization of other educational and scientific activities must become parts of doctoral programmes, which may be assessed, also, with some credits.

Only so we could ensure the compatibility of the national educational process with that European, creating the conditions for doctoral students and teachers mobility, for recognition of the national educational descriptions on the European market. Implementation of such initiatives would provide the educational and the scientific system, both the national economy and the entire of the Republic of Moldova the following major advantages:

- mobilization of the national scientific potential, by stimulating the cycle III doctoral studies;
- aligning training process at the European requirements;
- enhancing the responsibility of the scientific staff towards the doctoral training;
- efficient cooperation with universities in Europe to prepare qualified personnel;
- access to European research programs through trained co-for doctoral students by the trustee;
- getting the legal framework for providing mobilities for doctoral students, teaching staff, scientific researchers.

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NEW TECHNOLOGIES FOR WATER CLEAVAGE INTO HYDROGEN AND OXYGEN BY SOLAR RADIATION

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INTRODUCTION

Light energy converses to chemical energy through photosynthesis process was undertaken by organic solar cells. The majority of these cells have similar structures with anorganics, based on semiconductors (p-n junction or Schottky barrier). The conduction mechanism is incomplete elucidated yet, because of the energetic bands formation (valence and conduction) from anorganic semiconductors is not registered practically and in case of cells with organic substances films.





The actual tendency analyze in hydrogen energetic relieves the photo-electrochemical conversion of solar energy method by water cleavage into hydrogen and oxygen with tandem cells proposed by Michael Graetzel [1-3]. The tandem cells, without the advantages and perspectives offered, present also the disadvantage of a not too long life time, that why exist great reserves about the amelioration of the conversion yield.

1. GRAETZEL TANDEM CELL FOR WATER CLEAVAGE BY VISIBLE LIGHT

The solar radiation converters to electric energy are based on the photovoltaic effect, discovered by Becquerel in 1839. The very first photovoltaic cells with p-n junction between two different doped silicon layers it was maded in 1950 in Bell's laboratories. In present, the efficiency of the commercial photovoltaic cells vary between 18...20% for monocrystalline silicon cells and 10...12% for amorphous silicon cells, in conditions in which the polycrystalline silicon cells (the most effused cells from the market) has a intermediary efficiency.

Beginning with 1970, it was registered a new revolving interest for photovoltaic cells sensibilized with pigments (coloring agents). A new idea in this way dates from 1991 and belongs to Graetzel [2, 3]. Graetzel's cells are based on TiO₂ porous nanocristalyn electrodes, which have a very big specific intern surface. Electrodes consist by TiO₂ particles with colloidal dimensions (5-50 *nm*), that are connected in a sintering face, at low temperatures. A pigment monolayer deposed on a suchlike electrode it is enough to absorb the mass of the radiation from solar light spectrum. These cells are mass-produced by two firms and have 12% conversion efficiency.

The installation for water cleavage into hydrogen and oxygen by action of visible light (fig.1), patented by Graetzel in 1999 [4], is constituted by two photo-electrochemical cells, tandem inseriated and sensible to visible light. First cell has a box for oxidation of the aqueous electrolyte 2 with window 1 for solar light input and with the anode 4, transparent in yellow and red interval of solar light spectrum, covered on contact part with aqueous electrolyte 2 with a semiconductor oxide mesoporous layer 3, absorbent in blue and green interval of solar light spectrum. The second photoelectrochemical cell contain an solid organic electrolyte layer 7, placed between transparent electrode 4, covered on the contact side with organic electrolyte, with photovoltaic layer 6 by susceptible colorant, absorbent in yellow, red and part infrared interval of the sun light spectrum, and between the contraelectrode 8, galvanic bounded with the anode 4 from the first photoelectrochemical cell, as well as a reduction enclosure with aqueous electrolyte 9, in which is immersed the cathode 10 for the reduction of the protons formed in the oxidation enclosure of the aqueous electrolyte 2, cathode which is galvanic bounded by conductor 5 with the transparent electrode 4 from the second photo-electrochemical cell. On the aqueous electrolyte side 2, the oxidation enclosure is separated from the reduction enclosure by the ions exchange membrane 11, which can be a frit glass wall.

The known installation present the advantage of a simple, cheap construction, because are utilized nanotechnological simple processed materials at cut rate.

The disadvantages of the installation are:

• the presence of liquid electrolyte which conduct to diminution of life time (by evaporation in time);

•the necessity to charge the reduction enclosure with aqueous electrolyte that has the same composition like aqueous electrolyte from oxidation enclosure, concerning to the corrosion surface extension of metallic elements in contact with water and make necessary the control of the maintenance at same level, the aqueous electrolytes composition from both enclosures and the utilization of a hydrogen separator from steam;

•the presence in electrochemical circuit of three auxiliary electric resistances (contact resistances for interfaces: ions exchanger membrane – aqueous electrolyte; aqueous electrolyte – cathode and contraelectrode – aqueous electrolyte) conduct to additional losses of electric energy converted from





solar energy and so, limit the yield of solar energy conversion in chemical energy of the water decomposition components at 5%, in standard test conditions of photovoltaic cells AM1,5 (temperature 25^{0} C, the density of radiation flux 1000 W/m², at earth surface), what with a great part of this energy is not converted also, videlicet the energy from infrared interval that represent 55% of the solar radiation spectrum;

•the modality of ion exchange membrane layout, which reduce the active surface of photoelectrochemical cells illumination and the contact surfaces of the membrane with aqueous electrolytes from oxidation and reduction boxes. The operating principle of the installation is (fig.2) [5]: after the absorption of a photon, the pigment molecules pass into an excited state and from this condition it is injected one electron in the conduction band of semiconductor. At the other end



Figure 2. The operating principle of solar instalation with Graetzel photo-electrochemical tandem cells [5]

of the *n*-type semiconductor, the electron is takingup and can be inserted into an extern circuit (of the consumer) before returning into the system, by contraelectrode where reduce the oxidizing species. Concomitant, the oxidized pigment is regenerated by the acceptance of one electron from the reducering species of electrolyte. Along with the described electrochemical reactions come a suite of transformations which decrease the efficiency of the global process, determining great internal resistances, a great number of pigment molecules and a small active area. It was observed that a pigment monolayer absorbs only a few percents of incident radiation and the multilayer's structures determine the systematic diminution of the efficiency of electron injection in semiconductor.

Great reserves of the amelioration of these modern installations exist, which will be integrated more and more in the conversion systems of renewable energies in close future (fig.3) [5].

2. SOLAR INSTALATION FOR WATER CLEAVAGE INTO OXYGEN AND HYDROGEN WITH A TRANSPARENT PROTONS EXCHANGE MEMBRANE

The proposed installation (fig.4) [6], same with Graetzel installation, is constituted by two photoelectrochemical tandem inserted cells.

The first photo-electrochemical cell has the transparent glass window 1, which permit the solar

visible light input into aqueous electrolyte oxidation enclosure 2 and their propagation through the electrolyte layer to transparent anode, in yellow and red interval of solar light spectrum, covered with mesoporous semiconductive oxide layer 3 on aqueous electrolyte contact side, absorbent in blue and green interval of solar light spectrum, and the electroconductive glass 4. The layer 3, for example, tungsten trioxide WO₃ or iron trioxide Fe₂O₃, it is formed by a sol-gel type process. For this, it is prepared a WO₃ or Fe₂O₃ colloidal precursor solution, doped with selected elements from Si, Ge, Sn, Pb, Ti, Zr, Hf, Sb, Bi, V, Nb, Ta, Mo, Te and Re



Figure 4. Schematic drawing of solar instalation for water cleavage in oxygen and hydrogen with a transparent protons exchange membrane

series or F, Cl, Br and I series, which, after mixing with polyvinyl alcohol, it will be depose in fine film from 50 nm to 5 μm on the relative electroconductive surface of the plane perforated



Figure 5. The spectral dependency of the photon-to- electric current conversion achieved with the sensitized TiO₂ films for several ruthenium complexes [3]

glass 4 (Nippon Sheet Glass, formed by a SnO_2 film, doped with fluorine (SnO_2 :F), 10 *Ohm/o*), which served like electrons collector. The tungsten trioxide and iron trioxide are the single metallic oxides which can oxidize water in visible light and are resistant to photo-electrochemical corrosion, same to those in dark faze.

The second photo-electrochemical cell contains the transparent electrode 5, with the surface from right side covered with SnO₂:F film, whereon is deposed a monomolecular sensitized layer 6 based on a ruthenium polypyridyl complex from where $RuL_{2}(NCS)$, and $RuL'(NCS)_3$ series, L = 4,4' dicarboxyl-2,2',6',2" -bipyridine and L' = 4,4'4'' - tricarboxyl-2,2' -tripyridine. The best sensibility for yellow, red and partial infrared interval of sun light spectrum has the sensitized $RuL'(NCS)_3$ (fig.5). The titanium dioxide, TiO₂ mesoporous film 7 is deposed on sensitized layer 6. Its function is to polarize away the light from yellow, red and partial infrared interval of the spectrum that will amplify the electrochemical potential of electrons generated on the interface of semiconductor layer 3 with conductive layer SnO_2 : F of perforated glass 4. Than, the TiO_2 film 7 is put on contact with the solid organic electrolyte layer 8 and this, with the metallic contraelectrode 9, isolated on extern surface by isolating layer 10.

Between the two photo-electrochemical cells is hydrogen enclosure 11 with the reduction cathode 12, executed in perforated plate Nippon glass form with conductive layers SnO₂ : F covered surfaces with surface next to enclosure and supplementary covered with mesoporous fine layer 13 from reduction catalyst, chosen from Ni, Pt, Pd, Ru, Rh and Ir series or tungsten, vanadium or molybdenum polyacid and heteropolyacid. Cathode 12 with anode 3,4 formed together a parallel electrodes system, between which is placed the protons exchange membrane 14, manufactured by nanocomposite material transparent polymer-oxide based on organic/anorganic hybrid macromolecular example, polymers. for tetramethylene а (poly)oxide, ethylene (poly)oxide or a diagonal polyether's, with homogeneous incorporations of polyoxomethalate from $H_3PW_{12}O_{40}$, $H_4SiW_{12}O_{40}$ or $H_6P_2W_{18}O_{62}$ series.

The transparent electrode 5 and cathode 12 are inserted by extern circuit 15 and the anode collector 3, 4 and contraelectrode 9 by extern circuit 16.

The solar installation for water cleavage into hydrogen and oxygen functions in that mode.

The oxidation enclosure 2 is filled in with transparent aqueous electrolyte (in deionized water are dissolved NaOH, KOH, for electric conductivity improvement, or it is utilized the sea water).

The sun light come in by window 1, travels across the aqueous electrolyte layer from enclosure 2 and caves on semiconductor oxide mesoporous layer surface 3. The tungsten trioxide WO_3 or iron trioxide Fe_2O_3 thin film absorbs the blue and green part of sun light spectrum, than generate electronhole pairs, in conformity with electrochemical reactions:

$$WO_3 + hv \Longrightarrow WO_3 (e^-, g^+); \tag{1}$$

$$Fe_2O_3 + hv \Rightarrow Fe_2O_3 (e, g').$$
 (2)

The holes (g^+) from valence band (fig.6), created



Figure 6. The Z scheme of biphotonic water photolysis.

in excitation band of the tungsten or iron trioxide on the action of photons with short waves (380-565 *nm*), oxidize the water from aqueous electrolyte, forming oxygen and protons:

$$4 g^{+} + H_2 O \Longrightarrow O_2 + 4 H^{+}$$
(3)

Electrons from the conduction band will be collected on conductive surface of the perforated glass 4. By extern circuit 16, these electrons are transmitted to contraelectrode 9 of the second photo-electrochemical cell.

The yellow, red and partial infrared part of the solar light spectrum (photons with long wavelength, 565-900 *nm*) traverses the transparent optic medium, formed by anode 3, 4, protons exchange membrane 14, cathode 12, 13, enclosure with gaseous hydrogen 11 and transparent electrode 5 and is absorbed by the sensibilized layer 6 and TiO₂ film 7. Hereupon, the solid organic electrolyte 8 it polarized, which amplify the electrochemical potential of the photons emitted by water oxidation in the first photo-electrochemical cell. So, the electrons collected on the conductive surface of

transparent electrode 5 will had an adequate potential for protons reduction.

By extern circuit 15, electrons from transparent electrode 5 will be conducted on conductive surface of cathode 12, which is in contact with the catalyst layer 13, between the anode 3, 4 and cathode 12, 13 will be appear a potential difference which will conduct to the transfer of protons formed on the interface aqueous electrolyte – trioxide layer 3 by perforations of transparent conductor 4, protons exchange membrane 14, the cathode perforations 12. In catalyst layer 13 will have place the reduction of the protons transported with electrons displaced from electrode 5 with hydrogen formation:

$$4 H^+ + 4 e^- \Longrightarrow 2 H_2. \tag{4}$$

The summary reaction corresponds to the water cleavage process into hydrogen and oxygen under visible light action. So, the solar water cleavage installation into hydrogen and oxygen assures:

$$H_2 O \Longrightarrow H_2 + 0,5 O_2. \tag{5}$$

•the average of global energetic yield increase was 1,6-2,0 fold, yield of the conversion of solar energy to chemical energy of the elements in which is decomposed the water;

• pure hydrogen production (without steams);

•contact surface reduction of aqueous electrolyte with installation metallic elements and its corrosion probability, consequently;

•the simplification of the installation construction and it exploitation fiability improvement.

The proposed invention can be easily implemented, great capital investments are not necessary, and permit to get global energetic yields of the solar light conversion to chemical energy of water decomposition components about 8-10%. The installation function even in case of diffuse solar light and it is not dependent by atmosphere nebulosity.

3. SOLAR INSTALATION FOR WATER CLEAVAGE INTO HYDRO-GEN AND OXYGEN WITH SEMICON-DUCTIVE MATRIX ABSORBENT IN INFRARED SOLAR RADIATION

Another Graetzel installation improvement it's referring to conversion of infrared interval energy, which represent 55% of solar radiation spectrum.

The installation [7] is constituted by two photoelectrochemical tandem cells (fig.7). The first photo-electrochemical cell has the transparent glass window 1, which permits the solar radiation input in oxidation enclosure 2 of aqueous electrolyte and it



Figure 7. Solar instalation for water decomposition in hydrogen and oxygen with semiconductive matrix absorbent in infrared solar radiation spectrum

propagation across the electrolyte layer to transparent anode in yellow and red interval of solar radiation spectrum, covered on the aqueous electrolyte contact part with the semiconductor oxide mesoporous layer 3, absorbent in ultraviolet, violet, blue and green interval of solar light spectrum, and the electroconductive glass 4. The layer 3, for example, by tungsten trioxide WO₃ or iron trioxide Fe₂O₃ it is formed by a sol-gel type process, described in p.2.

The second photo-electrochemical cell contained a transparent electrode, which function it is realized by electroconductive layer 6 (SnO₂:F) of the electroconductive glass 4, on which is deposed the monomolecular sensibilized layer 7, based on a ruthenium polypiridil complex from the series presented in fig.5. On the sensibilized layer 7 is deposed the titanium dioxide, TiO₂ mesoporous film 8. It function is to polarize on action of solar radiation from yellow, red and partial infrared spectrum, which interval of the amplify electrochemical potential of the electrons generated at the interface of semiconductor layer 3 and conductive layer SnO₂ : F of the electroconductive glass 4.

Than, the TiO₂ film 8 is put on contact with the semiconductor compozit layer formed by a half transparent matrix 9 by polymeric material, inorganic or glass maded, for exemple, based on a polar polymers structures poly [2-methoxy-5-(2' - ethyl-hexyloxy)-1, 4-phenylen vinylen)], in which are dispersed nanoparticles 10 of photosensible to infrared radiation semiconductor, for example, PbS,

PbSe or InAs nanocrystals (fig.8) [8].

The colloidal PbS, PbSe or InAs crystals can be produced utilizing an organometallic procedure based on solution and precursor, respectively. For example, to prepare PbS crystals, it must be dissolved PbO in oleic acid and it warming to 150° C to obtain the lead oleate precursor. Like sulphur source it is utilize bis (trimethylsylil) sulphite (TMS) in oktadecane, which it is add to lead oleate solution, and the liquid phase is removed by warming. The temperature increase is admitted below the nucleation temperature line and it keep up to maximum admissible value. Oleic acid adheres to nanocrystals surface formed, head off their agglomeration and surface passivation by oxidation, which reduces non-radiative recombination, also. The nanocrystals dimension is controlled by the



Figure 8. Physical properties of PbS quantum dots synthesized by an organometallic route [8]:

a, b – high resolution TEM images of quantum dots with peak luminescence at 1440 nm; c) absorption spectra of PbS dots with exciton peaks size-effect tuned from 800-1800 nm; d) absorption and photoluminescence features of 6.5 nm diameter dots.

variation of protective binder concentration, temperature and injection time, of the maximum temperature and maximum processing time, of oleic acid participation in PbO and TMS solution. After the nanocrystals growth to necessary dimensions (1-8 *nm*), these sediments by adding polar solvent, like methanol, and redispersed in a non-polar solvent, like toluene. This is added in liquid phase of the matrix before it solidification. The Bohr excitation ray for PbS crystals is 20 *nm*, for InAs, 34 *nm*, for PbSe, 46 *nm*, and ray allow determining the volumetric concentration of photosensible nanocrystals from half transparent matrix (fig.9). Absorbance and the photoluminescence intensity of these advanced materials are presented in fig.8, *c* [8].

The role of the half transparent matrix 9 with nanoparticules 10 is to absorb the infrared solar radiation and, so, to amplify supplementary the electrochemical potential of the electrons generated on interface of semiconductor layer 3 and conductor layer SnO₂:F of electroconductive glass 4. The composite semiconductor layer, formed by half transparent matrix 9 with nanoparticles 10, contact by metallic contraelectrode 11, which is one of enclosure walls 12 of aqueous electrolyte reduction, separated from oxidation enclosure 2 on aqueous electrolyte side by ions exchange membrane 13. In aqueous electrolyte from enclosure 12, which have the same composition with aqueous electrolyte from enclosure 2, is immersed the cathode 14, with surfaces covered by fine mesoporous layers 15 from reduction catalyst, chose from Ni, Pt, Pd, Ru, Rh and Ir series or tungsten, vanadium or molybdenum polyacid and heteropolyacid. The reduction enclosure 12 is limited by isolating wall 16 from exterior.





The transparent electrode 6 and cathode 14 are galvanic bounded by exterior circuit 17, and collector 5 of anode 3, 5 and contraelectrode 11 by exterior circuit 18. The solar water decomposition installation to hydrogen and oxygen functions in that mode. The oxidation enclosure 2 it is maintained full with transparent aqueous electrolyte (in deionized water it is dissolved NaOH, KOH, to improve electric conductivity or it is utilized sea water). The solar radiation get through window 1, it propagates through aqueous electrolyte layer from enclosure 2 and drops to surface of mesoporous oxide semiconductor layer 3. The tungsten trioxide WO_3 or iron trioxide Fe_2O_3 thin film absorbs the blue and green part of solar radiation spectrum, generating electrons-holes pairs, according to electrochemical reactions (1)-(2).

The holes (g^+) from valence band, created in excitation band of the tungsten or iron trioxide, under short wavelength photons (190-565 *nm*) action, oxidizes the water from aqueous electrolyte, producing oxygen and protons according to electrochemical reaction (3). The electrons from the conduction band will be collected on conductive surface 5 of the electroconductive glass 4. By exterior circuit 18, these electrons are transmitted to the contraelectrode 11 from the component of the second photo-electrochemical cell.

The yellow, red and infrared part of the solar radiation spectrum (photons with long wavelengths, 565-3000 nm) cross transparent optic medium, formed by anode 3, 5, electroconductive glass 4, transparent electrode 6 and is absorbed (the yellow and red radiation total and infrared radiation partial) by sensibilazed layer 7 and by TiO₂ film 8. The part of infrared radiation with long wavelengths crosses the layers 7 and 8 and is absorbed by semiconductor composite, composed by half transparent matrix 9 with nanoparticles 10. Hereupon, the medium between transparent electrode 6 and contraelectrode 11 it is polarized, which amplify powerfully the electrochemical potential of photoelectrons emission of water oxidation from the first photoelectrochemical cell. So, the electrons collected on the transparent electrode 6 will had an adequate potential to reduce the protons of the aqueous electrolyte from enclosure 12, which swap with aqueous electrolyte from enclosure 2 through ions exchange membrane 13.

By extern circuit 17 the electrons from transparent electrode 6 will be conducted to the cathode 14 covered by catalyst layer 15. At interface aqueous electrolyte from enclosure 12-catalyst 15 from cathode surface 14 occur the protons reduction with the transferred electrons from transparent electrode 6 with hydrogen production (reaction (4)).

The summary reaction corresponds to the process of water decomposition in hydrogen and oxygen under visible light action, resulted by reaction (5). So, the solar installation for water cleavage into hydrogen and oxygen can be utilized in pure ecological chemical and energetic technologies for hydrogen and oxygen production and for the renewable energy conversion, because from hydrogen burning it is obtain again water, which is not a pollutant like in fossil combustible burning case. The proposed invention can be easily implemented, great capital investments are not necessary, and permit to obtain global energetic yields of solar light conversion in chemical energy of the components that is decomposed water round to 30%. The installation function also in diffuse solar light case, in case of partial or total atmosphere nebulosity and also, at night time, in presence of natural and artificial sources of ultraviolet, visible and infrared radiations.

4. CONCLUSIONS

1. The development of photovoltaic technologies begins with the study and fabrication of organic cells. The producers of silicon cells were collided with a serious technical problem about its purity. The advance purity silicon it can be obtain only through powerful separation/purification processes, so that energy consumption for a photovoltaic cell fabrication, and in adequate mode, the conversion costs are very big, which challenge their sustainability like renewable energy system.

2. More recent research was oriented to obtain a reduced cost cells, by other materials utilization like CdS, CuInSe₂ or CdTe. Although these can be produced at reasonable costs, ecologically still represent a less attractive choice, because of the toxic substances from its composition.

3. Light energy transformation to chemical energy through photosynthesis process was undertaken by organic solar cells. The majority of these cells have similar structures with anorganics, based on semiconductors (p-n junction or Schottky barrier). The conduction mechanism is incomplete elucidated yet, because of the energetic bands formation (valence and conduction) from anorganic semiconductors is not registered practically and in case of cells with organic substances films, where the specters indicates dimly superposed molecular orbital's (peaks present in specters are clear and a little different from their of dissolved molecules). The conductivity of these films can be improved by adding of doping agents like oxygen or iodine for p type films.

4. The actual tendency analyze in hydrogen energetic field relieves the photo-electrochemical conversion of solar energy method by water cleavage into hydrogen and oxygen with help of tandem cells proposed by Michael Graetzel. The tandem cells, without the advantages and perspectives offered, present also the disadvantage of a not too long life time, that why exist great reserves about the amelioration of the conversion yield. 5. Its were proposed two improvements of the photo-electrochemical solar energy conversion principled scheme:

a) the substitution of cathode-aqueous electrolyte system for proton reduction with a protons exchange membrane, produced by nanocomposite material - transparent polymer-oxide based on organic/inorganic macromolecular hybrid polymers, example, a poly(tetramethylene for oxide). poly(ethylene oxide) or diagonal polyethers, with polyoxomethalate homogeneous incorporations from H₃PW₁₂O₄₀, H₄SiW₁₂O₄₀ or H₆P₂W₁₈O₆₂ series; this solution presents the advantage of increasing sun visible light conversion yield in chemical energy of water decomposition products, by simplicity and high exploitation fiability of installation;

b) the replacement of solid organic electrolyte with a semiconductor composite formed by a half transparent matrix of polymeric material, inorganic or glass maded, for example, based on conjugated polymers structures like poly[2-methoxy-5-(2'ethyl-hexyloxy)-1,4-phenylen vinylen)], in which are dispersed nanoparticles from infrared radiation photosensible semiconductor, for example, PbS, PbSe or InAs nanocrystals; this solution present the advantage that converses the energy from infrared interval which constitute 55% of solar radiation spectrum.

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SPECTRUM OF HIGHER HARMONICS IN THREE PHASE CIRCUIT

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INTRODUCTION

Analysis of patterns of distribution of higher harmonics in three-phase circuit has more than seventy years. The basis of it is described in the [1]. Some of the provisions of this analysis without checking survived intact to this day and established research and academic literature on the theoretical foundations of electrical engineering [2, 3, 4]. It is necessary to discuss this issue taking into consideration two factors.

First. Increasing use of devices containing nonlinear elements, determines the importance of the validity of theoretical propositions in this area.

Second. A number of known distributions of principal provisions of the harmonic spectrum in three-phase circuits.

These provisions include the claim that the three-phase circuits without neutral wire can not proceed harmonic currents, whose frequency is a multiple of three.

So the [2] categorically states: "In the absence of a neutral conductor harmonic order is equal to three, in the current curves can not exist". In [3] states: "If there is no neutral wire currents in the phases do not contain harmonics of order multiple of three". Similar erroneous assertions hold relative to other harmonics. For example, consider that 5, 11, 17th, harmonics form a symmetrical system of currents feedback, and 1, 7, the 13th - a direct phase sequence. These statements are also far from the real picture of events. It should be noted that in the literature, no experimental confirmation of these provisions.

It is important not only to correct erroneous findings and conclusions, but also to identify the cause. Despite the perfection of the method of analysis of electrical circuits, the most common methodological principles to ensure unity of approaches to their analysis, not yet fully formed.

In respect of non-linear circuits such principle is not defined. Sufficient to indicate the absence of an algorithm that uniquely identifies a set of operations and sequence of their application for calculation of simple electrical circuits with nonlinear elements. In these and other works taking idealized initial conditions under which the harmonics whose order is three, the same three phases, and other harmonics form a symmetrical three-phase forward and reverse phase sequence.

ANALYSIS OF THE HARMONIC SPECTRUM OF THREE-PHASE CIRCUIT

Spectrum of higher harmonics in three phase circuit is determined by the nature of the nonlinear elements. Difficulty of analyzing nonlinear phenomena led them to consider not the corresponding methods of analysis of linear circuits. This is reflected in the fact that the system is nonsinusoidal currents of three phases, first appears symmetrical components of direct, inverse and zero sequence, then each of them expanded in Fourier series.

The fallacy contained in the source of the findings proved the elementary experiment by measuring the spectrum of harmonic currents in three-phase circuit with nonlinear load without neutral wire. Completed theoretic research and numerous measurements of the currents in the laboratory and operating facilities 10 kV led to the following conclusions.

Source is taken and other publications starting an "artificial" mode circuit, where the currents of three phases of each harmonic form a symmetrical system of currents of different sequences, essentially impossible. Even with identical characteristics of nonlinear resistors, each of these phases, under different stresses at each point in time has a different value. Asymmetric variation of the resistances of the three phases is asymmetry of the first and higher harmonic currents.

Therefore, as the initial position adopted by the presence of unbalance current harmonics. The correct analysis of the harmonic spectrum of such a chain is as follows. Sinusoidal phase currents are represented by Fourier:

$$\begin{split} i_{a} &= \sum_{\gamma} I_{av} \sin(\gamma \omega t + \varphi_{av}); \\ i_{b} &= \sum_{\gamma} I_{bv} \sin(\gamma \omega t + \varphi_{bv}); \\ i_{c} &= \sum_{\gamma} I_{cv} \sin(\gamma \omega t + \varphi_{cv}). \end{split}$$

Each unbalanced three-phase system of currents of equal frequency decomposed known method for symmetrical components:

$$\begin{vmatrix} \dot{I}_{a\gamma} \\ \dot{I}_{b\gamma} \\ \dot{I}_{c\gamma} \end{vmatrix} \Rightarrow \begin{cases} \dot{I}_{a\gamma,0}, \dot{I}_{a\gamma,1}, \dot{I}_{a\gamma,2} \\ \dot{I}_{b\gamma,0}, \dot{I}_{b\gamma,1}, \dot{I}_{b\gamma,2} \\ \dot{I}_{c\gamma,0}, \dot{I}_{c\gamma,1}, \dot{I}_{c\gamma,2} \end{cases}$$

where $I_{a\gamma,0}$, $I_{a\gamma,1}$, $I_{a\gamma,2}$ - symmetrical components, respectively, zero forward and reverse phase sequence of γ - harmonic.

In the presence of the neutral conductor on it will occur zero components of the currents of all the harmonics:

$$\boldsymbol{I}_N = \boldsymbol{3} \cdot \sqrt{\sum_{\gamma} \boldsymbol{I}^2_{\gamma,\boldsymbol{\theta}}}.$$

When disconnecting the neutral wire will disappear zero components of the currents $I_{\gamma,\theta}$ of all the harmonics.

In the phase conductors are symmetrical components of currents to flow forward and reverse sequences of all the harmonic. Similar findings relate to harmonics not multiples of three.

These harmonics do not form a symmetrical system of currents, as is stated in the sources of 1 and other and contains a variety of symmetrical components.

Below are details of the experimental studies of the harmonic spectrum of currents three-phase nonlinear circuit.

Three-phase circuit, composed of identical saturated chokes, fed a symmetric system of sinusoidal voltages. Harmonic spectrum measured harmonic analyzer C5-3 and Lovato DMK-32.

The table shows the values of phase variables and the symmetric components is zero, the forward and reverse phase sequence currents three-phase circuit with neutral wire, and without him.

All values are expressed in percentages (100% passed the current value of phase A).

These tables confirm the inaccuracy of the above and related many other provisions.

So, in 3 states that in the symmetric mode for neutral closed only harmonics of order multiple of three:

$$I_N = 3 \cdot \sqrt{I_3^2 + I_9^2 + I_{15}^2 + \dots}$$

In fact, the zero-wire current flows equal to the sum of zero components of all the harmonics:

$$I_N = 3 \cdot \sqrt{I_1^2 + I_3^2 + I_5^2 + I_7^2} + \dots$$

Similar adjustments should be made to estimate the distribution of higher harmonics when connected load in the triangle, operating currents, losses, noise level, resonance phenomena and other practical issues.

Harmonic	Phase currents						Symmetrical components of currents			nts		
number	imber											
γ	$I_{a,\gamma},\%$	$, \varphi_{a,\gamma}, o$	$I_{b,\gamma},\%$, $\varphi_{b,\gamma}$, ⁰	$I_{c,\gamma},\%$	$\varphi_{c,\gamma}, o$	$I_{a,\gamma.0},\%$	$I_{a,\gamma,0}, \%, \varphi_{a,\gamma,0}, O \qquad I_{b,\gamma,0}, \%, \varphi_{b,\gamma,0}, O$		$\mathcal{B}_{\mathcal{Y},\theta}, \mathcal{O}$	$I_{c,\gamma.\theta},\%,\varphi_{c,\gamma.\theta},^{o}$	
]	The sche	me of sta	ar-star w	vith neut	ral wire				
1	100	245	82	142	85	18	8,5	225	89,5	247	8,7	17
3	38	210	34,2	158	35,8	189	34,9	192	7,7	214	6,5	306
5	10,8	136	8	245	8	16	0,58	169	0,58	169	9,6	138
7	1,68	82	1,17	315	0,94	210	0,21	61	1,22	84	0,22	102
9	0,38	21	0,26	11	0,26	0	0,27	11	0,03	64	0,04	41
11	0,58	310	0,52	62	0,58	182	0,04	41	0,08	36	0,56	309
13	0,18	220	0,22	110	0,15	315	0,01	210	0,17	214	0,03	347
			Tł	ne schem	e of star	-star wit	hout neu	ıtral wir	e			
1	100	250	95	130	95,3	10	0	-	96	250	1,6	256
3	2,5	190	1,25	120	1,37	120	0	-	1,3	305	1,29	302
5	18	305	17,5	72	17,5	185	0	-	0,13	290	17,7	310
7	3,7	240	3,86	135	3,65	0	0	-	3,65	245	0,34	45
9	0,46	136	0,35	278	0,24	0	0	-	0,12	115	0,33	139
11	1,03	115	1,03	225	1,1	340	0	-	0,03	230	1,05	115
13	0,08	90	0,06	340	0,08	230	0	-	0,06	100	0,01	42

 Table 1. The harmonic spectrum of saturated chokes.

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ON CONTROLLING THE MAGNETIC SUSPENSION OF A FLYWHEEL SYSTEM

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1. INTRODUCTION

The flywheel systems or "electromechanical batteries" were especially developed for energy storage systems in Hybrid Electric Vehicles (HEV) purposes. Flywheels seem to be highly appreciated in the design of HEV, because of they outperform conventional chemical batteries in many important areas, such as: shorter recharge time, longer driving range, higher reliability and practically absence of the maintenance. Moreover, in the last decade, in the power quality market the flywheel has regained consideration as a viable means of supporting a critical load during mains power interruption.

The main drawback of the flywheel system is its relatively higher cost, but the technical development should significantly reduce the costs of such systems over time.

In [1] and [2] the numeric control of a magnetic bearing destined to be included in a flywheel storage system was synthesized. The paper purpose is to develop the synthesized controller taking into account the disturbance influences of the other flywheel system components.

2. THE FLYWHEEL STORAGE SYSTEM

The electromechanical battery we are studied is composed by a magnetically suspended flywheel, a synchronous motor/alternator and an inductive position transducer (see fig.1). The magnetic suspension has only one active axis and is composed by two hybrid magnetic bearings that act as two electromagnets in opposition. The radial stiffness is assured by the minimum reluctance effect. In the case of the absence of any current through the coils, the radial stability is assured "*passive*" through the presence of the permanent magnets. The chosen drive machine is a disk-type permanent-magnet synchronous machine [4].

3. SYSTEM MODELING

The equations that describe the working state of a hybrid axial magnetic bearing are:

- the electric equilibrium equation of the circuitry constituted by the series connection of the two coils placed each one on the superior and, respectively, the inferior stator of the bearing

$$u(t) = R_t \cdot i + \frac{d}{dt}(\Psi_1 + \Psi_2) \tag{1}$$

Where R_t - the sum of the coil resistances, Ψ_1 , Ψ_2 –

the total fluxes in the two bearing components

- the mechanical equilibrium equation:

$$m \cdot \delta(t) = -F_{rez} + (F_{ext} + m \cdot g) \tag{2}$$

where $F_{rez} = F_I - F_2$ is the resultant force of the suspension electromagnets, F_{ext} is the disturbing external force and *m.g* is the mobile part weight (including the entire shaft with the rotors of the motor and transducer).

The disturbing force F_{ext} is composed by an aleatory part and also by the residual forces from motor/alternator and transducer. For an accurate synthesis of the magnetic-suspension control system, the residual forces must be evaluated.

As concern the permanent magnet disk-rotor machine, their influence is low because of the permanent magnets that are much thicker (5 mm) as the maximum of the air-gap (1 mm). A simulation program based on the finite element method showed us that the disturbance forces created by the motor can not exceed 1 N.

In opposition, the position transducer is a magnetic-type sensor (see fig. 2.a) and produces disturbing axial forces as we can see in figure 2.b.

Considering that the air-gap is the same in the magnetic bearing and in the magnetic position sensor, the disturbing force due to the position sensor can be calculated with:

$$F_{PT} = \frac{S_{pt} \cdot h_{MPt}^2 \cdot J_t^2}{\mu_0 [h_{MPt} + 2 \cdot \delta_1(t)]^2}$$
(3)

where J_t and h_{MPt} – the magnetization and the thickness of the permanent magnet, S_{pt} - the pole surface, δ_l – the minimum of the two air-gaps from the transducer magnetic circuit.

We consider a power supply source characterized by the gain factor k_s and a position sensor that have an one-order transfer function. Considering low



Figure 2. The position sensor geometry and the produced disturbing force.

variations of the system variables a linear inputstate-output model is achieved [1]:

$$x(t) = A \cdot x(t) + b \cdot u(t) + e \cdot p(t)$$
(4)
$$y(t) = c^{T} x(t) \quad x = \begin{bmatrix} \Delta e & \Delta \delta & \Delta \dot{\delta} & \Delta i \end{bmatrix}^{T}$$

the state-variables being:

$$x_1 = \Delta e; \quad x_2 = \Delta \delta; \quad x_3 = \Delta \delta; \quad x_4 = \Delta i$$
 (5)

where $\Delta \delta$ is the air-gap variation, Δi is the coil feeding-current variation and Δe is the variation of the transducer output voltage.

4. EXPERIMENTAL RESULTS

4.1. Controller synthesis

The experimental plant presented in figure 1 is characterised with the following parameters:

- the mobile mass: m_1 =1.3Kg (whole system)
- bearing coil resistance: R_B =1.5 Ω
- turn number of the coil: N=180
- remanent magnetisation in bearing: J=0.5 T
- remanent magnetis. in transducer: $J_t=1.1 \text{ T}$

- natural frequency $\omega_{0n}=100 \text{ rad.sec}^{-1}$
- the air-gap sum: $\delta_1 + \delta_2 = 1.5 \text{ mm}$
- the pos. sensor time constant: $T_I = 0.002$ s.
- the initial current: $i_0 = 0.2 \text{ A}$

In [1] a controller synthesis considering only the axial magnetic bearing is presented. In this paper we expand the previous controller for the whole flywheel system and analysed their characteristics through numeric simulations in Matlab environment.

To insure the flywheel system stability we chose a polynomial-type control system that is presented in figure 3, where H(z) is the plant (the flywheel system including the two converters, numericanalogue CNA and analogue-numeric CAN) transfer function, $H_R(z)$ is the transfer function of the RSTtype controller with two degree-of-freedom and $H_{mr}(z)$ is the transfer function of the model that defines the tracking-rating behaviour between the



Figure 3. The closed-loop system structure.

reference ref(z) and the plant output y(z) and p(z) is the external perturbation.

Considering a sampling period $T_s=0.005$ sec, the plant discrete transfer-function yields:

$$H(z) = \frac{B(z)}{A(z)} = \frac{-0.075z^3 - 0.455z^2 - 0.212z - 0.008}{z^4 - 3.728z^3 + 1.086z^2 - 0.384z + 0.026}$$
(6)

In the polynom B(z) there can be separate a stabile part $B_s(z)$ and an unstable part $B_i(z)$, so that

$$B(z) = B_s(z) \cdot B_i(z) \tag{7}$$

where $B_i(z) = k(z - z_1)$ and $B_s(z) = (z - z_2)(z - z_3)$.

Taking into account the structure presented in figure 3, the close-loop transfer function $H_0(z)$ can be expressed through

$$H_{0}(z) = \frac{B_{0}(z)}{A_{0}(z)} = \frac{B(z)T(z)}{A(z)R(z) + B(z)T(z)} \approx \approx \frac{B_{i}(z)B_{md}(z)}{A_{md}(z) \cdot (z - p_{1f})^{n_{f}}}$$
(8)

In the last relation, $A_{md}(z)$ is a second-order polynom built with two dominant poles in order to have a desired dynamic behaviour. Considering a second-order element characterised by the natural frequency $\omega_{nd} = 0.9 \omega_n = 90$ rad/sec and a damping factor $\xi_d = 0.8$, its expression yields:

$$A_{md}(z) = z^2 - 1.344z + 0.487 \tag{9}$$

The supplementary pole $p_{lf} = 0.6$ having the order $n_f = 2$ was introduced to improve the dynamic performances of the close-loop system over the high frequency range.

The transfer function $H_{mr}(z)$ of the referencetrajectory model correspond also to a second-order element, which considering the natural frequency ω_n = 100 rad/sec and a damping factor ξ_d =0.8 results:

$$H_{mr}(z) = \frac{-0.08z + 1.53}{z^2 - 1.28z + 0.449}$$
(10)

The controller synthesis consists in finding out the four polynoms R(z), S(z), T(z) and $K_0(z)$, which must satisfy a specific condition (that is called Bezout equation) presented in [2].

The expressions we used for these four polynoms are [2]:

$$R(z) = (z-1)(z+r_0)B_s(z)$$

$$S(z) = z^{\alpha} + s_{\alpha-1}z^{\alpha-1} + \dots + s_1z + s_0$$

$$T(z) = B'_{mc}(z)A_0(z)$$

$$K_0(z) = z^2$$
(11)

where

$$B_{md}(z) = \frac{A_{md}(1) \cdot (1 - p_{1f})^2}{k(1 - z_1)}$$

The above mentioned condition can be written in this particular case as follows:

$$A(z) \cdot (z-1) \cdot (z+r_0) + B_i(z) \cdot S(z) = A_{mc}(z) \cdot K_0(z)$$
(12)

This equation put in a matrix form is useful to determine the unknown values for r_0 , $s_{\alpha cl}$, ..., s_l , s_0 . For the system parameters and chosen form of the polynoms we found the following numeric expressions:

$$R(z) = z^{4} + 0.81z^{3} - 1.119z^{2} - 0.663z - 0.028$$

$$S(z) = -11.958z^{4} + 15.053z^{3} - 4.31z^{2} + 1.251z - 0.083$$

$$T(z) = -0.046z^{2}.$$

4.2. Simulation results

The following figures present few simulation results, for the experimental plant-controller ensemble. For two values of the flotor mass, m_1 and $m_2=3m_1$, and for two variants of the control structure (with and without reference-trajectory-model), the

system behaviour is studied considering a step-jump of the reference variable.

The variables having index 1 corresponds to the mass m_1 and that having index 2 corresponds to the mass m_2 . A supplementary index $*_m$ refers to the case when the reference-trajectory-model is considered. The output voltages of the controller are showed in figures 4...7.

First time, we can see that the presence of the reference-trajectory-model lead just to a low delay in the controller response, both for the m_1 (figure 4) and m_2 (figure 5) flotor masses.

A comparison between the controller responses for the two masses is done in figure 6 (controller without reference-trajectory-model) and figure 7 (controller with reference-trajectory-model).

For the chosen cases, in the figures 8, 9 and 10 the output voltages of the position transducer are presented. One notes that the system displaces with a low delay when the reference-trajectory-model is used and, more, this delay increases corresponding to the flotor mass.

In the figures 11 is showed a magnitudefrequency characteristic corresponding to the perturbation - output variable transfer function, which is called also perturbation-output variable sensitivity function.

The obtained characteristics show a good stability and high dynamic performances for the synthesised numeric controller.

5. CONCLUSIONS

In the paper the influences of the elements composing a flywheel system over the magnetic bearing stability is analysed. In the proposed structure only the use of a magnetic-type position sensor lead to supplementary disturbance forces.

A polynomial-type controller for the whole flywheel system is synthesised. One notice that the presence of the magnetic-type position sensor lead only to some small modifications in the controller structure. This is owed to the identical behaviour of the bearing active forces and the sensor disturbing forces.

Considering variations of the constructive parameters and perturbation, by means of simulation programs the system behaviour analyses is performed. The simulation results show us that the synthesised controller assures, for the proposed flywheel system structure, a good stability and higher dynamic performances even for modifications in the control structure (with and without the reference-trajectory-model).



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THE VARIATION OF OXIDATION-REDUCTION POTENTIAL IN RED WINES

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INTRODUCTION

Wine is considered a precious aliment in the food industry. The quality of red wines depends on their composition, especially on the high content of phenol substances. Phenol complex substances present the most of consuming oxygen substances in red wines involved in many oxidation-reduction reactions, diminishing the red-ox potential values.

Amount of phenol substances and oxidationreduction potential can be manipulated by different treatments of the wine. The oxidation-reduction potential may be reduced by treatments: with sulfur dioxide, ascorbic acid, because these adjuvants possess antioxidant properties, thus protecting the wine from oxidation according to the literature [3].

The red-ox potential values increase at treating with cold, and on the strength of dissolved oxygen at low temperatures. The pasteurization of wine decreases the oxidation-reduction potential.

Measurement and correction of oxidationreduction potential values are important in wine production, especially the red one.

1. MATERIALS AND METHODS

The aim of this research was to study the variation of oxidation-reduction potential values in red wines Cabernet-Sauvignon and Merlot produced in different areas of the country, under the influence of technological treatments.

As material for analysis served red wines from Cabernet Sauvignon and Merlot grapes grown in wine regions: South (Cahul and Leova) and South-East (Talmaza), harvest 2009.

Oxidation-reduction potential value was determined by potentiometer method using HANNA 211.

Technological treatments applied to red wines, Cabernet Sauvignon and Merlot included:

• Treatment with different doses of 5% solution SO₂: 50 mg / L, 75 mg / L, 100 mg / L, 150 mg / L.

• Treatment with ascorbic acid: 50 mg / L, 75 mg / L, 100 mg / L, 125 mg / L. Measurements were made after three days of treatment. • Treating with cold wines was done by keeping over three days at temperatures:-5 ${}^{0}C$, 0 ${}^{0}C$, 5 ${}^{0}C$.

• Pasteurization was carried out by maintaining the samples at 80 ^oC for 30 min., later followed by sudden cooling.

2. RESULTS AND DISCUSSION

Physical-chemical and specific indices (table 1) that belong to the same grape varieties Merlot and Cabernet Sauvignon differed from one area to another being directly determined from soil and climate conditions based on made analysis.

Table 1. Specific and chromatic indices of red wines (Cabernet-Sauvignon and Merlot) from different wine regions of Moldova

Wine	Total	Total	Ic [*] ,	Nc**,			
	phenols,	anthocyanins,	u.a.	u.a.			
	mg/L	mg/L					
		Cahul					
Cabernet-	2267	253	17,3	0,58			
Sauvignon							
Merlot	2235	227	16,3	0,58			
		Leova					
Cabernet-	2233	222	14,9	0,51			
Sauvignon							
Merlot	2227	197	14,2	0,51			
Talmaza							
Cabernet-	2229	208	13,1	0,46			
Sauvignon							
Merlot	2217	194	12,0	0,51			

* - Intensity of color; ** - Hue.

We noticed that red Cahul wines (locality located on south end of Moldova) are characterized by an increased content of total phenols, total anthocyanins, according to the results, which is conditioned by the geographical location of this region. It is characterized by a great number of sunny days and hours of light per year and conditions that ensure full maturity of the grapes and emphasize the value of wines in this wine region. Red-ox potential values vary according to the wine area. These are caused by increased content of phenolic compounds and that they are inversely proportional to the amount of phenolic substances. The oxidation-reduction potential values from figure 1 note that it is smaller in Cahul wines, for Leova wines an increase of 13% Cabernet Sauvignon wine and 3% Merlot wine. The oxidation-reduction potential values in Talmaza wines increased by 15% in Cabernet Sauvignon wine and for Merlot wine about 14 %.



Figure 1. The dependence of red-ox potential in the red wines on wine zone.

• Treatment with sulfur dioxide (SO₂)

The antioxidant action of sulfur dioxide shall be exercised through several levels, namely: the destruction of oxidation-redaction enzymes that catalyze oxidation reactions, by combining directly with oxygen and easily oxidizable substances [1]. It should be noted that SO_2 cannot stop completely oxidation of wines, but can maintain acceptable limits for its normal development.

To determine and to investigate the dynamic variation of oxidation-reduction potential in red wines: Cabernet-Sauvignon and Merlot were given different doses of SO_2 . The results obtained are shown in table 2.

Table 2. The red-ox potential values in red wines, after treatment with SO2.

Wine	Doses,	Red-ox potential, mV					
	mg/L	Cahul	Leova	Talmaza			
1	2	3	4	5			
Cabernet-	Inițial	123	142	145			
Sauvignon	50	117	102	116			
	75	103	94	114			
	100	97	91	107			
	150	91	89	101			
Merlot	Initial	149	154	173			
	50	122	123	150			
	75	114	110	136			
	100	107	106	123			
	150	99	98	109			

Analyzing the obtained results, we found that oxidation-reduction potential value decreased on average by 19%.

The result that is conditioned by properties of SO_2 to protect wine from oxidation [1].

• Treatment with ascorbic acid

Ascorbic acid administration in various doses in red wines: Cabernet-Sauvignon and Merlot led to the results shown in table 3.

Table 3. Red-ox potential values in red wines, after treatment with ascorbic acid.

Wine	Doses,	Red-ox potential, mV			
	mg/L	Cahul	Leova	Talmaza	
Cabernet-	Initial	123	142	145	
Sauvignon	50	90	86	89	
	75	89	81	87	
	100	70	78	84	
	125	66	76	78	
Merlot	Initial	149	154	173	
	50	92	102	107	
	75	89	88	93	
	100	84	83	85	
	125	79	79	81	

According to data from research, red-ox potential values decrease on average about 39%, decrease that is conditioned by antioxidant properties of ascorbic acid, which occur on a single plane, limited only to the direct reaction of oxygen, a high speed reaction [4].



Figure 2. Oxidation-reduction potential change depending on the adjuvants used.

Analyzing the parallel action of used adjuvants on oxidation-reduction potential values, we see that in comparison with ascorbic acid, it is able to reduce SO_2 more pronounced red-ox potential values. Ascorbic acid is a greater reducing than the sulfur dioxide in the oxidation coupled with oxygen that's why it does not combine the two reactants simultaneously, but at first it reacts with ascorbic acid and the sulfur dioxide reacts with reduction product of oxygen (hydrogen peroxide) [1,4].

Protective action against oxidation of ascorbic acid has a lower range than when using sulfur dioxide. Thus, treatment with ascorbic acid is effective only if it is coupled with a sulphitation, because it cannot take the other actions of SO_2 . On the other hand coupling is dictated by the fact that ascorbic acid reacts with oxygen rapidly and has a protective role while the short-term sulfur dioxide requires several days to react with oxygen, prolonging its antioxidant action [3].

Cold treatment and pasteurization

The treatment of Cabernet Sauvignon and Merlot wines with cold increased oxidation-reduction potential values according to table 4: approximately 6% at temperature 5 $^{\circ}$ C, 12% at 0 $^{\circ}$ C temperature, 18% at -5 $^{\circ}$ C temperature. All the obtained results are in correlation with data from the literature and namely, that achieved high levels is favored by activation of oxygen bound as peroxide and by the reduction of phenol substances concentration [4].

Table 4. Oxidation-reduction potential values in red wines after cold treatment.

Wine	Т, ⁰ С	Red-ox potential, mV					
		Cahul	Leova	Talmaza			
Cabernet-	Initial	123	142	145			
Sauvignon	+5	158	145	161			
	0	168	160	183			
	-5	179	172	198			
Merlot	Initial	149	154	173			
	+5	163	168	185			
	0	179	180	202			
	-5	188	195	218			

Wines pasteurization contributes significantly to the decline in oxidative potential, on average by 13%, figure 3. This is explained by the fact that with the increase of temperature increases the reaction speed of oxygen with easily oxidizable substances [2].

Analyzing the obtained results, figure 3 we can note that the technology treatment acts contrary to the oxidation-reduction potential values of red wines: pasteurization contributes to the reduction values of red-ox potential, but cold treatment increase them.



Figure 3. Variation of oxidation-reduction potential values in dependence with thermal treatments

3. CONCLUSIONS

Made experiments allowed to emphases the role of grapes growing area that has direct influence on the physic-chemical composition of wines and, in particular, oxidation-reduction potential values.

Use of sulfur dioxide as an antioxidant contributed to reducing oxidation-reduction potential values depending on the dose.

Ascorbic acid has been shown as the most powerful reducing; decreasing oxidation-reduction potential amount depending on the dose by 39 %.

Red-ox potential on treatment with cold wine registers an average increase of 12%. Increase caused by activation of oxygen bound as peroxide and increasing concentration component [Ox] of red-ox systems.

Pasteurizing wine helps to reduce oxidationreduction potential, with approximately 13% due to the fact that with increasing temperature increases the reaction speed of oxygen with easily oxidizable substances.

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ORDINARY AND EXTRAORDINARY DISPERSION IN ZnAs₂ AND CuGaS₂ CRYSTALS

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INTRODUCTION

The anisotropy of optical properties of crystals is known from the times when Fresnel discovered the birefringence phenomena in 1810. The difference between the propagation speed of lightwaves in different crystal's directions, Island spar and many other crystals has offered the possibility to develop optoelectronic devices with interesting properties. The anisotropy of optical properties in semiconductors is mainly researched for crystals of A_2B_6 group. The development of semiconductor crystals with a strong anisotropy of optical properties on which bases the development of *p*-*n* junctions' active elements, Schottky diodes is possible are of a big interest. The materials' properties which can be used in the near IR range $(0.8-1.5 \mu m)$ are especially interesting. Birefringent crystals are used in different polarization devices, interferometers, dispersion compensators. deflectors, channel splitters etc. Polarization states (i.e. the presence of ordinary and extraordinary rays) which create the difference of the effective paths' length for these polarization states determine the main application of such materials. Ordinary and extraordinary lightwaves which pass through such a crystal possess different levels of refraction and, respectively, obtain a different passage through the crystal. The last one determines great possibilities and wide application areas of these properties.

1. EXPERIMENTAL METHOD

The measurement of optical reflection and absorption spectra were taken at 10K and 300K temperatures at a high light power (1:2) spectrometer MДP-2 and at a double ray diffraction spectrometer JASCO-86.

2. EXPERIMENTAL RESULTS AND DISCUSSIONS

2.1. ZnAs₂ crystals

 $ZnAs_2$ is a direct transitions semiconductor with a band-gap of 1.05eV at 10K temperature [1 -

4]. Boundary absorption at room temperature at E||c| and $E \perp c$ polarizations does not coincide [4 – 6]. The absorption at $1.35 \mu m$ wavelength at E||c|polarization is sharply increasing and the crystals with a thickness of some hundreds of microns nontransparent. become The crystals are transparent till the $1.3\mu m$ wavelength at $E \perp c$ polarization. Sharp absorption margins with a maximum of 1.29 µm are observed at this wavelength and $E \perp c$ polarization. As the temperature decreases the absorption boundaries are shifting towards high energies. The temperature shift coefficient $\beta = \Delta E / \Delta T$ equals $3.1 \times 10^{-4} eV / rad$ for E||c| polarization and for $E \perp c$ polarization equals $4.6 \times 10^{-4} eV/rad$.

The interference of transparency and reflection spectra is observed in the transparency spectra of crystals with thin thicknesses $d \ge 25 \,\mu m$. Figure 1 shows the transparency spectra of $ZnAs_2$ single crystals with $22 \,\mu m$ obtained from gas phase and measured at 300K for E||c and $E \perp c$ polarizations, respectively.

An intensive Fabry-Perot interference is observed at both polarizations. The absorption is weaker at $E \perp c$ polarization than at $E \parallel c$ polarization, this is why the interference spectra are revealed close to 1.3eV. The oscillation amplitude in interference spectra decreases as the radiation energy is increasing.

The frequency dependence of the refractive index in the ω_0 region for a polarized oscillator can be determined by a mathematical equality of continuous oscillation with the damping factor. The frequency dependence of the refraction and absorption indexes can be determined by the dispersion correlations in a real crystal, which has several oscillators and several frequencies:

$$\begin{cases} n^{2} + k^{2} - 1 = \sum_{i=1}^{M} \frac{4\pi A e^{2}}{m\varepsilon_{0}} \frac{\omega_{0i}^{2} - \omega^{2}}{\left(\omega_{0i}^{2} - \omega^{2}\right)^{2} + \gamma^{2}\omega^{2}} = \varepsilon_{1} \\ 2nk = \sum_{i=1}^{M} \frac{4\pi A e^{2}}{m\varepsilon_{0}} \frac{k^{2}\omega^{2}}{\left(\omega_{0i}^{2} - \omega^{2}\right)^{2} + \gamma^{2}\omega^{2}} = \varepsilon_{2} \end{cases}$$
(1)
The spectral dependencies n, k, ε_1 and ε_2 in the region of crystals' transparency (k << n) are calculated from the experimentally measured transparency spectra. This method is extremely productive in case of interference spectra measurements for thin crystals. In the region of $E > E_g$ energies the materials are not transparent and the calculation method of these parameters by the Kramers-Kronig relations from reflection spectra is used to determine n, k, ε_1 and ε_2 . Interference absorption (reflection) spectra contain maxima and minima corresponding to the following expressions:



Figure 1. *a)* The transparency interference spectra of thin $ZnAs_2$ crystals (thickness $d = 22 \mu m$) at E||c and E⊥c polarizations and 300K temperature; *b)* Spectral dependence of the refractive index obtained from the interference of transparency spectra calculations.

$$\lambda_{\max} = \frac{2nd}{m_1}; m_1 = 2,4,6$$
 (2)

$$\lambda_{\min} = \frac{2nd}{m_2}; m_2 = 1, 3, 7$$
 (3)

where: λ_{\max} , λ_{\min} – maxima and minima wavelengths in interference spectra, n – refractive index, m – order of interference strip, d – crystal's thickness. The refractive index for two adjacent strips is determined by the expression:

$$n = \frac{1}{2d\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)}.$$
(4)

The obtained spectra show that the distances between peaks (minima) are practically faintly changing as the energy increases at $E \perp c$ polarization. The refractive indexes for lightwaves with $E \perp c$ polarization in the wavelength range 1100 -1500nm is changing from 2.51 up to 3.71. The maxima (minima) of interference spectra show inspissations at E||c| polarization, i.e the distances between them is shortening while approaching to the resonant frequency of the electronic transition. The value of the refractive index changes form 2.7 up to 7.0 in the region 1500 - 1350nm at E||c|polarization (at some samples the maximal value reached 8.1). The growth of the refractive index as the energy of the lightwave increases reflects the branch of the ordinary dispersion. Weak strips that are residual from the $E \perp c$ polarization are observed in the energy region E > 1.04eV at E||c| polarization. The following thicknesses of $ZnAs_2$ for E||c| wave lengths are nontransparent and, respectively, the interference spectra must not be revealed. The obtained values of the refractive index at E||c|polarization are practically proving the frequency dependence of the polaritonic branch in the "bottleneck" region discussed in the works [5, 6]. The discussed anisotropy of optical properties and the dispersion of refractive index of ordinary and extraordinary rays in ZnAs₂ are intrinsic properties of this material. This anisotropy is also observed for thin crystals (several microns) [5, 6].

Figure 2 shows the transparency interference spectra of $ZnAs_2$ crystals at E||c and $E \perp c$ polarizations and 22K temperature. A thin Fabry-Perot interference structure is observed at both polarizations. The transparency reaches the minimal energy value 1.0306eV at E||c polarization, this value corresponds to the minimal energetic distance between $V_1 - C_1$ zones. The common contour of transparency spectra at $E \perp c$ polarization repeats the



Figure 2. *a)* Transparency interference spectra; *b)* Spectral dependence of the refractive index of $ZnAs_2$ crystals at 22K temperature.

transparency spectra contour the given at polarization for thicker thicknesses (fig. 2). A pronounced interference up to 1.3eV is revealed in spectra. A minimum in the interference spectra at 1.0376eV energy occurs in the region of direct transitions at the given polarization. This value corresponds to the direct transition in k = 0. The calculations of the refractive index at both polarizations are shown in figure 2. As it is evident from the figure the refractive index is obtained as in ordinary dispersion region as the in the extraordinary one.

The intersection phenomenon of dispersion curves n_e and n_o is observed at crystals because as the lightwave energy value decreases from the minimum of the band-gap the character of the electronic transitions changes. At some wavelength the ordinary and extraordinary waves are phase matching. If the phase matching condition is approved in the crystal, then the energy transfer can be realized from one mode to another, polarized orthogonally to the first one. As the distance from the absorption boundary increases towards long wavelengths' region the absorption value at E||cpolarization decreases sharply, than the absorption at $E \perp c$ polarization. At some wavelength λ_0 the absorption curves and, respectively, the *n* curves are intersecting. The energy transfer from the mode polarized as n_0 (or n_e) to the mode polarized as n_e (or n_0) occurs while the radiation with the $\lambda = \lambda_0$ wavelength passes through the crystal, i.e. the interaction of two orthogonally polarized modes is observed in the isotropic point (IP) of the crystal.

2.2. CuGaS₂ crystals

Two particularities, a and b, at 510.4nm (2.428eV) and 493.7nm (2.511eV) are revealed at room temperature at $CuGaS_2$ crystals for E||c|polarization in the transparency spectra. These particularities are conditioned by the electronic transitions $\Gamma_7(V_6) - \Gamma_6(C_1)$ and $\Gamma_7(V_2) - \Gamma_6(C_1)$ from the valence zones to the conduction zones, respectively, (fig. 3) [7 - 9]. A particularity at (2.528eV) is observed 490.3nm at $E \perp c$ polarization, which is conditioned by the electronic transitions $\Gamma_6(V_3) - \Gamma_6(C_l)$. It is evident from this data that the energetic interval between the zones V_I $-V_2$ equals 83meV and between $V_2 - V_3$ equals 17meV.

These results prove that the energetic intervals between valence zones at room temperature are different from these intervals at 10K [7 – 9]. In addition, the symmetry of V_2 zone became Γ_7 and the one for V_3 zone became Γ_6 . The symmetry of these zones is inversed at 10K. Consequently, as the temperature decreases different temperature coefficients of V_2 and V_3 zones' shift lead to the fact that those ones change their positions. The transparency curves are intersecting in the region 600 - 650nm, which gives evidence on the presence of the isotropic point (fig. 4). Figure 4 shows the transparency spectra for crystals with 4.5 µm thickness at E||c and $E \perp c$ polarizations. It is evident from the figure that the curves of the transparency spectra are intersecting in the region 641.9nm (λ_{01})

and in the region 526.6nm (λ_0). The calculation of the refractive indexes $n_o(E||c)$ for the ordinary and $n_e(E \perp c)$ for extraordinary rays had proved the presence of isotropic wavelengths at 637nm and 526nm. The optical constants n, k, ε_1 and ε_2 are calculated (fig. 5, right part) for these crystals in the particularities' region linked with the optical transitions in the band-gap minimum (wavelengths region 560 - 400nm).



Figure 3. Transparency spectra of CuGaAs₂ crystals with 14.5 μ m thickness at 300K and E||c, E \perp c polarizations.



Figure 4. *a)* Transparency spectra of CuGaAs₂ crystals with 4.5µm thickness at 300K and E||c, E⊥c polarization; *b)* Spectral dependence for ordinary n_o (E||c) and extraordinary n_e (E⊥c) rays (crystals' thickness 4.5µm).



Figure 5. *a)* Spectral dependence of n_0 , n_e , k, ε_1 and ε_2 for the ordinary rays (E||c) at CuGaS₂ crystals; *b)* Spectral dependence of n_0 , n_e , k, ε_1 and ε_2 for the extraordinary (E \perp c) rays at CuGaS₂ crystals; (crystals' thickness 4.5µm).

The transparency spectra of a plane-parallel plate of a certain thickness (0.007mm and 0.235mm) positioned between two polarizators parallel oriented are shown in figure 6. The optical axis of the crystal is positioned in the plate's plane. A thin absorption line at 639.5nm is observed for these crystals' thicknesses. This structure represents a *Band Elimination Filter*. Thin lines 1 – 6 which distance between deepens towards short wavelength part are revealed from the short wavelength part λ_0 at crystals with thin thicknesses (0.007mm).

The dispersion is determined by the hypotrophy properties of the crystal lattice from the long wavelength part of λ_0 that leads to negative birefringence $(-\Delta n = n_e - n_o)$, the refraction index for ordinary n_o and extraordinary n_e rays). A contribution to the negative birefringence can also make the deformational lattice distortions |(1-c/2a)|,



Figure 6. Transparency spectra of CuGaS₂ crystals positioned between parallel oriented polarizators (Band Elimination Filter).

where *c* and *a* are the lattice parameters. The negative birefringence can be also linked with other mechanisms, for example, the anisotropy of impurities absorption, free charge carriers etc. Birefringence $(-\Delta n)$ is a crystals' property at the crystals measured by us and is not an induced one.

1. CONCLUSIONS

In conclusion is has to be mentioned that such materials can be used as comb filters in the visible and near IR range and all birefringent crystals can be successfully used for developing different polarization devices, interferometers, dispersion compensators, deflectors, channel splitters etc.

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STUDY OF WATER-OIL EMULSION AND COAL DUST-WATER SUSPENSION STABILITY

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INTRODUCTION

One of the main directions of research in preparation for burning fuel, refer to decrease their pollutant potential and the development of alternative fuel production technologies.

In this direction in industrially developed countries has been tested with positive results a new type of artificial fuel - water-oil emulsion (WOE) or coal dust-water suspension (CDWS), prepared by emulsification of fuel oil, coal dust that mixed with water.

Of features of WOE, that CDWS as a artificial fuel interested, primarily, physical properties that affects storage, transportation and spraying it (the degree of dispersion, viscosity, stability, density and freezing temperature) and secondly, the energy characteristics, such as mass heat, thermal conductivity, heat of combustion, flammability and ignition temperatures.

In the present study is presented WOE or CDWS stability.

1. GENERAL CHARACTERIZATION OF STABILITY

Stability is an important feature for storage and transport of WOE and CDWS.

As a parameter characterizing emulsion stability is adopted the time when the water concentration in the top layer of WOE or CDWS will be reduced twice.

In accordance with Stokes's formula [1], sedimentation velocity of a drop of a radius in the continuous phase,

$$v_s = \frac{2}{9} \cdot \frac{\rho_2 - \rho_1}{\rho_1 \cdot v_1} \cdot g \cdot a^2 , \qquad (1)$$

where, ρ_1 and ρ_2 is the density of continuous phase (the fuel) that the dispersed phase (water), $[kg/m^3]$; ν_1 - kinematic coefficient of viscosity of continuous phase, $[m^2/s]$; $g = 9.81m/s^2$ - the gravitational acceleration.

Formula (1) shows that the sedimentation of water droplets of WOE or CDWS and the stabilization of the aqueous phase of fuel are influenced by three main factors: the difference between densities of water and fuel oil, $\rho_2 - \rho_1$, the viscosity of heavy oil, ν_1 and water droplets size in WOE or CDWS, *a*. Because water and droplet densities are practically equal ($\rho_2 \approx \rho_1$) and density of fuel oil with high viscosity may even exceed the density of water, practically the first factor will not influence the sedimentation of water droplets in WOE or CDWS, but to a greater extent will promote emulsion stability.

Variation of viscosity is limited by storage temperatures and techno-economic and security considerations. Therefore, practically the only factor that can influence the sedimentation and coalescence processes of droplets is their size, *a* which depends on the technology of preparation of WOE or CDWS.

2. WOE OR CDWS PARTICLE SEDIMENTATION AT THE FLOW THROUGH A HORIZONTAL PIPE

We will consider the sedimentation of particles dispersed phase of a monodisperse emulsions or suspensions flowing with the speed \vec{u} through a horizontal pipe (Fig. 1, a) with a rectangular section with height H and width b (Fig. 1, b) or with circular section by diameter D (Fig. 1, c). To determine the effectiveness of the sedimentation process will first determine how varying the concentration of particles in the sedimentation process [1].

Given that the WOE or CDWS are incompressible, $div \vec{u} = 0$ therefore

$$\frac{Dn}{Dt} = -n \cdot B \cdot div \vec{F} , \qquad (2)$$

where $\frac{Dn}{Dt}$ is the total derivative of the concentration of particles along their trajectories, B is the particle mobility $(B = 1/6\pi\mu_2 a), [s/kg]; \vec{F}$ -the external force under the action of that sedimentation occurs, [N].

Formula (2) shows that in a solenoid force field $\frac{Dn}{Dt} = 0$ and particle concentration along the trajectory remains constant.

sedimentation process of particles is calculated as:

Effectiveness or efficiency

 $\eta_s = \frac{n_0 v_s S_s}{\underset{n_0}{\xrightarrow{}} u S_c} = \frac{v_s S_s}{\underset{u}{\xrightarrow{}} s_c}, \qquad (3)$

of

the

where S_s and S_c are respectively the surface areas of sedimentation and cross-section of the pipeline, $[m^2]$.

For pipe with rectangular section, equation (3) is explicitly written as:

$$\eta_{s1} = \frac{n_0 \int_{-b/2}^{b/2} dx \int_0^L v_s dz}{n_0 \int_{-b/2}^{b/2} dx \int_0^H u_s dy} , \qquad (4)$$

If a pipe with circular cross section,

$$\eta_{s2} = \frac{n_0}{n_0 \pi \int_0^{D/2} u \cdot r \cdot dr} \quad , \tag{5}$$

To determine the dependence of the initial coordinates $(x_0 \text{ and } y_0, \text{ Figure 1}, b; r_0 \text{ and } x_0, \text{ Figure 1}, c)$ of a particle P arbitrarily taken in the inlet section of pipe by the particle distance L along the z-axis travels to the sedimentation pipe wall (Figure 1, *a*) we'll write the equations of motion of the particle assuming neinertial motion of it:

$$\frac{dz}{dt} = u$$
 and $\frac{dy}{dt} = v_s$, (6)

and the equation of connection between Cartesian coordinates x_0 and y_0 cylindrical r_0 coordinates:

$$r_0^2 = x_0^2 + y_0^2, (7)$$

We obtain the correlation between yield η_s and length of sedimentation process of sedimentation, *L*.

$$\eta_{s1} = \frac{L_1 v_s}{H \, u} = \gamma_1 \,, \tag{8}$$

Thus, if a pipe with rectangular section,



Figure 1. Scheme for calculating the sedimentation process of particles dispersed phase of WOE or CDWS flowing through a horizontal pipe: ______ *power lines; ------*

and for pipe with circular cross section the dimensionless parameter has the form:

$$\gamma_2 = \frac{3}{4} \cdot \frac{L_2 v_2}{D \vec{u}} , \qquad (9)$$

Theoretical dependences $\eta_{s1}(\gamma_1)$ and $\eta_{s2}(\gamma_2)$ are shown in Figure 2.



Figure 2. Theoretical dependencies $\eta_{s1}(\gamma_1)$ and $\eta_{s2}(\gamma_2)$.

3. METHODOLOGY FOR DETERMINING THE WOE OR CDWS STABILITY

With the use of water-oil emulsion is not possible wide variation of γ_1 and γ_2 parameters in equations (8) and (9) in order to obtain sufficient experimental data to validate these relationships.

For this reason it was chosen a model emulsion - droplets water in transformer oil that permits this even at room temperature.

Layout process to study sedimentation of water droplets transformer oil-water emulsion is shown in Figure 3.



Figure 3. Experimental layout for the study of the sedimentation process of water droplets in the emulsion in laminar and turbulent flow:

1 - closed contour, 2 - pump, 3 - graded pipeline,
4 - water meter; 5 - emulsifying chamber,
6 - water injector, 7 - transformer oil tank, 8, 11,
12-valve, 9 - beaker, 10 - flow control valve

The installation is carried out as a closed outline1, which, with a pump 2, is circulated studied emulsion. The process of sedimentation of water particles occurs in graduated horizontal pipe 3, by circular or rectangular cross-section diameter D (height H) and length L. Emulsion formation occurs in the emulsifying chamber 5, where, with the injector 6, in the oil transformer taken from tank7, sprayed water droplets in a wide range of 1 $\mu m \le a \le 1 mm$ sizes. The flow regime of emulsion through the pipe 3 is fixed by adjusting valve 10.

Emulsion flow adjusted with valve 10, to the fully open valve 12 and the valve closed position 11, is measured using beaker 9. For this purpose, the valve 12 closes and opens valve 11. Using a stopwatch we determine the period of time τ to fill a emulsion volume V measured with beaker 9. Thus the flow of emulsion will be determined by the

formula:

$$\dot{V} = \frac{V}{\tau} , \left[\frac{m^3}{s}\right].$$
 (10)

At the closing of the valve 11 and opening valve 12, speed emulsion through graded pipeline 3 is calculated by the formula:

$$u = \frac{4 \cdot V}{\pi \cdot D^2} , \left[\frac{m}{s}\right], \tag{11}$$

if circular pipeline, or

$$u = \frac{\dot{V}}{b \cdot H} , \left[\frac{m}{s}\right], \qquad (12)$$

for pipe with a rectangular section, where b is the width cross section of the pipeline.

Measurement methodology is as follows.

Contour 1, by opening the valve 8 (valves 10 and 12 open, valve 11 is closed), is filled with transformer oil in the tank 7. On the scale of the tank 7 we measure the volume of oil V_u wich filled contour 1. Valve 8 closes and oil pump 2 is put into operation. The air is discharged from the system through a special connector (not shown in Figure 3). After removing air, with injector 6 water is sprayed in the oil in the emulsifying chamber. The volume of sprayed water V_{H_2O} registers with water meter 4. It is determined by the volumic fraction of water α_{VW} in the emulsion to provide the desired value α_{VW} :

$$V_{H_2O} = \frac{\alpha_{VW}}{1 - \alpha_{VW}} V_u \tag{13}$$

The range of values of the fraction α_{VW} is $0 \le \alpha_{VW} \le 0.2$, that it starts from the minimum value, for example $\alpha_{VW} = 0.05$.

With the valve 10 is set velocity value u of the emulsion through the graded pipeline 3, which is calculated by formula (11).

After the emulsion circulation within 1-5 min using a magnifying glass to determine the diameters of water droplets $2a_i$ sedimented at the bottom of the wall pipe 3 and the distance L_i from that drop to the inlet section of the emulsion in the pipeline 3. The formula (1) is calculated sedimentation rate v_{si} of each drop of water. Thus, sedimentation dimensionless parameter is calculated by the formula:

$$\gamma_{1i} = \frac{L_i \cdot v_{si}}{H \cdot u},\tag{14}$$

for rectangular section pipe and

$$\gamma_{2i} = \frac{3 \cdot L_i \cdot v_{si}}{4 \cdot D \cdot u}, \qquad (15)$$

for circular pipeline.

Sedimentation process yield is calculated as:

$$\eta_S = \frac{v_S \cdot S_S}{u \cdot S_C} \tag{16}$$

where S_s is the surface area of wall pipe 3, covered with drops, $[m^2]$; S_c - cross-sectional area of the pipe ($S_c = \pi D^2/4$ - for circular pipeline and $S_c = H \cdot b$ - for rectangular section pipe).

In this way, varying speed emulsion u and concentration of droplets in the emulsion which depends on α_{VW} , are determined the experimental dependences $\eta_{S1}(\gamma_1)$ and $\eta_{S2}(\gamma_2)$ [2].

At α_{VW} variation starts from the minimum and calculating additions of water is determined the increasing values of α_{VW} . Each time, after the determination of emulsion flow through beaker 9 by fitting to eliminate the air quantity of emulsion is placed in a closed contour circuit.

4. EXPERIMENTAL RESULTS

WOE stability largely depends on the size distribution of water droplets. Distribution functions f(a) of water droplets from the WOE on rays are shown in Figure 4. The analysis of these functions results in two aspects:

1) distribution functions f(a) are lognormal type;

2) With increasing time of preparation of the emulsion, the average radius of water droplets moves in the small size area.

Figures 5 and 6 are presented the dependences of the distributions of statistical parameters f(a), average radius, \overline{a} and dispersion, σ_a^2 of preparation time τ_{pr} .

With increasing time of preparation of



Figure 4. Distribution functions f(a) of water droplets from WOE on ray:

a, $[\mu m]$: 1-11; 2-16; 3-21; 4-32; 5-51. σ_a^2 , $[m^2]$: 1-8,123 10⁻⁶; 2-9,719 10⁻⁶; 3-1,092 10⁻⁵; 4-1,284 10⁻⁵; 5-1,506 10⁻⁵



Figure 5. The dependence of the average radius of water droplets in WOE, \overline{a} on WOE.

emulsion, τ_{pr} average radius, \overline{a} decreases, asymptotically approaching its minimum value. And dispersion distribution σ_a^2 is reduced with increasing τ_{pr} .

Therefore, in the cavitational process of mixing water with fuel oil occurs reducing the size of water particles that leads to increased WOE stability.

Dependences of yield sedimentation process of WOE water droplets on dimensionless parameters (4) and (5) for a circular and rectangular pipeline section are presented in Figures 7 and 8. The solid lines are drawn theoretical graphs calculated with relations (4) and (5). There is a satisfactory agreement with the experimental and theoretical data, which validate the process model of sedimentation of water droplets of an emulsion flowing through a horizontal pipe, described in paragraph 3.



Figure 6. Dependence of distribution dispersion of water droplets in WOE, σ_a^2 on WOE preparation time, τ_{pr}



Figure 7. Dependence of sedimentation efficiency η_{S1} of water droplets in WOE on a dimensionless parameter γ_1 for rectangular section pipe.



Figure 8. Dependence of sedimentation efficiency η_{S2} of water droplets in WOE on dimensionless parameter γ_2 for circular section pipe.

5. CONCLUSIONS

1. Were presented some general features about the stability of emulsions and modeling particle sedimentation process at the flow of WOE or CDWS through a horizontal pipe.

2. A plant was presented and the methodology for determining the stability of WOE or CDWS.

3. The experimental results validates the theoretical equations and particle sedimentation model along the pipeline.

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THE ACTION OF ELECTRICAL DISCHARGES IN IMPULSE PLASMA ON STRUCTURE AND PROPERTIES OF STEEL 45 SURFACE STRATA

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INTRODUCTION

It is known that pieces used in machine and equipment building often function in condition of mechanical wear, under wide range of temperatures, in aggressive media from chemical point of view etc. These specific operating conditions of modern technology impose special requirements on durability and reliability of the whole construction and of their constituents separately.

A new technology always has a value to human society if it meets the following criteria: practical applicability, the financial economy, reliability and performance. Obtaining special properties of surfaces with nanometer thin films is the tendency of contemporary strategic research by developing new proceedings and material processing technologies, thus ensuring high productivity and material economy and ensuring high quality of products.

There exists and develops more and more fierce concurrence between traditional and nonconventional material processing on the global market of technics and technology. Favor is on side of new technology, which actually intended to annihilate material and energy crisis that swept around the world.

Electrical discharges in impulse as concentrated sources of energy increasingly find non-conventional applicability in materials processing technology in order to modify structure and properties of superficial strata of machine building pieces. With help of this technology we can achieve surfaces with high thermal and electronic emission properties, hardened surfaces, surfaces with anti-corrosion properties, surfaces with increased electrical surface resistance, surfaces with anti-sticking and anti-friction properties, surfaces with anti-wear properties, etc.

The aim of present investigations consists in analysis of the action of electrical discharges in impulse plasma on the structure and properties of steel 45 surface strata.

1. METHODOLOGY OF EXPERIMENTAL INVESTIGATIONS

Cylindrical steel 45 samples were made as electrodes for experimental investigations. Working surface of the samples was grinded and polished up to "mirror" surface for more qualitative analysis of the processed surfaces. The electrodes were fixed into the interstice establishing device so that the working surfaces of the anode and cathode are parallel to each other.

As a source of energy was used current impulse generator that includes the following electrical blocks (Figure 1): power impulse generator, starter block destined for electrical discharge initiation and command block whose role is to synchronize power with starter block impulses.

As it is shown in the figure power impulse generator consists of autotransformer (T1) power transformer (T2), rectifier (D1-4) ballast resistance (R1), capacitors (C1-C4); switches (k1-k4); block of diodes (D5), thyristor (D7).

Starter block contains the following elements: transformer (T4), rectifier (D9-12), capacity (C5), thyristor (D8), high voltage transformer (T3).

The command block allows performing not only the synchronization impulses, but changing the working frequency of the generator too.

The functional principle of the generator which electrical scheme is shown in Figure 1 is based on accumulating a quantity of electrical energy in condenser battery and its discharging in form of a short term ($\tau = 200-250 \ \mu s$) impulse.

Capacities (C1, C2, C3, C4), depending on the position of switches (K1-4), are powered through the charging impedance (R1) out of a DC source, which consists of autotransformer (T1), power transformer (T2) and rectifier (D1-4).

Autotransformer (T1) allows fine tuning of the operating voltage and supplies the impulse generator.



Figure 1. Principal electrical scheme of the impulse generator: 1 – power impulse generator; 2 – starter block; 3 – command block.

Block of diodes (D5) is designed to protect generator of the high voltage impulse entering into it.

Resistance (R1) has the function of charging current limitation, which prevents the conversion of electrical discharge in impulse to electrical discharge in arc.

The charging of the capacitors (C1-C4) and (C5) takes place in the process of installation functioning simultaneously.

The command block sends a signal that causes opening of the thyristor (D8). Because of this, capacity (C5) is discharged through the primary coil of high voltage transformer (T3) and the electrical current begins to move through it. This electrical current causes the appearance of high electric voltage (striking voltage) in the secondary coil terminals, which are joined respectively with anode and cathode of the experimental installation. Due to high voltage, striking of the interstice and formation of conductible canal take place.

At the same time, the command block emits another signal that causes the opening of the thyristor (D7) and discharging of the capacitors (C1-C4), with formation of the basic impulse. After that, the process repeats again.

The phase shift of thyristor (D7) and (D8) opening moments is very small and can be adjusted within the large limits, by the command block.

Starter block allows preventive ionization of the interstice with high-voltage impulse of 12 kV and 0.3 μ A current value. Impulse forms of the power generator and the starter block is shown in Figure 2.

Processing is performed in sub-excited regime, i.e. when the energy released on the sample surfaces does not reach values necessary for melting the processing surface layer. Energy balance condition in this case is:

$$Q = \frac{4W_s}{\pi d_c^2 S} < Q_{melt} , \qquad (1)$$

where $W_s = \int_0^t u(t)i(t)dt$ is amount of energy

released in the interstice; u(t) is voltage drop in the interstice; i(t) is momentary value of current in the interstice; τ is impulse duration; d_c is diameter of the plasma canal; S is the interstice value; $Q_{melt} = q_{melt} \cdot \rho$ is melting volume density of the workpiece; q_{melt} is specific melting heat of the workpiece material (for steel 45 - $q_{melt} = 84$ kJ/kg); ρ is material density at the melting temperature (for steel 45 at its melting temperature T_{melt} = 1500°C density $\rho = 6900$ kg/m³).

Then the amount of heat released in a volume of surface: $Q < 579,6 \text{ MJ/m}^3$.

For example, for distance between electrodes S = 1.5 mm, the diameter of the plasma canal dc \approx 3-4 mm (approximately is equal to the width of the strip determined by the authors [4]) and the energy released in the interstice $W_s < 6-10$ J.

The value of energy released in the interstice in limits $W_s = 0,4-4$ J corresponds to values of the charging voltage of condenser battery $U_c = 100-200$ V and capacities $C = 100-600 \mu$ F of the impulse generator. This satisfies the above condition.



b)

Figure 2. Variation of current intensity and voltage respectively:

- a) of an impulse of the starter block;
- b) of an impulse of the power generator

2. RESULTS OF INVESTIGATIONS AND THEIR ANALISIS

The phenomena of micro-tempering (Fe- γ appearance in the surface layers) and formation of iron oxides and hydroxides in amorphous state is attested during the machining of plane piece surfaces made of steel 45 by applying electrical discharges in impulse in ordinary conditions in regime of "cold" electrode spots (without appearance of liquid phase). It is confirmed by the results of quantitative and qualitative analysis of the machined surfaces (Figure 3-5).



Figure 3. Mössbauer spectroscopy of steel 45 sample surfaces machined by applying electrical discharges in impulse [1, 2].

The amount of oxygen dissolved in the surface piece layer made of steel 45 range from about 60 at the workpiece surface until about 20 at 240 nm depths. This phenomenon can be explained based on the diffusion, micrometallurgical and electrochemical processes that produce in the material of the workpiece under the action of electrical discharge in impulse plasma.



Figure 4. Concentration elements distribution in steel 45 surface strata after machining by applying electrical discharges in impulse [1, 2].





Figure 5. Spectrogram of steel 45 samples after machining by applying electrical discharges in impulse (electronic microscopy TESCAN, ×1000).

Detailed research on surface electrical resistance and resistance to corrosion of pellicles formed on steel surfaces 45 with electrical discharges in impulse [3, 4] have shown that, due to the formation of oxides and hydroxides in the amorphous state, the surface electrical resistance of the samples increased from hundredths of Ω until ~1 M Ω , resistance to corrosion has increased in about 2 times. Due to simplicity of technology and lower costs of electricity, the formation of oxides and hydroxides pellicles using electrical discharges in impulse can be successfully applied in manufacturing of resistors for microelectronics and radiotechnics and in corrosion protection of drinking water pipes. Experimental investigations demonstrate that microoxidation processes occur simultaneously on the surface of the tool-electrode too, but they proceeded with an intensity of about three times lower than for the workpiece. Electrodetool surface oxidation and erosion cause breach of the workpiece surface processing technology, that is why the special conditions required for their elaboration. During the machining of the rotary surfaces and, in a particular case, cylindrical and conical surfaces (exterior or interior) condition of continuous work of the apparatus is to maintain constant the size of the discharge interstice. Therefore, it is proposed to manufacture electrodetools with conjugated to the workpiece surface configuration and their coaxial positioning in relation to the processing surface. At the same time, it is required that their active part mast be manufactured of a less active material to oxidation.

3. CONCLUSIONS

Based on the results of personal experimental research and to those obtained by other researchers we can conclude the following:

- a considerable amount of oxygen is dissolved in steel 45 piece surfaces under the action of electric discharges in impulse plasma;

- the processes of structure and chemical composition modifying of piece material occur in the machined surface;

-oxide and hydroxide pellicles formed by applying electrical discharges in impulse can be successfully applied to increase active electrical surface resistance and resistance to corrosion of pieces in machine and apparatus building.

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CALCULATION OF EMISSION FACTOR

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INTRODUCTION

In the last decades much attention is drawn energy and environment problem, emissions, energy sustainability and another.

Rapid energy production growth leads to environmental impacts which can also constrain development. Energy production, whether from depreciable fossil and nuclear fuels or large – scale exploitation of hydroelectric or biomass resources, leads to many of the most severe environmental impacts faced by developing and industrialized nations alike. These include air pollution, radioactive waste, siltation of river basins, deforestation and soil erosion, etc.

In the past, environmental issues have been considered secondary to economic growth in developing and industrialized nations.

Air Pollutant consists of CO_2 , CO, NO_x , SO_x , Pb Particles;

- NOx control is performed by controlling the combustion process have control after burning process.

- Control during combustion can reduce NO_x emissions by 15-50% by controlling the amount of air.

- Control by the amount of fuel accounts for 40-60% NO_x emissions reductions.

- Reduction of NO_x by ammonia solution injection.

- Total reduction of NOx can be 80-90%.

The main source of GHG is CO_2 which is as a result of burning fuel, energy companies Contribute one third of CO_2 - global emissions.

Carbon plants emit 24 kg C / GJ, fuel oil plants produce 20 kg C / GJ whiles natural gas combustible plants emit 14 kg C / GJ [7].

The most important greenhouse gas in the atmosphere is water vapors (H_2O), responsible for approximately 2/3 of the total greenhouse effect. The content of water in the atmosphere is not directly influenced by anthropogenic activities, but rather it is determined by the cycle of water in nature, expressed in a simpler way, as a difference between evaporation and precipitations.

Carbon dioxide (CO_2) has a 30 percent share in the greenhouse effect, while methane (CH_4) ,

nitrous oxide (N_2O) and ozone (O_3) taken together account for 3 percent.

The group of artificial substances (man-made): chlorofluorocarbons (CFC) and their substitute, hydro-fluoride-carbons (HCFC, HFC) and other substances, as well as per-fluoride-carbons (PFCs) and sulphur hexafluoride (SF6) are also attributed to direct GHG.

There are other photo-chemically active gases, such as carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC) (include substances such as: propane, butane and ethane), which are not attributed to direct GHG, but have an indirect contribution to greenhouse effect. Such gases influence the formation and destruction of ozone in the atmosphere in the presence of solar rays (ultraviolet radiation) and are considered to be ozone precursors in the troposphere.

Though GHG are considered to be natural components of the air, their presence in atmosphere is strongly affected by anthropogenic activities. Increased concentrations of GHG in atmosphere (caused by emissions of anthropogenic origin) contribute strongly to greenhouse effect thus leading to additional warming of the atmosphere. concentration in atmosphere The GHG is determined by the difference between GHG emissions and removals. It has been stated with certainty that GHG concentration in atmosphere have increased significantly in comparison with preindustrial period. Thus, since 1750 the concentration of CO2 increased by 35 percent, concentration of CH4 - by 143 percent, and concentration of N₂O - by 18 percent.

To control their effect or reduce it, investigations have to be made and their causes highlighted.

1. EMISSION FACTOR

The purpose of this work is to find a method for calculating greenhouse gas emissions for renewable sources of energy. Despite, these sources are considered clean, it is obvious that biomass for example in any combustion process results in greenhouse emission. The problem of greenhouse gas calculation is studied in most countries of the world. There are various methods and programs for calculating these emissions, such as GEMIS, MARKAL, EMPEB etc. Unfortunately all these methods do not take into consideration emissions from renewable energy sources as their results always indicates zero pollution from them, which is not always the reality.

As an example, combustion process of biomass will be analyzed, which is also considered renewable source of energy. The by-product of combustion process will be examined taken into consideration greenhouse gases.

For each of the impacts considered, environmental controls in the form of regulations can be applied to reduce environmental discharges or other effects. The type of regulation depends on the evaluated impact. Table 1 lists the regulatory options available for each impact [1].

IMPACT	REGULATIONS	
	AVAILABLE	
Air Pollution	Emission limits	
	Required control device	
	Chemical content of fuel	
Water Supply and	Water intake limit	
Pollution	Wastewater volume	
	discharge limit	
	Pollutant concentration	
	Required equipment	
	Chemical content of fuel	
Land Use	Land use restriction	
	Land restoration	
	requirement	
Solid Waste	Waste quantity limit	
	Required control technique	
	Chemical content of fuel	
Occupational Health and	Required control program	
Safety		
Resources	applicable	

 Table 1. Regulatory Controls Available

The regulations can be imposed singly or in combinations. It is possible to designate regulations that will apply only to specified facilities, specified types of facilities, in designated geographical areas, after a specified starting date, or to new, existing, or all facilities. This gives the user flexibility to apply different regulatory control programs.

The proposed basic equation, using air pollution as an example is as below [1]:

$$UEM_i = UEF_i * E_{input}$$
(1.1)

where:

 UEM_i - Uncontrolled emissions of Pollutant *i* (kg/year),

UEF _i - Emission Factor for Pollutant i (kg/GJ_{in}),

 E_{input} - Energy Input (GJ).

In general, an emission factor is dependent on the fuel used except SO_2 [9]. For SO_2 emission factor has the form:

$$EF_{SO_{e}} = 2C_{s} \left(1 - \alpha_{s}\right) \frac{1}{H_{u}} 10^{6} \left(1 - \beta\right)$$
(1.2)

where:

• EF_{SO2} - specific emission factor;

• C_S - sulfur content in fuel, %;

• α_{s} - sulfur content in the ashes;

• H_u - heat capacity of gas;

• A century - the efficiency of secondary reduction in%;

• β - the possibility to provide secondary measures, in%

Calculation methodology of the emission [2], one determined the following values and constrains:

$$C_{m} = C_{v} \cdot \frac{22.4}{M_{pol}} \cdot \frac{273.15 + t}{293.15} \cdot \frac{1,013 \cdot 10^{5}}{p_{b}} \quad \left[mg/m^{3} N \right]$$
(1.3)

where:

 C_m - mass concentration of the pollutant, in ppm,

 C_v - volumetric concentration of the pollutant, in mg/m³N

Mpol - molar mass of the pollutant, in kg/kmol,

22,41 - molar volume under normal conditions, in m3/kmol,

t - temperature, °C

p_b - barometric pressure, in Pa.

Thus the mean value becomes:

$$\left[(C_m)_{med} \right]_i = \frac{\sum_{i=1}^n (C_m)_i}{n} \qquad \left[mg / m^3 N \right] \quad (1.4)$$

where:

n - is the simultaneous registered traffic values, i – specie of the pollutant.

Emission factors and emission inventories have long been fundamental tools for air quality management. Emission estimates are important for developing emission control strategies, determining applicability of permitting and control programs, ascertaining the effects of sources and appropriate mitigation strategies, and a number of other related applications by an array of users, including federal, state, and local agencies, consultants, and industry. Data from specific source of emission tests or continuous emission monitors are usually preferred to estimating a source's emissions because those data provide the best representation of the tested source's emissions. However, test data from individual sources are not always available and/or they may not reflect the variability of actual emissions over time. Thus, emission factors are frequently the best or only method available for estimating emissions, in spite of their limitations.

Emission factors may be appropriate to use in a number of situations such as making specific source emission estimates for area wide inventories. These inventories have many purposes including ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. Use of emission factor may also be appropriate in some permitting applications, such as in applicability determinations and in establishing operating permit fees.

For the purpose of Electricity production from renewable or for the purchase of green electricity, emission factors given in table 2 can be used.

Table 2. Emission factors for local production of electricity from renewable sources:

Electrical Energy Source	Standard factor emission (T CO ₂ /MWhe)	LCA emission factors (T CO ₂ - eq/MWhe)
Solar	0	0,020 - 0,050
Wind	0	0,007
Hidroenergy	0	0,024

2. GEMIS - GLOBAL EMISSION MODEL FOR INTEGRATED SYSTEMS

Another method for calculating greenhouse gas emissions is GEMIS method [10].

GEMIS (Global Emission Model for Integrated Systems) is a computerized life-cycle analysis model, LCA database, and cost-emission analysis system. GEMIS evaluates environmental impacts of energy, material and transport systems, i. e. air emissions (SO₂, NO_x, particulates, CO, NMVOC etc.), greenhouse gases (CO₂, CH₄, N₂O etc.), solid/liquid wastes, and land use. It can be used to analyze local, regional, national and global energy/material/transport systems, or any scope of sectoral or cross-spectral sub-system (e.g., a plant, facility, or special life-cycle). Furthermore, GEMIS can determine the economic costs of scenario options.

Program GEMIS is linear, it is worth looking quantities x_1 counts type equations

$$x_1 = f_k(y_j) = y_{kj}y_j + k_{ko}$$
 (1.5)

where: $f_k(y_j)$ is a linear function, and input variables y_j , k_{kj} , k_{ko} constants.

For example the emissions of a substance during combustion of fuel Ej compute GEMIS of relation:

$$E_J = k_j * Q \tag{1.6}$$

where:

kj so-called emission factor,

Q is the heat in the process of bringing fuel.

The emission factor kj are either stored in a data file or are computed. The size issue can be further adjusted for specific conditions such as the concentration of solid particles in the exhaust gas can be adjusted by the effectiveness of dust separators. The advantage of linear algorithms of the program is to simplify and speed up the computation, as each individual process chain can easily superimpose. This solution represents a certain compromise between calculation accuracy and the benefits to the user.

Program GEMIS defines the products as inputs and outputs of processes. Products contain the necessary information for calculating the energy and environmental characteristics of processes. Standard database GEMIS version 4 includes features over 750 basic types of products.

Types of products are defined as:

- Carriers of Energy - products entering or leaving a process, other than fuel, it can be electricity, steam, hot water,

- Solid and Liquid Fuels (Solid / liquid fuels) - the type of energy carrier

- Materials - products entering or leaving a process than carriers of energy (chemical compounds, building materials, industrial and agricultural products, semi-finished products, food, drinks, etc.)

- Resources - products that can be converted into energy or materials (fuel, water, wind, ore bearing materials), also contain information about the quality of environmental influences,

- Gases - Sub-Categories fuels (natural gas, LNG, LPG),

- Gaseous emissions (Emissions into air) -Theoretical GEMIS calculated pollutant emission from fuel element analysis,

- Waste (Residuals) - solid or liquid waste products of processes, data on the major waste are listed in the database, the user can also freely enter your own data on five types of waste.

GEMIS defines a process as a specific activity, which aims to transform the input product for the product output. However, it may be used other auxiliary input products (such as auxiliary power), and may occur in the secondary outputs (eg emissions of harmful substances). Like processes, products can be detected by filters, which greatly facilitates the work as the standard version 4.3 includes over 9500 processes.

GEMIS includes the following basic types of processes:

• transformation of energy (Energy conversion), combustion, heat exchangers, turbines, etc.

• conversion of material (conversion), production of steel, chemical products, etc.,

• incineration (Combustion)

• mining and acquisition of materials (Extraction), such as oil, ores, fuels,

• transport of goods, persons (Freight transport service, transport Person)

• handling of waste (Waste treatment facility

• cash (Monetary services)

• dispatcher (Mixer) - not a real process, but the sum of several processes, the contribution of the main process is quantified (in%), such mix of electricity produced in power plants of various types and used as the entry product in the primary process.

GEMIS analyze the above processes all subprocesses that chain, auxiliary energy consumption and consumption of materials. For these processes are in the data base characteristics and constants, like the products:

Each process has its own code name, which must briefly comment on the nature and process by which the compiled script. Two different processes may not have the same name. Process list contains the names of processes in different colors to distinguish the data source.

CONCLUSION

The proposed calculation method is good because it introduces a new approach, namely: it calculates not only emissions but also take into account efficiency of equipment for the reduction of the effects of emission, and the second factor is that one can evaluate the effects of emission not only during production but also through the entire period of development of the source. For example, if we have a bio-fuel plant - the emissions occur, but it takes into consideration the emissions from equipment industrial production (LCA-Life Assessment cycle). The actual emission = emission due to material + production process emission emission captured.

Equations used in GEMIS and that of the proposed method had been discussed in this paper. Comparison of results from the proposed method and GEMIS will be carried out in the next paper to show its effectiveness.

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THE DYNAMIC OF CHANGING ANTHOCYANIN CONTENT IN HYDRO-ALCOHOLIC MACERATED MADE FROM FROZEN BERRIES

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INTRODUCTION

The colour of beverages is an essential quality, which customer appreciate the drink. Shades of colour are very different: white, greenishwhite, yellow-white, yellow, pink, purple, redpurple, etc. These shades are duet o anthocyanin and leucoanthocyanin that involved in colour formation, in the proportion between themeselves and the number of anthocyanine, which are forming colorants.

Anthocyanin are compounds that give colour beverages. Their presence in beverages is dominant as monoglucozide and in very small quantities as biglugozide. Anthocyanin content in beverages is highly variable, depending on the variety of vine or variety of berries, fruits etc, and the technology used for obtain beverage (1).

1. METHODS AND MATERIALIS

It has been studied the following frozen berries: raspberries, black currants and black berries located in Moldova.

For preparing macerated solution were used hydro-alcoholic solutions with alcoholic concentration of 50% and 70% by volume. The duration of maceration was chosen depending on the obtained data from studied literature. Base on these data, were chosen three factors to optimise the process of maceration berries, and it was elected the basic level

 $X_1 - 50 \text{ g/100 cm}^3$ solution;

 X_2 – maceration during 20 days;

 X_3 -concentration of hydro-alcoholic solution 60% by volume.

Wide range of λ for these three factors:

for X₁- λ - 10 g/100cm³ solution;

for $X_2 - \lambda - 5$ days;

for X₃ - λ - 10 % vol.

For all these analysed berries was set the optimization parameter Y – total concentration of anthocyanins mg/dm³.

2. REZULTS AND DISCUSSIONS

Were performed 8 variants of experience for frozen berries: raspberries, black currants and black berries, weighing 40 grams and 60 grams in 100 cm hydro solution – alcoholic strength of 50 and 70 % and maceration period from 5 days to 25 days.

Anthocyanin content was determined by the phtocolorimetric method wavelength 530 nm, 1 mm tanks.

In Figures 1-3 are represented the dynamics of change for each a anthocyanin of frozen berry content depending on the duration of maceration: 5, 10, 15, 20 and 25 days.

Maximum anthocyanin content was found for the 5th day raspberries macerated, for 10 days of maceration blackberries and black currants to 15 days of maceration.

CONCLUSION

Was established the maximum levels of anthocyanins for berries analysed separately and extraction parameters for raspberries: duration maceration -5 days, 10 days for blackberries and 15 days for black currants.

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Figure 1. Anthocyanins dinamic in alcoholic extract (for 50 and 70 % volume) of frozen raspberries.



Figure 2. Anthocyanins dinamic in alcoholic extract (for 50 and 70 % volume) of frozen black currants.



Figure 3. Anthocyanins dinamic in alcoholic extract (for 50 and 70 % volume) of frozen blackberries.

FORMS AND PATTERNS OF THE CREATION PROCESS AND THE CREATIVE INDIVIDUALITY

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INTRODUCTION

Defining the concept of *creativity* and presenting a research background for creativity led us to making its general characteristics. It is well known that creativity is manifested in various forms of human activity. For this reason, creativity has always had a specific character. The present paper aims at approaching creativity under differential aspects: emphasizing the specific **forms** of creativity and placing technical and technological creation within these forms, as well as identifying the stages, the types and the structure characteristic of technical and technological creation.

1. TYPES AND FORMS OF CREATIVITY

Some authors believe that there exist as many forms of creativity as there are distinct occupations, as well as many aspects as the human nature has. It is easy to guess how the mechanism of structuring the creativity forms works as every creative potential needs to take some specific form to become concrete. Following this idea we should establish the forms and the types of creativity. A consequent analysis of referential literature which treats forms of creativity has been done.

Most researchers introduce certain criteria of classification in order to identify forms of creativity [1]. We adhere to the criteria suggested by A. Carnauhov and D. Patraşcu and will adopt the following **criteria for creativity form classification**: 1) the subject potential and abilities; 2) the creating aspect; 3) the domain in which creativity manifests; 4) the creative process approach; 5) the performance; 6) to which social category the subject belongs; 7) the biological factor – the age of the subject.

Treating every criteria of classification separately we can identify different forms of creativity. According to criteria: the subject potential and abilities we may distinguish: *mental creativity, practical / praxiological creativity;* the

creating aspect – *individual creativity, group creativity*; the **domain in which creativity manifests** – *scientific creativity, technical creativity* (technological creativity, technico-technological creativity), artistic creativity; the creative process approach – spontaneous (inspired) creativity, stimulated (organized) creativity; the performance - scientific, technical, technological, economic, literarv. socio-political, sports, creative performing, pedagogical (educational), managerial, etc.; to which social category the subject belongs - pupil creativity, student creativity, teacher creativity, engineer creativity, etc.; the biological factor – adult creativity, teenager creativity, preadolescent creativity, pre-school creativity, ante preschool creativity.

Identifying these **forms of creativity** we should emphasize that new forms of creativity may be found within the existing forms. For example: 1)within scientific creativity there may be identified creativity in mathematics, physics, chemistry, etc.; 2) in technical creativity – project creativity, constructive, modeling creativity, technological creativity; 3) in artistic creativity – poetic creativity, musical, plastic art, interpersonal creativity, etc.

Differentiation of types of creativity has been within made more frequently investigating scientific. technical and artistic creativity. Simplifying the problem and adhering to the creativity typology proposed by D.W.Mackinnon and Al. Roşca we distinguish three types of creativity. The pertinence of the creative product and the relationship between the rate of interiorization and of exteriorization within the creative process serve as criteria of such classification.

According to *the first type*, the creation product is an expression of the creator's interior world (needs, perceptions, motives, evaluations). Within *the second type* of creativity the created product is not in relationship with the creator as a person; the creator acts largely as mediator between needs and goals (the works of the scientific researcher in physics, industry, education, etc.). *The third type* of creativity (representation artists, architects, designers, etc.).

These three types of creativity are accepted by me in technical creation because in the process of technical creation certain interior feelings of the individual are being manifested as well as the mediation of the individual with the outer world.

2. DEVELOPING TECHNICAL, TECHNOLOGICAL AND PEDAGOGICAL CREATIVITY

Further on, we shall focus our attention on technical, technological and pedagogical creativity. Here we ascertain that specialty literature treats, almost exclusively, individual technical creativity, whereas there is less literature dedicated to the research which demonstrates collective technical creativity, technological and pedagogical creativity.

At present, researchers treat technical creativity as both science and arts, identified within the term *inventica*. V. Belous considers **inventica** as science to the extent to which its creative product is related to logicality, and as arts to the extent to which this process remains in the sphere of co-participation between the conscious and the subconscious, between the ability of sequencing convergent and divergent thought, between the algorithmic and the heuristic, between deduction and induction, between analysis and synthesis, between logical-algorithmically techniques and methods and the intuitive ones [2; 3; 4].

The explanation of the process of creation is based on psychoanalytical concepts pointed out by S. Freud, A. Adler and K.G. Jung. Thus, in order to explain the process of creation to students we resort to the fundamental principles issued by S. Freud:

1. *Psychic Determinism*: there exist in psychological acts relations of causality, interdependence, continuity; random psychological acts do not exist

2. *The Unconscious*: it has major importance for the mental activity. It is governed by certain laws; between the conscious and the unconscious there is a barrier which is called censure, acting as a filter.

3. *Motivation*: human behavior is always driven by motivation: any act, expression, action has a logical significance, and is grounded on hidden motivation on the unconscious level.

4. *Evolution of the individuality*: the character is born out of *pregenital pulses*, and develops under social pressure, capable of changing its object.

K.G. Jung's research in determining the individuality structure has acquired special

significance in explaining the developing of students' creative abilities within the process of technological creativity.

In K.G. Jung's opinion the individuality structure includes: the psyche; the consciousness of the Self; the personal unconsciousness which includes various complexes; interactions between individuality structures; individuality dynamics and development; psychological types; the place of symbols and dreams in the individuality structure.

The consciousness of the Self, the personal and the collective unconsciousness manifest in an especial way within the creative process. The consciousness is that part of the brain which can be known by the individual through its four basic mental functions: thinking, affections, sensitiveness, and intuition. The prevailing of one of the functions will stamp the individual character with some specific qualities: thoughtfulness, sentimentality, sensitiveness, or intuition. The personal unconsciousness is that part of the individual which stores from one's birth all personal and conflict experiences, moral problems, the unsettled ones, the ones which seem to have little importance, everything that is sensed, thought, felt, and forgotten. The irrational includes the psychological functions of the major importance for the creative process, such as intuition, feeling, and occurrence.

3. SAMPLES OF THE CREATION PROCESS AND OF THE CREATIVE INDIVIDUALITY

In this article we resorted to two types of patterns; **patterns of the creation process** and **patterns of the creative individuality**

Patterns of the creation process. To stimulate and develop students' creative abilities within the process of technological training the research has resorted to the ideas incorporated within a series of patterns of the creation process. Further on we will list specifics of the patterns: *the constructivist stage of the intelligence development*, *the three-square heuristic of the technical creation, the sequencing of the creation process, creativity as a product, hierarchic of the creative plans, functional of creativity, tetrahedron of the creativity, geometric of the volume (intensity) of creativity; preponderantly under the aspect of our research.*

Let us point out the specifics of the constructivist stage of the intelligence development pattern. J. Piaget considers that

creative imagination is gradually integrated into intelligence in pace with the children's growing. According to the author [4], during the development process the creative imagination rather grows than diminishes; creativity and intelligence synergistically support one another in order to generate a more productive mental activity. The ability to evaluate a situation from multiple perspectives is essential in the creative process. This ability is formed in early childhood through a diversity of activities related to the sensorial-motor exploration of objects. J. Piaget considered similarly significant the docile nature of the creative process: it alters alongside with the child's progress within development stages.

The three-square heuristic pattern of the technical creation. Its author, I. Moraru [5; 6] proposes to call the functional structures which share partnership in realizing creativity, inventions, and discoveries "heurism" (from the Greek heuriskein – to learn, to discover, etc.). Thus, heuristic structure means a grouping of functional parts, related to each other, which have a distinct function in the production of the new. To say it otherwise, *heurisms are called the structures which work together at realizing creativity and participate in inventions and discoveries*.

All conjugated creative structures will form the psyche (person) as an integral creative system. The part as well as the integral should be conceived multi functionally. A part may work in succession and simultaneously in more creative structures, which, in their turn, work in succession and simultaneously with each other, within the integral creative system – the person. The fundamental psychic processes are considered as functional parts which are structured to form heurism, the latter with proper functions and well defined within the creative intention. The following 6 heurism are defined in accordance with their basic functions:

(1) *The heurism of accumulation and comprehension of information*, achieved by memory, convergent thought, language, interests, etc..;

(2) *The combinatory-associative heurism*, achieved by divergent thought, imagination, intuition, fantasy, memory, the conscious and the unconscious, etc.;

(3) *The stimulating-energetic heurism*, which integrates a synthesis of the passion, the feelings, the motivation, the interest, the will, the courage, the needs, the engagement, the environment, and the pleasure of inventing and making discoveries, etc.;

(4) *The critical, evaluative heurism*, achieved by analytical thinking, logic-deductive, by the

critical function of the intelligence and the conscious, etc.;

(5) The inductive-perceptive heurism and pertaining to objects images, in which ideative, perceptive and motor components participate;

(6) *The action–practical (technological) heurism* [1, p.36].

The heurism pattern (Figure 1) expresses the configuration of the mentioned structures within a square analogical to the logical square.



Figure 1. The heurism pattern (after I. Moraru)

The author points out that heurism involved in producing new original ideas are placed on the four sides of the square, whereas the heurism which participate in transforming ideas into things and masterpieces (scientific, technical, artistic, pedagogical, etc.) are placed on the two diagonal lines.

Apparently included within the limits of functional and processional psychological coordinates, the developed form of the pattern (Fig. 2.) the integration of the psychological level into the anthropologic, based on the environment-nature, organism – human being, brain – psyche, creativity – creation, and the ontological centered on concepts of existence, becoming, creation and duality.

The synthesis of the heurism pattern and the pattern of duality series and progressive transformations (Figure 2), in the hypothesis of its



Figure 2. The pattern of duality series and progressive transformations of the existence (after I. Moraru).

applicability, including consciousness as an objective part of existence, contours a heuristic pattern, such as indicated in Figure 2. This pattern insures the cognition and the reconstruction of the creation process, the psychosocial effort of tearing out whatever is called novelty of the nonexistent and its integration into the existent.

Besides the explanatory value which this pattern has in knowing the structure of the creative psycho-behavioral module, the author demonstrates its applicative value in heurism graph. It consists in a succession of creative sequences, which integrates into a creative process [7].



Figure 3. The heuristic pattern (after I. Moraru).



Figure 4. The sequencing pattern of the creative process (after V. Dulgheru, L. Cantemir, M. Carcea)

It insures a graphic arrangement of sequences of a discovery or invention, in their succession, based on biographical, autobiographical or documentary information (analysis of activity products. evidence. notes. etc.), facilitates rigors comparative analysis, securing and efficiency. We use the method in analyzing the history of a discovery as an exercising activity.

I. Moraru's pattern is disputable due to interference of certain plans and individuality variables; yet, it is advantageous in its attempt to integrate the "*couples*" which intervene in the complex process of creation. This pattern reflects only the contribution of the creative subject in achieving the technical creation (Figure 3).

The sequencing pattern of the creative process. The first phasing of the creative process belongs to J.Wallas [8] and differentiates four phases: preparation, incubation, illumination/inspiration, evaluation. *Preparation* is a phase which preponderantly takes place at the level of conscious structures and lies in successive definitions and redefinitions of the problem, as well as in organized and consequent data collecting which may lead to finding a solution.

Incubation, the most controversial phase of creation, takes place preponderantly at the level of the unconscious structures, where spontaneous, unconscious processing of problem data take place, as well as of information which was collected consciously in order to solve it in terms of a certain criteria.

Illumination represents the moment of growing aware of a relation, more or less expected, between the problem data and a certain informational which structure, results from conscious and unconscious data processing. simultaneous and consecutive.

Evaluation consists in conscious examining of the ways of equilibrating the informational corpus *problem* with the informational corpus *solution* in one or more concrete situations.

The intuitive pattern of the creative process phases is graphically presented in Figure 4.

On the horizontal line is represented the time variable from the moment of realizing the problem situation – to the identification of the solution – t1; duration of the integral process of creation will be dt, with variable values from the case, from the order of seconds to that of years. In most situations, the creation process has not a unique direction; the illumination moment may offer just an alternative to the solution, which in its evaluation phase may lead to new preparations and incubations. On the vertical line are represented the active psychic levels in different phases. The continuous arrows suggest in this pattern the informational input, and the interrupted ones – the psychological energy input which supports the process.

Alongside with the creativity patterns based on the process, specialty literature proposes patterns of creativity as a product. The pattern of creativity as a product. At a high level of abstraction, the creation product is expressed by performance under the aspect of the main characteristics of creation, and namely its social novelty and value. Among the most accepted definitions of creativity stands the one developed by Ghiselin, which states that a creative performance is a first modeling of a universe of meanings, expressive of the way in which the individual understands the world and himself [9].

According to the author, the appreciation criterion of the creative product is the measurement which he succeeds to use to restructure the whole universe of meanings.

The hierarchy pattern of creative plans. Analysis of definitions and approaching creativity vertically claim examining the idea that *all persons are potential creators to some extent* [10] and the idea that there exist several levels of structuring creativity. These ideas allowed Irving A. Taylor to develop [10], a pattern which may be considered operational enough to evaluate creative products of different levels of complexity. I. A. Taylor describes five different creativity plans, in hierarchal succession:

- *expressive creativity plan* characterizes the universe of childhood, where behavior is what really matters, not the ability of the obtained product. This plan finds expression in specific products: drawings, games, fantasy stories, spontaneous and free improvisations;

- *productive creativity plan*, which relates to acquiring some incentives for certain domains (of communication and expression);

- *inventive creativity plan*, which means the capacity to achieve new links among already known elements. This plan is attained in inventions and discoveries based on flexibility and receptivity towards the environment;

- *innovative creativity plan*, characteristic of few people, lies in finding some new solutions with a theoretical and practical resonance;

- *emergency creativity plan*, the highest level of creativity, specific of genii who, through their contributions, have revolutionized an entire domain of science, techniques or arts [10].

The functional pattern of creativity. Implementation of instructional programs of creativity, based on classical patterns of creativity (the factorial pattern and the processional one) lead to stating that these generate significantly different effects, namely, training abilities leads to raising potential creativity, without externalizing an increase of performance under the aspect of the manifested creativity, and the process training favors the appearance of some concrete products of creation – projects, patent projects, didactic projects developed by students – not attested by a significant increase of potential creativity.

The presented pattern is qualified as functional, on the one hand, as it offers priority to the role it has in the structure of the practical didactic activities of developing professional creativity (in the technical, technological and pedagogical domains), on the other hand, due to the meaning attributed to creativity. Let us stipulate that we approach the problem of creativity from a systemic perspective which permits acceptance of the following premises:

- creativity represents the specific difference which defines *the human psychic system* reported to those infrahuman, constructive (creative) adjustment being established in terms of its maximum generality (the aim of the system);

- creativity is achieved through interaction of cognitive and affective processes at the specific intellectual and human level, respectively, of feelings and passion which we consider conscious, integrated emotions, in time with profound psychic structures;

- creativity improves in conscious creative activity due to the capacity of optional selfregulation of the human psychic system through feedback.

Within the functional pattern, creativity is due to the interaction of the psychological processes, to the evolution of the cognitive and affective process component. At this point creativity is considered a permanent phenomenon, evolutional and descriptive, oriented towards finalizing the creation product. The phases developing between the two restructures of the incipient structure can be described using the classical phases of creativity: information looking for (preparation) assimilation of restriction (incubation) \rightarrow integrating restriction those anterior (illumination) \rightarrow selecting and reorganizing the pertinent informational zone (verification of solution).

The functional pattern permits to formulate the following conditions to finalize the creative activity into a creation product:

- the cognitive restrictions should be deliberately interpreted as an increase in cognition in both confirming the formulated hypothesis, indicating the opportunity of advancing in the selected direction, and in infirming the hypothesis, in closing research direction, in which investments have been made;

- the feeling which comes along with the positive experience of creation should be understood in order to accelerate the transformation of discreet, situational emotions into continuous emotions and passions;

- equivalent and interdependent treatment of cognitive and affective components, in their specific humane manifestation by imaginationthought and feeling-passion forms. The affective component gives the energy necessary for new acquisition of knowledge, and the cognitive one orients the person towards pertinent informational zones, both dealing with individualized data processing.

The functional pattern integrates aspects of creativity product and process and suggests the subjective conditions of the interaction personsituation favorable for the creative act.

The tetrahedron pattern of creativity – developed by V.Feier – includes the creating subject, the creative product, the creative activity, the creative environment. In the geometrical figure the V. Feier pattern represents a tetrahedron, in which the four surfaces confining the body (the creative system) are constituted of: the creative product (ΔABC); the creative subject (ΔABD); the creative activity (ΔACD); the creative environment (ΔBCD) - (Figure 5)



The creativity tetrahedron possesses properties, which prompted recommendations that serve as guidelines in the practice of developing students' creative abilities in the of technological process training:

All four surfaces are

Figure 5. The creativity tetrahedron

(V. Feier). necessary to make the tetrahedron work, that is, develop creativity, and each of them should have its area smaller than the sum of the other three;

* Each triangle interrelates with the other three, forming the corresponding edges;

* Only one point of view is not enough "to see" the whole body;

* To increase the quadrate of a triangle it is necessary to alter the configuration of the other triangles.

In order to disclose the strategy and the tactics of students' creative abilities in the process of technological training, we will analyze the geometrical pattern of the creativity volume (intensity) - developed by V. Enătescu [1, p.71-76] from a psycho informational perspective, presented in the creativity pyramid (Figure 6).

From the creativity pyramid pattern we may see that the new objectively-introduced factors are

related to: 1) technico-organizational conditions: the technical level; the level attributed to the research; 2) the researcher individuality: the individuality indices; the age; the scientific position.

All these factors are necessary, but they do not reflect creativity integrally. They only serve as



Figure 6. The creativity pyramid (V. Enătescu).

an impetus for understanding the dialectics of the creation process, on which the process of formation students' creative abilities in the process of technological training is organized.

Different from the patterns of the creative process, pointed out previously, the specialty literature describes patterns of the creative individuality, which we are going to refer to further on.

Patterns of the creative individuality. This article aimed at our taking decisions regarding the intelligence pattern, the factorial pattern and the descriptive pattern of the creative individuality.

The intelligence pattern – a fundamental *ability of the creator*. Responding to the aims of the article, it is necessary to identify the peculiarities of the creative people, alongside with the peculiarities of teachers engineers. Starting from G. Sperman's idea that two categories of factors can be distinguished within the human abilities context, a general factor – which participates in performing all activities, and numerous special factors - which correspond only to concrete conditions of one form of activity (engineering, pedagogy, artistic. managerial, etc.), it is considered that creative people possess intelligence and specific thinking. Yet, a man's thinking depends on the activity he was practicing. It has been established that the artist's thinking character is different from that of a technocrat, based on the predominance of this or that form of thinking (Figure 7, a). The artists' dominant form of thinking carries a mythological or magic character, they are marked by powerful

feelings of guilt, are independent of their parents and introverts; whereas the technocrats are dominated by scientific thinking. In case of teachers engineers, both forms of thinking are characteristic with them (Figure 7, b), because in their activity both scientific thinking and mythological and magical thinking (from the point of view of pedagogy as arts) manifest, they are also endowed with alchemic and religious-ethic thinking.



Figure 7. The nature of thought of artists, technocrats and engineers teachers.

The stated ascertainment allow us to argue the fundamental ability of the human creator – the intelligence (a term derived from Latin, the Romanian equivalent of *cleverness*), with reference to engineers, teachers of technological education

Intelligence is a complex phenomenon and therefore its defining is difficult. Definitions made so far have not yet met a unanimous acceptance. However, *intelligence* can be defined as *a general cognitive function*, *based on abstraction*, *pattern construction and problem solving*. In our research *intelligence* is treated as the *general ability to solve problems optimally, that is the ability to meet all obligations that require some adjustment capability, and a spirit of observation and logical deduction*, etc.

Basic functions of the intelligence are: abstract thinking, mathematical skills, verbal expression, ability to diagnose and resolve, memory and creativity. Thurstone established the following factors of intelligence: reasoning (deductive and inductive). memorizing. capacity, perceptual quickness, spatial operation, understanding of words and verbal fluency. Intelligence can be assessed. Empirically it can be evaluated by: efficiency, learning ease and depth of understanding, difficulty and novelty of the issues which the subject is able to solve. The best-known parameter for determining the level of creativity is intelligence quotient IQ (measured in points), which differs from person to person. Research shows that the vast majority of people (except those who have a pronounced degree of debility) possess creative skills (Figure 7).

Statistical surveys have shown that IQ – ranges in average between the extremes of 60 and 140 with the majority placed between 90 and 110 and that its value increases until the age of 25-30 years. Statistically, the distribution of IQ for a given population has values that are represented by Gauss's curve (Figure 8).



Figure 8. IQ curve (or Gauss's curve) at various categories of people.

One of the great issues of intelligence is related to the factors that determine it fundamentally. *Is intelligence innate, congenital or acquired?*

Milson Ehile established that human *intelligence* is a quantitative aspect, which has *a double determination - genetic* and *environmental*. According to this theory, the man is born with a certain *potential* intellectual genotype, whose realization depends on the environment, favorable or unfavorable. After H.J. Eysenck, intelligence is genetically determined in the ratio of 75-80%, the environment having a 20-25% of influence.

It is to be accounted that measured intelligence increased up to 15 points from one generation to another. It can not be explained by the increase of the *"informational*" bombing upon subjects, or it can not be explained essentially from this point of view.

Age has also an influence on intelligence, research and innovation. There are views and the assumption that scientists have produced their best works at the age between 30 and 34 years. H. Abt concluded that the most important discoveries were made at the age between 30 and 70 years, although the maximum number of major work was done at the age of 45-50 years.

The factorial pattern of creative individuality. A complex model of the creative individuality has been proposed by A. Munteanu [11]. It has teaching and psycho diagnosis destination in developing creativity. According to the author, creativity training involves multiple cooperation among the three categories of factors: psychological, biological and socio pedagogical.

The three-dimensional pattern of the intellect. Researches of J.P. Guilford highlight and systematize the intellectual skills involved in creative activity.

Creativity is seen as a set of specific intellectual skills, integrated in a unitary intellectual structure defined on three dimensions: individuality, content processed by intellectual processes and the products of such processing.

The specific continuity that features it is a divergent thinking, seen by the diversity of orientation of sequences of operations, seeking different solutions to problems. The phrase is used by J.P. Guilford by analogy with the concept of imagination. Variants of processing knowledge progress on the direct-indirect cognition dimension, in the following sequence: perceptual knowledge \rightarrow storing \rightarrow convergent thinking \rightarrow divergent thinking \rightarrow evaluation.

Attributing meaning to the order in which the processes are presented in the patterns, we can deduce that the divergence processes previously collected and fixed in memory content, being oriented towards providing the necessary data for a convergent processing, and choosing the one and correct answer from among all possible alternatives. The contents vary according to specific-abstract criteria in the following sequence: figural \rightarrow semantic \rightarrow symbolic \rightarrow behavioral. These contents are representative for specialized domains of activity: the figural – the technical-applicative and the fine arts domain; the symbolic – sciences, the specialty literature and technical concepts widely use the semantic content, and the behavioral – in the social sciences and the humanities, including those of education. Please note that by *representative* we do not understand exclusiveness. The size of products is divided according to the particulargeneral criteria: after the first two relational factors, after the quantitative criteria (one and) clear quantitative structural differences appear, which express the nature of the relationship between the units and classes or among several classes, generating systems, functional units convertible into new structures, with implications for *neighboring* systems (any system that can achieve the new system, regardless of the criteria).

In this pattern there have been identified six specific skills of creativity, each one being able to *divergent production*, which can be translated into partial or integral products.

From the point of view of pedagogy, we advert to the risk of giving priority to the pattern, namely the one which considers any problem solving a creative exercise. The perseverance with which J.P. Guilford returns to the idea that any act of creation is actually a problem solving, indicating reciprocal risk accuracy (that any problem solving is a creative act) is false.

Similar to J.P. Guilford, V. Lowenfeld [13] came to similar features, who, besides restructuring skills, analysis, synthesis and consistency of organization, defines *four factors* that seem to be *related to* the *functional features of complex mental processes* such as: sensitivity to problems that would be based on non-sensory sensitivity, *responsive availability, mobility* and adaptive to different situations that feature and *originality* that defines by contrast with "*conformity*".

Along with the researches of J.P. Guilford and V. Lowenfeld, we highlight the following specific skills pointed out by A.N. Luk in the context of the psychology of creativity: a) alertness in researching issues, 2) the ability to compress the operations of thought, 3) ability to transfer the experience, 4) the integrity of perception, 5) approaching terminology; 6) memory training, 7) flexibility of thought, 8) the ability to think; 9) ability to assess, 10) chaining and unchaining capability, 11) ease of generating ideas, prediction skills, 12) speech flow, 13) processing capacity, 14) capacity and creative potential [14].

Description of factors and intellectual skills involved in creativity, emphasizes the cognitive component of the creative individuality, striking a balance between the image of the bizarre genius, weak and vulnerable, and the strong one, pragmatic, victorious, not as a mix, but as multiple and alternative patterns of diversification, and what is essential, with equal chances of success.

CONCLUSIONS

Concerns about the conceptualization of the creativity phenomenon are dominated by identifying the features of the creation process and of the creative individuality.

To stimulate and develop the students' creative skills in the process of technological training the ideas embedded in the patterns of the creation process are effective.

Experts say that *creativity* is *seen as a set of specific intellectual skills of the person*. Creativity includes the following skills: analysis, synthesis, consistent organization, fluidity, flexibility, redefinition, development, originality, sensitivity to problems, receptive availability, mobility etc. These skills can be initiated and developed in teaching, resorting to problem solving and applying well-structured instructional strategies.

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SCHEDULE OPTIMIZATION ON ROUTES SERVICES OF PUBLIC PASSENGER TRANSPORT

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Urban passenger's public transport, the main component of urban transport, is one of the most important functions of a city because it ensures unity and coherence of all its activities. Although it occupies a prominent place in the human activity, the organization of urban transport, in general, is currently a big issue in most major cities.

Public passenger transport aims to take over passenger flows from the transport network in both directions of traffic. In this context, it is necessary to determine the hourly variation of the flow of passengers for each route and then, depending on the length of the route, capacity and speed of available vehicles, to determine vehicle needs at different times of the day in question to draw appropriate timetable.

The production activity of carriers within the technological process of transportation is focused on achieving at the same time two diametrically opposed goals:

- minimizing travel time of publics;

- minimizing resource consumption in the transport process.

Thus, there is need for objective evaluation of optimal process parameters, characteristic for the transport system and its components.

In public transport, the importance of efficient use of transport capacity is even greater because of the scarcity, fleet structure and characteristics of traffic flow irregularity.

During unloaded periods between rush hours, the efficiency of buses carrying capacity decreases significantly, requiring the need to adopt measures to optimize the system of public transport by linking the number of vehicles on route with real flow of passengers.

The methodology of schedule optimization developed in this paper is based on the queuing theory, arising from the nature of processes characteristic for the operation of a public transport route.

It is considered a random process of accumulation and embarking of passengers at intermediate stations of urban bus routes during unloaded periods between rush hours. For optimization of the routing service it will be use the queuing theory. Suppose that the accumulation of passengers at intermediate stations of the route takes place according to Poisson law, the arrival of buses is realized as exponential law.

If *n* is the number of passengers arriving at the station in the intermediate time interval $(0, t_o)$, the probability of arrivals under Poisson law is given by:

$$P_n = \frac{(\lambda t)^n}{n!} e^{-\lambda t_o} \tag{1}$$

where: λ is the intensity of passengers accumulation (arrival) in the station, passenger, pas·h⁻¹;

 t_o – the time between arrival of the first passenger and the arrival of the bus in the station, h.

In the case of Poisson distribution, mathematical expectation M (n) is equal to the intensity of arrival passengers in the station, so we have:

$$M(n) = \lambda \tag{2}$$

On the other hand, according to queuing theory it's necessary to respect the following ratio:

$$\lambda = \frac{N}{T},\tag{3}$$

where: N is the number of passengers, accumulated at the station in period T.

In period t_o the accumulated number of passengers the station is as follows:

$$N^* = \frac{N}{T} t_o \tag{4}$$

Period T is the interval of time in which the number N of passengers accumulates at the station and remains constant, usually this period does not exceed 10-13 min. Beyond that period, passengers choose other available travel options, including other routes or types of transport. Therefore for full takeover of passenger flow of station, it's necessary to comply with the following ratio:

$$t_o < T \tag{5}$$

Time of arrival of buses to the station complies with the exponential distribution:

$$F(t) = 1 - e^{\mu t} \tag{6}$$

where: μ is the intensity of the arrival of buses in the station, auto $h^{\text{-}1}$

$$\mu = \frac{60}{I} = \frac{60 \cdot A_R}{T_R} \tag{7}$$

where: *I* is the interval of circulation on route, in min;

 A_R – number of buses on route, units,

 T_R – period of a bus turnover, min.

The interval of circulation on route during the day technologically varies from minimum value $I_{min} = 3 - 5 \text{ min}$, characteristic for rush hours, to the maximum $I_{min} = 12 - 20 \text{ min}$ for unloaded periods. Real value range of interval of circulation is actually a practical criterion for assessing the quality of services.

The time of arrival of the bus in station t_S is given by:

$$t_{S} = \frac{1}{\mu} = \frac{T_{R}}{60 \cdot A_{R}} \tag{8}$$

To ensure the boarding of all passengers accumulated in station, the following condition must be complied:

$$t_o \leq t_S \tag{9}$$

Substituting in relation (9) relationships (4) and (8), we obtain:

$$\frac{N^* \cdot T}{N} < \frac{T_R}{60 \cdot A_R} \tag{10}$$

If we define the ratio $\eta_F = \frac{N^*}{N}$ as a ratio of revaluation of passenger flow in station, then

equation (10) may be transcribed as follows:

$$A_R > \frac{T_R}{60 \cdot \eta_F \cdot T}, auto \tag{11}$$

Equation (11) allows formulating the following optimization principle: minimizing the number of buses to the route may be achieved by increasing the value of the coefficient of revaluation of passenger flow in station and the period of passenger's accumulation in the station to acceptable levels for the passengers.

Traffic flow N * accumulated in period t_o may be taken if there is place in the bus. However, if there is no free place, then the passengers that could not be embarked are waiting for the next bus, which should arrive faster than the time T. If the last condition will

not comply, the carrier can't assert passengers flow, which will then degrade or will redirect to other transport solutions.

For maximum revaluation of passenger traffic, accumulated during period t_o in the station, it's necessary to use buses with a larger number of seats or, alternatively, to reduce proportional the period of turnover.

CONCLUSIONS

As a result of developing optimization methodology of the passenger transport on public routes service, the following main conclusions can be drawn:

- applying queuing theory to rationalize transport on public routes service provides real optimal solution, applicable in practice;

- minimum possible waiting time of bus is ensured if the system is planned so as to comply equation (9);

- maximum revaluation of passengers flow at stations is ensured if the route is served by a number of buses, computed in comply with relation (11).

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THE POLICIES AND MANAGEMENT'S METHODS FOR INTERNATIONAL MARITIME FRAUDS PREVENTION

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The special interest for consignment gave a pronounced development of maritime criminality. This is a particular truth of them, who damage the system without being involved in directly.

"The operation" of the consignment on maritime way it's a process of continuous expansion and in present, in the international maritime commerce, undoubtedly this "art" become being able to be practiced with few chances to be discovered.

Eventually this was possible till governmentally and in maritime expedition industry started to be taken actions and to be encouraged positive actions in this way.

Initiated management's policies for fighting and control of this illicit process created majors problems, both to the cause and effect level. But the effort is not knows by the simple people who don't see the consequences that should directly affect them, which not brings to ask for protective measurements. Management's methods for frauds preventions will be commented in a bigger social, economical and commercially interrelated context.

a) Documentary fraud as a economicalmanagerial modality.

Commercial details of the documents for international commerce makes the fraud and the associated false to become a complex procedure associated with implicated parts: the seller and buyer. The phenomenon became the subject of international debates where the geographical distance it's bigger and the implicated persons are less, the confidence in documents it's essential from the point of view of commerce. But the system it's obviously vulnerable by the fraudulent manipulations.

The time and the distance implicated in maritime transport of goods makes the system of payment before the delivery to be a current practice.

One of the two parties, the sender or the recipient, for a short time, should not be in possession of any money or property. The development of the system put the beneficiary in this position.

This convention has given rise the letters of credit system as a banking tool. The operating

system has been tested over time and is still available with good results. The distance that separates the parts determine the involvement of an intermediary, which inevitably is a bank. The buyer, who usually places his money under the risk, nominates a bank who will pay the money to the seller, once the well established preconditions have been met. This situation centers on the transfer of documents, because they can be transferred much faster than goods to which they refer.

The falsehood has become an important factor in this type of crime, as is the focal point of business documents transfer. The paying bank should give satisfaction to the sender, waiting to be paid and who, at its turn, satisfied the conditions imposed by the receiver. The common denominator in this case could be the bills of lading, which can be true or false. Is obvious that not all banks are willing to accept, in a letter of credit, to follow the instructions. Up to a certain extent this attitude is understandable. The banks deal with the letters of credit with thousands and different conditions for some of them would make the whole system more difficult to master. Moreover, are recorded many examples in which the most elementary caution could prevent the loss of large sums of money. There were cases in which the goods were offered on the stock market as being on board that is under way. A simple verification of the name of the ship in cargo port could show that the ship is away of the port in question on thousands of miles. It's surprising that neither the victim nor the forger check these facts.

With such a lack of attention to detail is not surprising that sometimes the fake bill offers an amount of goods that exceed the ship's tonnage witch will make the transportation. Who'll be responsible, if it were possible to verify the authenticity of the documents? May claim that bank as a place to change the documents would have to handle this? The banks almost have not met any responsibility for the actions or the consequences thereof for any deficiencies of the action. There are situations in which the banks are victims of maritime frauds. In such a case recently in New York, a bank was a victim of forged documents maritime expedition. The experts think that this case is rooted in the massive fraud against the National Bank of North America and the author is Tidal Marine who was engaged in business as an owner of ships.

This kind of business takes place usually on borrowed money. The most important safety measure o guarantee granted mortgage loans is the taken mortgage of ship and a notify of the charterer entered in the current deal between owner and operator of ship. Although fundamental, letter of credit system operates only between the buyer and seller, there are plenty of involved, such as an international agents transaction becomes multinational, and who leads the inherent investigative and jurisdictional issues. Regarding insurance, are cases where the insurer can take the load on the policy, so that goods are not subject to risk. This is evident in the case of fraud where knowledge documentation, invoices, certificates of origin are falsified. If the goods do not exist, at that time is nothing on which insurance may be attached, and the insurer disclaims liability under the policy.

In terms of prevention there are no insurmountable problems. It's necessary to update the commercial practice and the involved parties should take their own measures for protection.

b) Contract fraud

The contract fraud is committed by the charterer in the detriment of the ship's owner or operator. The changes in recent years in the expedition, the aging and maritime the technological obsolescence of ships, created a fertile ground type of crime. Lot of this kind of ships is in the hands of small owners that are ready to run. They are ideal from the economical point of view to be involved in fraudulent arrangements, particularly in areas where the social development is overcome by the development of commercial practice. The unethical or fraudulent operators will charter this kind of ship, paying the necessary minimum costs, regarding cargo space, collecting charter taxes, and then checking if the ship is loaded in its road towards the destination. When the second or the next rental fees must be paid to the owner, it finds out that the carrier is gone and there is no funding. The problem is complex and the motivations of various parties, other than the carrier, are all understood so that further progress becomes difficult.

The sender that is entirely an innocent party in the transaction, except the imprudence to accept a low cost of carrier or other such "advantages ", wants his property to reach their destination. The importer, paying the goods wants to get in their possession and the owner, who is usually the commander of his own ship, discovers that he has not, for example, enough food to complete the voyage, to pay salaries, the fuel, port fees and other.

These problems have been solved in different ways. The shipper agrees, sometimes, to pay a higher carrier rate in order to see the goods at destination, without taking into account other consequences. Sometimes accepts a diversion and a sale of assets to cover costs and then begin a new export operation. It can happen that the ship's owner or master will deviate the ship from the normal route and then will sell the loads where he can. And it is a crime as serious as those of the charterers that endanger the entire state of affairs. The legal proceedings may become endless, with responsibility for the losses encountered, usually divided among the participants. As in the case of documentary fraud, these situations can be avoided by exercising a bigger commercial prudence than is usual now.

c) The intentionally sinking ship fraud

The old ships with expired life, that floods the market, fall into hands of small owners or owners of the "unique ship", which prospect to obtain a higher income from insurance than from legal trade that appears more attractive. These ships who load goods, depart having a bigger value than the ship itself. Later the crew escaped by a miracle, will tell about "catastrophic conditions" that led the ship sinking. The investigations often show that the ship has entered into an unscheduled port, downloaded and sold the cargo on the quay, before the "catastrophe" that led to sinking. The ease with which these crimes can be committed is accidently than derived from a previously well-designed plan. The recent development of this type of crime has shown those not only don't stops to the old and small ships, nor absolve the owners or charterers of involvement.

d) The piracy

Another result of political instability is the recrudescence of piracy. The phenomenon is currently expanding and all measures taken in the International Maritime Organization had not expected any results.

e) Who Pays?

Even the sea fraud is on a small scale, the size of the damages claimed, the difficulty of the standard trade exhibition can be considered as having two roots.

The first, the overall volume of world trade, not necessarily the maritime one, is increasing, and what was particular became general.

Second, exist lot of commercial fields that earn their operational autonomy before to learn the base principles of international trade.

It's true that immediate injured are the insurers, the maritime companies, individual exporters and importers, the owners and even the state itself. The today's losses became tomorrow overcharged and in the final analysis is the consumer who pays, because he is the last of the chain of those who bear the burden of price increase.

f) The future

As was shown, the maritime criminality from particular situation increased and grew rapidly on the background conditions created by the current international trade.

By influencing the business climate can make:

- from those who have the power of foresight to realize that they are the potential victims and should exercise more attention than ever exercised. This is not a critic for they, but only an attention on the experiences of others.

- The intervention of specialized organizations has become essential.

For such complex problem like this one, it not exists a simple panacea, but should be operated at all levels. This necessity arise tasks on commercial organization's capability and place it at the level of an organization which, while having a proper commercial practice all these variations, however, is enough to provide corrective measures at government level.

g) Specific activities to prevent fraud

All the parts that could protect themselves, being extremely careful when they are negotiating for the first time with the unknown juridical persons or by initiating discreet investigations about standards and the integrity of those persons, before concluding a firm deal. Specially, the owner could deal with owners or transporters who have a good reputation. If the transporter is not known by the loan's owner, this can see in Lloyd Register if the ship is classified, what is it's transport capacity with was registered and after to see the Bulletin Lloyd the information about the ship. In many cases the transport ship wasn't in the situation to fulfill its obligations.

The cargo owner must take care when he notices that the shipping fee is too attractive. This could be explained in a way, but he should manifest more prudence than when he fined out that the transport ship is owned by a company of naval transporting who has one owner and passed more than 15 years from the last time when the ship departed on the sea, and changed many owners. If the cargo owner is not decided, he can renounces and ask elsewhere or to support the consequences engaging a dishonored transporter.

A such trader who is interest in these issues will be able to modify their demands according to its own risk assessments.

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INFLUENCE OF FLOW REGIMES OF MOVEMENT AND ACCUMULATION OF TRANSPORTATION TO INCREASE TOXICITY OF EXHAUST GAS EMISSIONS BY CITIES LINES

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In terms of transport flows dense engine operating conditions lead to extensive exhaust emissions into the atmosphere. We think the amount of emissions $\sum N_i$ is proportional with amount time of engines operating under non-standard transmission schemes, therefore:

$$\sum N_i = F(t) \tag{1}$$

where: $\sum N_i$ – total emissions of toxic substances.

$$\sum N_i = n_1 t_1 A_1 + n_2 t_2 A_2 + \dots + n_n t_n A_n \qquad (2)$$

where: $n_1, n_2, ..., n_n$ – quantity of toxic substances emitted $n_1, n_2, ..., n_n$ by a car, m^3/s ;

> $t_1, t_2, ..., t_n$ – emission of these substances during the performance of distance measurement S_i ;

> $A_1, A_2, \dots A_n$ – groups of cars with characteristic toxic emission $n_1, n_2, \dots n_n$.

Sectors characteristic of the measurements may be areas of acceleration, braking and uniform movement.

Let's examine the three regimes of movement of cars in the areas of acceleration S_1 speed v_1 , movement in the regime S_2 speed v_2 and brake S_3 speed v_3 on all the intersections between city bus S= $S_1 + S_2 + S_3$.

The distance travelled by the automobile sector to accelerate S_l , relationship can be determined:

$$S_{1} = \frac{1}{2a} \left\{ \frac{G_{a}}{g} \delta \ln \left| av_{i}^{2} + bv_{1} + c \right|_{v_{1}}^{v_{2}} - bt_{1} \right\}$$
(3)

where: $a = a_M \frac{u_T^3 \eta_T^3}{r_m^3} - kF$; $b = b_M \frac{u_T \eta_T}{r_m}$; $c = c_M \frac{u_T}{r_m} - G_a \psi$ – coefficients equal

balance of power;

$$a_M = -\frac{M_p c'}{100 n_p}; \quad b_M = \frac{b'}{10 n_p};$$

 $c_M = M_p a'$ – coefficients equal torque;

 G_a – vehicle weight, kg;

 u_T – automobile transmission gear ratio;

 η_T – transmission efficiency car;

 r_m – car wheel rolling radius, m;

 M_p – engine torque at maximum power, Nm; n_p – speeds of the crankshaft of the engine at maximum power, rot/min;

 ψ – road drag coefficient;

a', b', c' – coefficients, which depend on engine type and number of times;

 t_1 – time of the acceleration of the vehicle on S_1 .

On the S_I during vehicle movement, t_I relationship can be determined from power balance:

$$dt = \delta \frac{G_a}{g} \left(\frac{dv_i}{av_i^2 + bv_i + c} \right)$$
(4)

Solving differential equality (4) has the form:

$$t_{l} = \frac{\delta \frac{G_{a}}{g}}{\sqrt{b^{2} - 4ac}} \ln \left| \frac{2av_{i} + b - \sqrt{b^{2} - 4ac}}{2av_{i} + b + \sqrt{b^{2} - 4ac}} \right|_{v_{1}}^{v_{2}}$$

$$\operatorname{if}\left(b^{2}-4ac\right)>0\tag{5}$$

 \sim

$$t_{I} = \frac{2\delta \frac{G_{a}}{g}}{\sqrt{4ac - b^{2}}} \operatorname{arctg} \frac{2av_{i} + b}{\sqrt{4ac - b^{2}}}$$

$$\operatorname{if}\left(b^2 - 4ac\right) < 0 \tag{6}$$

$$t_{l} = \frac{2\delta \frac{G_{a}}{g}}{2av_{i} + b} \qquad \text{if } \left(b^{2} - 4ac\right) = 0 \qquad (7)$$

Time t_1 is active toxic emissions during acceleration. In this case it is necessary to focus on dynamics of acceleration of a the less dynamic group of cars. After this group of cars, the attention can be driven at medium speeds of the transport flow:

$$v_{medl} = \frac{S_1}{t_1} \tag{8}$$

On the S_2 – when reaching by the car speed v_2 it can move within the following traffic arrangements:

- 1. constant speed v_2 as a single car or a reduced intensity of traffic flow;
- 2. in a dense flow with variable intensity of transport movements;
- 3. in the transport stream after leader.

Consider the distribution of intervals in the transport stream is subject to the distribution of *Poisson* [1].

$$P_{i}(\Delta t) = e^{-\Delta t \frac{M}{T}} \frac{\left(\Delta t \frac{M}{T}\right)^{i}}{i!}$$
(9)

where: $P_i(\Delta t)$ – transition probability *i* vehicles tracking the benchmark in period Δt ;

M – number of cars that pass by this benchmark for the entire period of follow-up;

T – follow-up period. If T = 1 hour (3600 s),

then the relationship $m = \frac{M}{T}$ expresses the

mathematical expectation of the number of cars at the benchmark in a second. Taking this into account, equation (9) takes the following form:

$$P_i(\Delta t) = e^{-\Delta tm} = e^{-\lambda}$$
(10)

where: $\lambda = \Delta tm = A_i$ – number of cars passing through this part (sector) during Δt .

Taking into account the distribution of properties *Poisson* can be written that:

$$\Delta t = \frac{A_i}{m} = \frac{A_i T}{M} \tag{11}$$

The average number of cars A_i , on the lane will be:

$$A_i = A_i \pm \sqrt{A_i} = \Delta t m + 1 \tag{12}$$

From equation (12) is found time Δt :

$$\Delta t = \frac{\left(A_i \pm 1\right)}{m} = \frac{\left(A_i \pm 1\right)T}{M}$$
(13)

According to his Lithil and Witham [1]:

$$M = cq \ln\left(\frac{q_i}{q}\right) \tag{14}$$

where: q – transport traffic flow density, *auto/km*;

 q_i – maximum density of traffic (in case of congestion v = 0 km/h; $q_i = 228$ auto/mile); c – movement speed, set at maximum capacity crossing (c = 17,2 mile/h).

Since
$$q = \frac{M}{v}$$
, then:

$$\Delta t = \frac{(A_i \pm 1)T}{qv}$$
(15)

From equation (15) shows that at one and the same density q, time Δt is greater, when v transport stream speed v is less.

If $\Delta t > t_2$, then the movement of vehicle in traffic flow is being performed uniformly with speed v_2 . However, if $\Delta t < t_2$, then the movement of vehicle in traffic flow is being performed after the leader and flow velocity can be determined by relations:

$$v_a = 78,0 - 0,0385 M - for \text{ cars}$$

 $v_c = 54,2 - 0,0122 M - for \text{ trucks}$
(16)

Sector length $S_2 = v_2 t_2$. Speed v_2 may be restricted by appropriate signs prohibiting or limiting the speed or limit speed driving in the city $v_2 \le 60 \text{ km/h}$.

On the S_3 car slows down approaching the intersection traffic when light signals change. The balance of movement of the car when braking (the motor is disconnected from the transmission) has the form:

$$F_j = F_t + G_a \psi + k F v_a^2 \tag{17}$$

where: $F_t = G_a \varphi \cos \alpha - car$ wheels brake force;

 F_j – car inertial force for critical brake.

Solving the equality (17) we determine the braking time on sector S_3 :

$$t_{3} = \frac{\left(v_{i} - \frac{kFgv_{i}^{3}}{3\delta G_{a}}\right)}{\left[\frac{g}{\delta}(\varphi + \psi)\right]}$$
(18)

where: v_i – initial braking speed depending on the density flow transport.

Considering the final speed braking zero distance S_3 of braking sector can be determined:

$$S_3 = \frac{t_3 v_i}{2} \tag{19}$$

The total number of cars that are on the lane in the direction of movement is determined from the relationship (12). Considering the relation (2)groups of the same type car, it can be written:

$$\sum N_i = n_1 t_1 A_1 + n_2 t_2 A_2 + n_3 t_3 A_3$$
(20)

where: n_1, n_2, n_3 – quantity of toxic substances emitted by a car during the regimes of acceleration, braking and uniform movement given m^3/s ;

 A_1, A_2, A_3 – number of cars that move on acceleration, braking and uniform movement schemes given.

 $\sum N_i$ – total emissions of toxic substances on the sector *S*.

CONCLUSIONS

1. The total amount of emissions of toxic substances on the movement of the automobile on sector S depends on the number of cars moving, vehicle movement regime and intensity of toxic emissions at those regimes.

2. Time and distance of travel of the vehicle at different regimes of movement depends on its operating characteristics.

3. Regime of movement of cars under intense traffic depends on the intensity of the flow movement and flow distribution ranges density in the automotive transport stream, which can be considered subordinated to Poisson distribution. The greater the period of developing of the car in the range of time given, the less is the dependence of solitary car speed with other road users speed. Otherwise, solitary car speed depends on leader's speed and it diminishes with growing of traffic intensity

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IDEA GENERATION IN THE PROCESS OF BUSINESS INNOVATION

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Developing and maintaining a company's competitiveness in the current conditions is possible only on the basis of innovation activities involving creative methods. Economic and political environment being very changeable, as well as global and national economy, may become in turn, a strong impetus to adopt new decision to comply with these changes and to find strategic business development path.

An innovative company through its business innovation becomes competitive for long term and very attractive to investors. The companies who tend to achieve this status should facilitate creativity, emergence of new and innovative ideas, to analyze the innovative potential and to improve their innovation activity to discover internal creative potential.

The trends of the new economy, which implies a globalization of ideas and business relationships, lead to increase the competitive effect and the frequency of operations by frequent occurrence of changes. These changes or extreme situations which make the enterprise or business to change their direction may include several actions of transformation: from organizational changes, to complete change of business direction. The change is a frequent phenomenon and the organizations must address it in a prompt and proper way for a better chance of survival and prosperity.

To manage the creative process in a rational way in the company and to provide a supportive environment for disclosure of this process, we need to apply certain management principles.

The utility of using the creativity in the company will be to resolve a number of problems, internal conflicts, simplification of procedures, application of motivation, problem solving, developing a new design, new product/service and medium to long term strategies. Thus, the creativity can be applied in any situation. Without it, many processes will become a routine.

The best exploration of necessaries ideas for company at a moment would be collecting ideas from company's employees. Namely, they are those who face specific problems every day and know the specific activity of their work better than managers. Other "providers" of ideas may be the company customers. After analyzing their complaints and grievances, could garner good information that could be turned into lucrative ideas.

As background for problems solving, could be used a default model that would meet some settlement and implementation stages. Obviously after capturing ideas from employees, with their later implementation, it requires a control process by the management. Below this process is shown schematically:



Figure 1. Capturing ideas process and their implementation.

Source: Developed by the author

The simplest model of accumulation of ideas can be presented as the following scheme:

- 1. Idetinfing of the problem
- 2. Gaining ideas
- 3. Identifying the best ideas
- 4. Analyzing the post-implementation effect.

The creative process can meet some factors that hinder creativity, such as:

- Ineffective company management
- The existence of old school managers or who are oriented on material things,
- Lack of stimulating ideas,
- Taking the creativity as a silly thing,
- Strong team hierarchy,
- Inhibition of creative imagination,

- Lack of employee motivation to produce new ideas and the prevalence of routine work, properly paid,
- Resistance to change,
- Misconceptions that the best ideas come from senior managers,
- Ineffective or poor communication,
- Formality and rigid rules,
- Slow decision making
- The fear of organization's employees to expose their ideas and opinions etc.

Companies are influenced both by external factors, which may have direct or indirect influences and internal factors. Overall these factors, regardless of their nature influence strongly the formation of the new ideas in the company. Generally it can not underestimate the role of none just that sometimes could form a group of factors with certain influence.

In a further factor modification, the company should take some actions that initially appear in the form of ideas. Regardless of the change effect, the company has to mobilize domestic resources to generate solutions that may become the company's future strategy in the short or long time.

If the company's internal resources are insufficient or lacking certain necessary qualities, the external factors can have devastating effects, if exists a possibility of negative repercussions when the factors take a way that could be favorable to the company, it may lose some existing opportunities.

In the company's factors should exists a harmony and every factor to combine the determinative criteria that will make it functional. Because without a leadership that don't have a coherent strategy, a clear vision of company's management and business, will not be possible ever to achieve some quantitative indicators and qualitative.

Once these criteria exist in the company should be secured other positions: formation of an organizational culture based on respect, trust and integrity, providing new motivations and its integration to make certain decisions and creating creative and innovative values. Company's efficiency can be achieved only by the interaction of all internal factors, which would allow more effective actions.

Any deviation from this scheme would lead to internal conflict until the dissolution of the company. The primary role of ensuring the factors harmony that would help to establish a healthy creative climate in the company and to make the actions more effectives, will lead to strengthening the company's market positions.

With the successful implementation of the ideas would require tracking their progress. Regardless of the severity of change and innovation, the trajectory of "application- implementation- post-implementation results" should be watched very closely. Even if the idea will be successful, a further frivolous application or entirely without control can lead to implementation and desired business changes will not occur.

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UNE BIOCAPTEURS DE TYPE JETABLE POUR LA DÉTECTION DES COMPOSÉS PHÉNOLIQUES DANS DES MATRICES COMPLEXES

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INTRODUCTION

Les composés phénoliques sont largement utilisés dans la fabrication de résines, des polymères et des produits pharmaceutiques [1]. Les plus suivant ils sont étudiés en raison de leur propriété antioxydante et cancérogène. Les phénols sont probablement les composés organiques le plus souvent associés à des problèmes organoleptiques; ils provoquent des problèmes de goût et d'odeur à des concentrations aussi faibles que 1 $\mu g/1$ [2].

Cependant, le coût élevé et les temps de rotation lents des méthodes photométriques et chromatographiques conventionnelles [3] utilisé pour le dosage de dérivés phénoliques, indiquent un besoin de techniques analytiques plus rapides. Pour répondre à ce besoin, un système à base de détecteur simple d'utilisation, peu coûteux, jetable (accessible) et fortement sensible aux phénols, devient de plus en plus important dans l'analyse environnementale et les produits agroalimentaires. De ce fait, des méthodes alternatives parfaitement adaptées telles que les biocapteurs sont de plus en plus utilisées pour des analyses de routine.

Un nombre relativement important de biocapteurs ampérométriques enzymatiques pour la détection du phénol a été déjà mis au point à partir de la tyrosinase (Tyr) [2 ; 4-6]. Mais le problème de détection rapide des dérives phénolique reste toujours actuel et surtout la détection de ces composés dans de matrice complexe.

Le but de notre travail a été de mettre au point un biocapteur à base de tyrosinase qui serra facilement utilisé dans les matrices complexes de certains produits fumés.

2. MATERIELS ET METHODES

2.1. Réactifs

Phénol, glutaraldehyde (SIGMA). P-crésol, m-crésol, guiacol, créosol, eugénol, 4-ethylguaicol (ACROS), syringol, o-crésol (ALDRICH), isoeugenol (LANCASTER), 4-propylguiacol for SAFC, dichlorophénol, tyrosinase (E.C. 1.14.18.1, approximately 3216 U/mg) from Fluka, poly (allylamine hydrochloride) for Alfa Acsar. Le stock des solutions standards de composés phénoliques a été préparé dans le méthanol de grade HPLC (PROLABO).

Les produits analyses bacon, poulet, jambon et saumon fumée ont été achete dans le marcher local (Nantes, France).

2.2. Fabrication d'un système à trois électrodes sérigraphiées

Au cours de cette étude, nous avons mis au point et utilisé le système à trois électrodes sérigraphiées. La figure 1 présente en réalité quatre systèmes identiques qui peuvent être facilement séparés en cassant la plaque d'alumine prédécoupée.



sérigraphiées préparés au laboratoire

Dans le cas des électrodes sérigraphiées (figure 1) on utilise un montage à trois électrodes composé, d'une électrode de référence à base d'argent sérigraphiée à partir d'une encre commerciale (LtJ, Gwent, Pontypoll, GB), d'une électrode de travail (ou indicatrice) et d'une électrode auxiliaire toutes deux à base de graphite.

Les substrats utilisés pour la sérigraphie dans le cadre de ce travail sont des plaques d'alumine prédécoupées provenant de chez LAZER COATING UK. Les encres utilisées ont été formulées soit au sein de notre laboratoire, soit obtenues de chez GEM (Gwent Electronics and Materials, Pontypool, Ltd, UK).

2.3. Protocol de préparation du biocapteur a base de tyrosinase

Les électrodes modifiées sont préparées par le dépôt sur l'électrode de travaille d'un mélange de trois composés : la tyrosinase; le Paa - poly (allylamine) à 0,05% et la Glutaraldéhyde (Glut) à0,0125%. Les solutions de Paa et Glut sont préparées chaque jour. La modification des électrodes se fait par un dépôt manuel à 3μ L de mélange sur l'électrode de travail. Les électrodes sont ensuite laissées à sécher 1h.

2.4. Apparatus and procedures • FIA

Le dispositif expérimental utilisé durant cette étude pour l'analise par injection en flux continu est constitué d'une pompe péristaltique multicanaux (Ismatec) permettant un réglage du débit volumique, d'une valve d'injection six voies (Rhéodyne) munie d'une boucle d'injection de volume égal à 100 µL, d'un potentiostat (BAS CV-1B), d'un enregistreur i=f(t) (Linseis L200E) et d'une cellule électrochimique de détection de type wall-jet fabriquée au laboratoire. Les mesures ont été réalisé dans la solution tampon phosphate 0,1M, pH=6 avec un ajout de 0,1M KCl. L'Analyse par injection en flux continu a été utilisée en premier temps pour tester le biocapteur en termes de sensibilité, stabilité, repetabilite et linéarité. En deuxième temps pour le dosage de produits phénolique dans des échantillons réels.

• CPG

Le système chromatographique est représenté par une chromatographe en phase gazeuse Hewlett - Packard HP 6891, l'échantillon est injecté manuellement à l'aide d'une microseringue a 1µl et d'un détecteur à ionisations de flamme (FID). Le mode d'injection est un mode splitless, la colonne utilisée est une colonne HP5 ayant les dimensions suivantes : $30 \text{ m} \times 0.25 \text{ mm}$ × 0.25 µm. La colonne utilisé est une colonne capillaire Agilent, avec une polarité intermédiaire composée à 95% de diméthylsiloxane et a 5% de copolimère diphényle. De ce fait l'analyse s'effectue en chromatographie de partage (gaz/liquide). La température du détecteur est de 260°C, celle du l'injecteur est à 290° C.

Le four a été programmé de la façon suivante : 80°C (1,5) min ; 80°C à 290°C à 50°C/min est maintenu à température finals pour 10 minutes. La réponse du détecteur est enregistrée à l'aide du logiciel HP ChemStations.

3. RESULTATS ET DISCUSSIONS

Les biocapteurs ampérométriques basés sur l'immobilisation de la Tyr permettent la détection des dérivés monophénoliques et o-diphénoliques. Selon la plupart d'auteurs [7-9] le mécanisme de catalyse de l'oxydation du phénol par la tyrosinase peut être représenté en quelques étapes :

- première étape : utilisant l'oxygène moléculaire, la tyrosinase catalyse l'hydroxylation du monophénol avec la formation d'o-diphénol (la catéchol) ;

Phénol + tyrosinase $(O_2) \rightarrow$ catéchol

- deuxième étape : l'oxydation d'o-diphénol à o-quinone ;

catéchol + tyrosinase $(O_2) \rightarrow o$ - quinone + H_2O

- troisième étape: l'o-quinone peut être électrochimiquement réduit en o-diphénol avec un surpotentiel bas par l'équation suivante.

o – quinone + 2H⁺ + 2e⁻ \rightarrow catéchol

Ainsi, la détection du phénol repose sur le contrôle de la quantité de la quinone formée ou sur la détermination du cofacteur de consommation de l'oxygène. Le fonctionnement du biocapteur est basé sur la mesure du courant de réduction de l'ortho - quinone enzymatique générée au potentiel 0V /Ag/AgCl. La réponse ampérométrique de l'électrode est directement liée à la concentration en substrat dans la solution.

Nous nous sommes intéressés à tester et valider, le biocapteur de type sérigraphiée a base de tyrosinase en les couplant à la technique d'analyse par injection en flux continu pour l'analyse de certains phénols standard.

Pour une détection rapide de compose phénolique une recherche des conditions optimales d'analyses (l'influence du pH, du potentiel, du solvant organique) c'été imposé.

Influence de pH sur la réponse du biocapteur.

La cinétique d'une réaction enzymatique est toujours dépendante de la valeur du pH dans l'environnement de l'enzyme. Le point isoélectrique de la tyrosinase est situé aux alentours de pH_i = 4.7 - 5, nous avons donc choisi de réaliser l'étude entre pH 4 à 8, pour une concentration de phénol de 50µM. L'expérience a été réalisée sur la même électrode. La figure 2 montre la variation de l'intensité du courant en fonction du pH du milieu réactionnelle. La dépendance présente une forme caractéristique en cloche. Nous avons obtenu une réponse ampérométrique optimale pour un pH de 6.0. Ensuite pour l'électrode à tyrosinase, nous avons choisi une valeur de pH de 6 pour le milieu 'analyse.



Figure 2. Influence du pH sur la réponse ampérométrique d'une électrode Tyr/Paa/Glut.

Choix du potentiel de travail

L'ortho-quinone produit par la réaction enzymatique est un composé qui peut être réduit électrochimiquement en ortho-diphénol correspondant. Pour déterminer le choix du potentiel nous avons mesuré la réponse en courant du biocapteur pour une concentration de phénol de 50μ M, dans l'intervalle de potentiel compris entre -0.3 et + 0.3V/Ag/AgCl et pour un débit et un volume d'injection constants. Le courant de réduction maximal se situe à un potentiel E=-0.3V (Figure 3).

Même si la sensibilité du biocapteur est maximale au potentiel de -0,3 V vs Ag,AgCl, cependant ce potentiel présente certains



Figure 3. Influence du potentiel de mesure sur la réponse de biocapteur Tyr/Paa/Glut.

inconvénients tels que la durée nécessaire pour la stabilisation de la ligne de base. En effet, environ deux heures sont nécessaires pour que la ligne de base se stabilise lorsque le potentiel de travail est fixé à -0,3 V. A une valeur de potentiel de 0 V, nous avons constaté que seulement 5 à 7 min sont nécessaires pour obtenir une ligne de base stable

avec de très faibles bruits. Il faut également noter qu'à 0 V, on minimise les réactions de réductions électrochimiques de l'oxygène

Pour la suite des expériences et pour minimiser le courant de base, nous avons choisi d'effectuer notre étude à une valeur de potentiel de 0V /Ag/AgCl.

En optimisant le fonctionnement du biocapteur nous avons testé l'électrode pour le dosage du phénol. La courbe d'étalonnage (figure 4) présente une zone de linéarité pour des concentrations en phénol allant de 10µM jusqu'à 150µM. Les calibrations des électrodes ont été



Figure 3. Courbe d'étalonnage (FIA) pour l'électrode Tyr/Paa/Glut. Potentiel de travail : 0 V vs. Ag/AgCl, tampon phosphate (0,1 mol/L, pH = 6,0 + KCl 0,1 mol/L)

faites sur des solutions de phénol de concentrations connues préparées dans du tampon phosphate 0,1 M à pH 6,0 avec du KCl 0,1M comme électrolyte support.

Ensuit nous avons testé la réponse du biocapteur pour autre substrat comme guiacol, créosol, syringol, phénol, 4-ethylguiacol, o-crésol, eugénol, isoeugénol, p-crésol, 4-propylguiacol et mcrésol qui sont les principaux composés phénoliques présents dans le produits fumés [Sérot et coll., 2004]. En résultat nous avons obtenu que le biocapteur à tyrosinase détecte le phénol, le m- et le p-crésol. Les résultats de l'étalonnage de l'électrode avec de solutions de phénol, p-crésol et m-crésol sont présentés dans le tableau 1.

Les résultats montrent que la performance analytique du biocapteur étudié dépend du type de composé phénolique utilisé pour l'étalonnage. L'électrode reflète une meilleure sensibilité pour le p-crésol mais en ceux qui concerne le domaine de linéarité les meilleurs résultats on obtient pour le phénol. Pour le dosage du composés phénoliques dans les échantillons réels on a utilisé courbe d'étalonnage avec la solution de phénol.

Composés	Equations	Coefficient de Corrélation	Sensibilité, nA•cm ⁻² • µmol • l ⁻¹	Linéarité, µmol/l	Limite de détection, µmol/l
Phénol	y = 4,6062x + 26,637	$R^2 = 0,9955$	4,61	5 - 150	5
m-crésol	y = 2,1746x + 25,206	$R^2 = 0,9943$	2,17	5 - 100	10
p-crésol	y = 14,52x - 1,8761	$R^2 = 0,9999$	14,52	5 - 50	5

Tableau 1 La réponse ampérométrique du biocapteur pour différents substrats

Dans le but de valider les résultats des mesures obtenus pour le dosage des composés phénoliques dans les produits fumés avec le biocapteur, nous avons comparé avec les résultats obtenus à l'aide de la méthode par chromatographie en phase gazeuse. Bien que les méthodes utilisées varient fortement au niveau de leur principe de fonctionnement et de préparation des échantillons, nous avons trouvé pour les mesures de dérivés phénoliques dans les produits fumés une bonne corrélation entre les résultats obtenus en CPG et en biocapteur tableau 2.

Tableau 2. Corrélation entre la teneur en phénol et p-crésol obtenue par le biocapteur en mode FIA et par chromatographie en phase gazeuse (CPG).

Produits analyses	FIA	CPG	
Jambon fumé	Phénol + p-crésol : 44.44 ± 1.09	Phénol : 40.23 ± 1.38 p-crésol : 2.92 ± 0.42 Total : 45.1 ± 1.54	
Bacon fumé	Phénol + p-crésol : 39.1 ± 0.99	Phénol : 36.68 ± 7.31 p-crésol : 2.32 ± 0.39 total : 39 ±7.7	
Filet de poulet fumé	Phénol + p-crésol : 41.4 ± 2.35	Phénol : 35.13 ± 1.12 p-crésol : 17.21 ± 1.73 total : 52.34 ± 2.85	
Saumon fumé	Phénol + p-crésol : 7.07 ± 1.86	Phénol : 30.76 ±0.86 p-crésol : 7.5 ± 1.34 total : 38.26 ± 2.2	

Les résultats suivants sont les moyennes de trois déterminations successives.

4. CONCLUSION

En conclusion on peut dire que les biocapteurs peuvent apporter les contributions déterminantes en contrôle des bioprocédés. La possibilité d'avoir des biocapteurs, multiparamétriques et présentant une stabilité accrue favoriserait certainement une utilisation plus large.

Nous avons mis au point un biocapteur simple à mettre en œuvre pour la détection du phénol. La composition de l'électrode a été optimisée pour améliorer les performances analytiques (sensibilité et stabilité) du biocapteur final.

L'électrode Tyr/PAA/Glut peut être utilisée pour déterminer les faibles concentrations en phénol dans des échantillons réels d'aliments fumés, tels que le jambon, le bacon, le poulet et le saumon. Les résultats obtenus lors de l'utilisation du biocapteur en FIA ont une bonne corrélation avec les résultats obtenus en CPG.

La détermination électro – enzymatique des dérivés phénoliques pourrait constituer une méthode alternative très prometteuse pour les dosages en routine de composés phénoliques dans les produits fumés dans les sites industriels.

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PHENOLIC COMPOUNDS IN GRAPES

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INTRODUCTION

Phenolic compounds play a major role in enology. They are responsible for all the differences between red and white wines, especially the color and flavor of red wines. They have interesting, healthful properties, responsible for the "French paradox". They have bactericide, antioxidant and vitamin properties that apparently protect consumers from cardiovascular disease [2].

These molecules come from various parts of grape bunches and are extracted during winemaking. Their structure varies a great deal when wine ages in the barrel or in the tank and in the bottle, according to the conditions, but these modifications have not yet been fully explained [1].

Indeed, even the latest chromatography techniques (HPTLC, LPLC, HPLC) still produce relatively limited results and are only capable of analyzing simple and little polymerized molecules.

Furthermore, physicochemical methods, focused on structural definition (NMR, mass spectrometry), are not very well-suited to the study of these types of molecules, although their applications are constantly being extended. Further complications are due to the interference of a colloidal state that does not involve covalent bonds. This interference definitely plays a role in the structure and, consequently, the properties of phenolic compounds in wine. The colloidal state is, however, difficult to study, as it is modified by any manipulation of these substances [4].

1. TYPES OF SUBSTANCES

1.2. Phenolic Acids

Grapes and wine contain benzoic and cinnamic acids. Concentrations are on the order of 100-200 mg/L in red wine and 10-20 mg/L in white wine.

Phenolic acids are colorless in a dilute alcohol solution, but they may become yellow due to oxidation. From an organoleptic standpoint, these compounds have no particular flavor or odor. They are, however, precursors of the volatile phenols produced by the action of certain microorganisms (yeasts in the genus *Brettanomyces* and bacteria). Ethyl phenols, with animal odors, and ethyl gaiacols are found in red wines. In white wines, vinyl phenols, with an odor reminiscent of gouache paint, are accompanied by vinyl gaiacols. It has been clearly established that these compounds result from the breakdown of *p*-coumaric acid and ferulic acid [5].

When wines are aged in new oak barrels, the toasting of the wood involved in barrel manufacture causes the breakdown of lignins and the formation of various components in the same family, with a variety of smoky, toasty and burnt smells (Figure 1): gaiacol, methyl gaiacol, propyl gaiacol, allyl gaiacol (isoeugenol), syringol and methyl syringol.

Ųн			
	R ₄	Name	Origin
	$CH_2 - CH_3$	Ethyl phenol	Red wine
	$CH = CH_2$	Vinyl phenol	White wine
$ _{R_4}$			
011	D	N	0
OH	R4	Name	Origin
CH ₃ O	Н	Gaiacol	Wood
	CH ₃	Methyl gaiacol	Wood
	CH2-CH3	Ethyl gaiacol	Red wine
	$CH = CH_2$	Vinyl gaiacol	White wine
R_4	$CH_2 - CH_2 - CH_3$	Propyl gaiacol	Wood
	$CH = CH - CH_3$	Allyl gaiacol	Wood
он			
CH ₃ O OCH ₃	R4	Name	Origin
ΥY	Н	Syringol	Wood
	CH ₃	Methyl Syringol	Wood

Figure 1. Volatile phenols in wine [1]

Tyrosol (Figure B) or *p*-hydroxy-phenyl-ethyl alcohol may be included in this group of compounds. It is always present in both red and white wine (20–30 mg/L) and is formed during alcoholic fermentation from tyrosine (*p*-hydroxy phenylalanine), in turn synthesized by yeast. This compound, which remains at relatively constant concentrations throughout aging, is accompanied by other non-phenolic alcohols like tryptophol (0–1 mg/L) and phenyl-ethyl alcohol (10–75 mg/L).

Coumarins (Figure 2) may be considered derivatives of cinnamic acids, formed by the intramolecular esterification of a phenol OH into the α of the carbon chain. These molecules are

components of oak, either in glycosylated form (esculin and scopoline) in green wood or in



Figure 2. Phenolic alcohols and coumarins [1]

aglycone form (esculetin and scopoletin) in naturally seasoned wood. Although very small quantities (a few $\mu g/l$) of coumarins are found in wood-aged wine, they still affect its organoleptic characteristics, as glycosides are bitter and aglycones are acidic, with a detection threshold in red wine of 3 $\mu g/L$ [4].

Another family of more complex polyphenols is also present in grapes, wine and oak wood. Stilbens have two benzene cycles, generally bonded by an ethane, or possibly ethylene, chain. Among these *trans*-isomer compounds, resveratrol or 3, 5, 4- trihydroxystilben (Figure 3), is thought to be produced by vines in response to a fungal infection.

Resveratrol, located in the skins, is mainly extracted during the fermentation of red wines and seems to have some healthful properties. Concentrations are on the order of 1–3 mg/l. Recent research has identified many oligomers of resveratrol in *Vitis vinifera* [3].



Figure 3. Trihydroxy-3, 5, 4-stilben [4]

2. FLAVONOIDS

These are more-or-less intense yellow pigments (Figure 4), with a structure characterized by two benzene cycles bonded by an oxygenated heterocycle, derived either from the 2-phenyl chromone nucleus (flavones and flavonols) or the 2phenyl chromanone nucleus (flavanones and flavanonols).

The most widespread compounds are flavonols, yellow pigments in the skins of both red and white grapes and, to a lesser extent, flavanonols, which are much paler in color. In grapes, these molecules



Figure 4. Flavonoids: a, flavone $(R_3 = H)$ and flavonol $(R_3 = OH)$; b, flavanone $(R_3 = H)$ and flavanonol $(R_3 = OH)$ [1]

are present in glycoside form (Figure 5), e.g. rhamnosylquercetin. They are differentiated by substitution of the lateral nucleus, producing kaempferol (1 OH), quercetin (2 OH) and myricetin (3 OH). All three pigments are present in red wine grapes, whereas white wine grapes only have the first two [2].



Figure 5. 3-O-Rhamnosylquercetin [1].

These compounds are present in red wine in aglycone form, as the glycosides are hydrolyzed during fermentation. Concentrations are in the region of 100 mg/l. In white wine, where fermentation takes place in the absence of grape solids, typical values are from 1 to 3 mg/l according to the grape variety. Pre-fermentation maceration in the aqueous phase has less impact on this concentration than settling.

The flavanonol most frequently identified in grapes and wine is dihydroquercetin, also known as taxifolin. The role played by these various compounds in the color of red and white wines will be discussed later in this chapter [3].

3. ANTHOCYANINS

Anthocyanins are the red pigments in grapes, located mainly in the skin and, more unusually, in the flesh ("teinturier" grape varieties).

They are also present in large quantities in the leaves, mainly at the end of the growing season.

Their structure, flavylium cation, includes two benzene rings bonded by an unsaturated cationic oxygenated heterocyclic, derived from the 2- phenyl-benzopyrylium nucleus. Five molecules have been identified in grapes and wines, with two or three substituent (OH and OCH₃) according to the substitution of the lateral nucleus (Figure 6).

These molecules are much more stable in glycoside (anthocyanin) than in aglycone (anthocyanidin) form. Only monoglucoside anthocyanins (Figure 7) and acylated monoglucoside anthocyanins have been identified in *Vitis vinifera* grapes and wines; acylation is made with *p*-coumaric (Figure 7), caffeic and acetic acids [3].



Figure 6. Structure of anthocyanidins in grapes and wine [3]



Figure 7. Structure of: (a) anthocyanin 3-monoglucosides, (b) anthocyanins 3-monoglucosides acylated by *p*-coumaric acid on position 5 of the glucose (R_3 and R_5) [1]

HO

HO

The presence of diglucoside anthocyanins (Figure 8) in large quantities is specific to certain species in the genus *Vitis* (*V. riparia* and *V. rupestris*). Traces have, however, been found in certain *V. vinifera* grapes. The "diglucoside" character is transmitted according to the laws of genetics, as a dominant characteristic. This means that a cross between a *vinifera* grape variety and an American species (*V. riparia* or *V. rupestris*) produces a population of first-generation hybrids that have all the diglucosides. On the other hand, results obtained with a new cross between a first-generation hybrid and a *V. vinifera* vine show that the recessive "absence of diglucoside" characteristic.

These findings led to the development of the method for differentiating wines by chromatographic analysis of their coloring matter.

This played a major role in ensuring that traditional grape varieties were used in certain French appellations of origin, as well as in monitoring quality.



Figure 8. Structure of anthocyanin 3,5-diglucosides (R_3 and R_5 see Figure 7) [1]

The color of these pigments depends on conditions in the medium (pH, SO2), as well as the molecular structure and the environment. On the one hand, substitution of the lateral cycle leads to a bath chrome shift of the maximum absorption wavelength (towards violet). On the other hand, glucose fixation and acylation shift the color in the opposite direction, i.e. towards orange. These molecules are mainly located in the skin cells, with a concentration gradient from the inside towards the outside of the grape.

Pigment molecules are in solution in the vacuolar juice in the presence of other polyphenols (phenolic acids, flavonoids, etc.) likely to affect their color. Copigmentation generally gives wines a

violet tinge. These factors explain the different colors of red grapes. All grape varieties have the same basic anthocyanidin structures, but there are a few small variations in composition. Indeed, among the five anthocyanins, malvidin is the dominant molecule in all grape varieties, varying from 90% (Grenache), 50% (Sangiovese). Malvidin monoglucoside (malvine) may be considered to form the basis of the color of red grapes and, by extension, red wine [1].

On the other hand, the quantity of acylated monoglucosides is highly variable according to the grape variety. In *vitis vinifera* wines, the presence of ethanol works against copigmentation (Section 6.3.8), and the acylated anthocyanins disappear rapidly a few months after fermentation, so it is not reasonable to use them to identify grape varieties.

This leaves only the five monoglucosides, predominantly malvidin. Concentrations vary a great deal according to the age of the wines and the grape varieties. Starting at levels of 100 mg/l (Pinot Noir) to 1500 mg/l (Syrah, Cabernet Sauvignon, etc.) after fermentation, they decrease rapidly in the first few years, during barrel and bottle aging, until they reach a minimum value on the order of 0-50 mg/l. In fact, this concentration was determined by a free anthocyanin assay, using chemical and chromatographic methods. In fact, the majority of these pigments combines and condenses with tannins in wine to form another, more stable, class of color molecules that are not detected by current assay methods. These complex combined anthocyanins are responsible for color in wine but cannot be identified by standard analyses. Another relatively small fraction of the anthocyanins, however, disappears, either broken down by external factors (temperature, light, oxygen, etc.) or precipitated in colloidal coloring matter. The elimination of these pigments is particularly detrimental to the quality of the wine, as it leads to loss of color [4].

Another recently demonstrated property of anthocyanins involves their reaction with compounds containing an α -dicarbonylated group, such as diacetyl (CH3–CO–CO–CH3). This reaction gives rise to castavinols (Figure 9), not present in grapes but formed spontaneously in wine. These colorless compounds are capable of regenerating colored anthocyanins in an acid medium, by a process called the Bate–Smith reaction, which converts procyanidins into cyanidin. However, in the case of castavinols, this reaction does not require very high temperatures and acidity as it occurs spontaneously and gradually in wine during aging. The color of the anthocyanin is stabilized by substitution of the molecule in carbon



Figure 9. Structure of castavinols resulting from fixing diacetyl on carbons 2 and 4 of the anthocyanin and their transformation into flavylium substituted in 4 and colored by heating in an acid medium [1]

4. According to several authors, the concentration of castavinols in wine is on the order of a few mg/l. Nevertheless, these substances are likely to play a role as reserves of coloring matter [3].

4. TANINNS

Tannins are, by definition, substances capable of producing stable combinations with proteins and other plant polymers such as polysaccharides. The transformation of animal skins into rot proof leather results from this property, as doe's astringency, fining and enzyme inhibition. Tannins react with proteins in each instance: collagen in tanning, glycoproteins in saliva and proline-rich proteins (PRP) for astringency, proteinbased fining agents in fining wines and the protein fraction of enzymes. In chemical terms, tannins are relatively bulky phenol molecules, produced by the polymerization of elementary molecules with phenolic functions. Their configuration affects their reactivity. They must be sufficiently bulky to produce stable combinations with proteins, but if they are too bulky, they are likely to be too far from the active protein sites. The molecular weights of active tannins range approximately from 600 to 3500. Condensed or catechic tannins are distinguished from complex or mixed tannins by the type of elementary molecules. Hydrolyzable tannins include gallotannins and ellagitannins that release gallic acid and ellagic acid, respectively (Figure 10 a, b), after acid hydrolysis. They also contain a glucose molecule. The two main ellagitannin isomers in oak used for cooperage are vescalagin and castalagin (M = 934), as well as two less important compounds, grandinin and roburin (Figure 10). These molecules include а hexahydroxydiphenic and a nonahydroxydiphenic acid, esterified by a non-cyclic glucose [1].

The partial hydrolysis of vescalagin and castalagin, involving the loss of hexahydroxydiphenic acid, produces vescalin and castalin (M = 632) (Figure J c). The various molecules are water soluble and dissolve rapidly in dilute alcohol media such as wines and brandies. They play a considerable role in the aging of red and white wines in oak barrels, due to their oxidizability and flavor properties. The ellagitannin composition of extracts from the duramen depends on the species of oak. All four monomeric and four dimeric (roburin A, B, C and D) ellagitannins are present in the three species of European oak, while the American species have practically no dimmers.

Hydrolyzable tannins are not naturally found in grapes. On the other hand, they are the main commercial tannins legally authorized as wine additives. Ellagic acid in wine originates either from wooden containers or from the addition of enological tannins. On the other hand, gallic acid from the skins and seeds is always present in wine. Condensed tannins in grapes and wine are more or less complex polymers of flavan-3-ols or catechins. The basic structural units are (+) - catechin and (-)-epicatechin (Figure 10). Heating these polymers in



Figure 10. Structure of phenolic acids (a and b) and ellagitannins (c and d) in extracts from the duramen of oak and chestnut wood [1]

solution in an acid medium releases highly unstable carbocations that are converted into brown condensation products, mainly red cyanidin, which explains why these compounds are known as "procyanidins", replacing the formerly used term "leucocyanidin". Analysis of these molecules is particularly complex, due to the great structural diversity resulting from the number of hydroxyl groups, their position on the aromatic nuclei, the stereochemistry of the asymmetrical carbons in the pyran cycle, as well as the number and type of bonds between the basic units. In spite of the progress made in liquid chromatography, mass spectrometry and NMR, all of the structures have not been analyzed: only the procyanidin dimers and some of the trimers have been completely identified. This diversity explains the existence of tannins with different properties, especially as regards flavor, in various types of grapes and wine.

Tannin content should not be the only factor considered, as structure and colloidal status also affect the impression tannins give on tasting [3]. It is possible to isolate and fractionate the following constituents of grapes and wine: (+) - catechin, gallocatechin, (-) - epicatechin, epigallocatechin,

and epicatechin-3-0-gallate. There are also dimeric, trimeric, oligomeric, and condensed procyanidins.

Basic "catechin" units may not be considered as tannins, as their molecular weight is too low and they have very restricted properties in relation to proteins. They only have a high enough molecular weight in dimeric form to bond stably with proteins. Catechins (Figure 11) have two benzene cycles bonded by a saturated oxygenated heterocyclic (phenyl-2 chromane nucleus). This structure has two asymmetrical carbons (C2 and C3) that are the origin of the four isomers. The more stable forms are (+) - catechin and (-) - epicatechin.



Figure 11. Structure of flavan-3-ol precursors of procyanidins and tannins [3]

Dimeric procyanidins may be divided into two categories, identified by a letter of the alphabet and a number:

1. Type-B procyanidins (C30H26O12) are dimmers resulting from the condensation of two units of flavan-3-ols linked by a C4–C8 (B1 to B4) or C4–C6 (B5 to B8) bond. As there are five different types of monomers and two types of intermonomeric bonds, there may be $2 \times 52 = 50$ dimers in wine. The eight procyanidins presented have been identified as the most common ones in wine.

2. Type-A procyanidins (C30H24O12) are dimmers that, in addition to the C4–C8 or C4–C6 interflavan bond, also have an ether bond between the C5 or C7 carbons of the terminal unit and the C2 carbon of the upper unit. Procyanidin A2 has been identified in wine Form B can change to form A via a radical process [4].

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DESIGN OF A FLEXIBLE AND GENERIC SYSTEM OF EVALUATION FOR COMPLEX INFORMATICS SYSTEMS

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"What is the right level of control For my IT such that it Supports my enterprise objectives"

INTRODUCTION

A functional, flexible and easy to maintain system's design is highly important.

The opinion of the users is highly important in order to establish how many resources are necessary. The finalization of all the project's activities in due time is to be admired, but this means a good management, that is an efficient control of the project's each stage of activity and the flexibility to adapt to the purpose and the strategy of the unit

To be in charge of such a project does not simply mean to gather these activities and resources. It also means that the project's manager is faced with a series of "negotiations", Sometimes the costs can be decided, influenced and sometimes the time can be the most important factor. It takes time to listen to the requested of the beneficiary, time to code, to design, to test. You can create a quality soft, but you can fail at its respond to the user's demands. You can design a perfect system, but you may not have time to test it. Time IS hard to administrate. What if we find ourselves in the situation of having " no time"? More time doesn't always means achieving the results we expect. The message is to be careful not to prolong the deadlines.

1. THE DESCRIPTION OF THE BASIC EVALUATION AND CONTROL DATA

The evaluation of the assistance and support activity is based upon the defining processes of the levels of service, the leading of the service team, the performance management, of offering a continuous service, the security of the system, the identification of the costs for assistance and support, the teaching and training of the users, the assistance and advise of the clients, the configuration management, the organization of the problems and incidents that might appear, the data , facilities and operation management(addition, accuracy, validation, upgrading and stocking).

All the attempts in defining the leadership is centered upon the idea that the leadership is

different from the management ,that leaders are different from the managers, due to certain personal qualities and abilities In a corporation, an efficient leader has a future strategy of the organization, which takes into consideration the true interests on a long term of all those involved in it Then the leader develops a strategy in order to reach that purpose by obtaining support from the employees and in the same time motivating them to reach that purpose.

In every I.S. there are four independent factors: price, quality, time and risk... We can not have the fullest efficiency from all the four factors. That is we can not have a system made by smaller costs, with high quality, quickly made and with smaller failure risks. Mainly we can talk about the first three factors. It is possible to build a quality system with relatively small costs. Anyway, the chances that this type o system to fail rise dramatically.

To make sure that a system is successful, we must take into consideration the following factors:

1. Every major product must be examined by verifying its accuracy and correctness...

2. The support of the manager to the project must be carefully supervised. We must make sure that the managers are aware of the team's progress.

3. We must have the proper technical leadership for the project...

The managers have to understand the technological impact and the informatics applications upon the business they lead, taking into account the fact that I.T. assures them the necessary information and that of being able to select that information in due and real time. Today's businesses are more and more organized, lead and aromatized around the series of processes and the relations established among them. These processes involve developments and the products and services, the interactions with the clients and the support of those processes and of human resources. Thereby, we suggest the identification of the solutions for the successful planning of the specific I.S. activities and their management in accordance with the company strategy, as well as the evaluation and control of main lines of work in accordance with: the following information criteria: efficiency, effectiveness, availability, integrity, confidentiality, accord, safety and the financial and human resources through a flexible system of evaluation.

The managers need to understand the impact of the technology and of the informatics application upon the business they lead, taking into consideration the need to select the information in real time. Today's businesses are more and more organized, lead and aromatized around the series of processes and of relations among them. These processes involve developments and lines of production and services, the administration of interaction with the clients and the support of the processes and of the human resources.

The information are storage in a data base in order to be able to make complex operations, the access to these information being made by taking into account the manager's purposes and abilities. The application becomes efficient through the design's methods, allowing the interpretation and the manipulation of the data depending on the abilities of each user. One can describe such evaluation criteria able to understand the context, the user's medium and to respect the domain of the application.

The system can be adapted to each project manager's way of working, to the company's strategy, the financial and human resources offered by that company. The main criteria selection of the evaluation and control activities has been made after the following information criteria:

- 🖕 effectiveness,
- 🖶 integrity,
- confidentiality,
- 📥 availability,
- 🖶 accordance,
- **I**rust in the information.

2. THE ADVANTAGES OF THE FLEXIBLE DESIGNED EVALUATION SYSTEM

It is a system, which allows the project's manager to establish the evaluation criteria and to concentrate upon the performances made in the administration of the specific I.S. activities.

The control of the activities is essential for the accomplishment of the projects. It is essential the role of each of the identified process in the Cobit standard for the accomplishment of the final project and the current stage of the organization, by grouping the processes in four activities:

• Planning and organization of complex I.S.:

• The acquisition of goods and services for the project;

• Delivering the designed system and the accomplishment of the paper documentation for the project.

These problems and opportunities appear as a result of the desire of the companies to adapt to changes, a major aspect being occupied by informational processing. Due to the high degree of flexibility, the importance of the evaluation method is underlined. Starting from the observation that a main characteristic of each level is that of finalizing with a check up and a validation in order to eliminate certain anomalies, it is underlined the fact that a good security of the I.T. and the administration practice's control of the complex I.S. projects is essential. Under these circumstances, one can search new managerial solutions in order to integrate:

- Time control,
- Cost control,
- Quality control of the working team,
- **4**Obtained results control.

Unrealistic deadlines, not wanted personnel and not working with the expert persons are reasons for which a projects fails.

The informatics solution, which is given, underlines the functionality and the easy way to handle it. The application is capable of interaction, of dividing the application as well as not synchronized interactions, divided space works.

The transformation of the company in terms of high-level processes allows the managers to have a measure as far as the determination of the successes of the processes and the comparison of their result with those of the competition. It is the ideal way to maintain a strong focus on the clients and their needs and to structure the relations with the partners and suppliers.

The processes supply a way to organize the I.T. resources and to give priority to the I.T. tasks as well. They represent the key which assures that the I.T. investments support the strategies of the unit and guarantees a reasonable retrieve of the investments.

The designed system is a useful tool for the manager because it:

♣ Offers a generalized frame of the processes of evaluation;

Let a way to evaluate and self-evaluate with flexible criteria;

4 Can serve as *"best practice*" for standardizations and future researches.

Most of the economic decisions are based upon financial information. However, as decedent, to have information at the right time is not everything. This information must be trustable.

The need for competent and independent evaluations is bigger every day. The given evaluation system is a tool that allows:

the check up in order to see if the necessary conditions are fulfilled to assure the equilibrium of an organization;

↓ to control the disorder, to adapt to changes;

4 To evaluate the degree of security and the risks undertaken by a company.

This kind of I.S. evaluation is very useful. The aims of every institution and the manner, in which they are reached, depend on the abilities and leading manner of the managers. Their integrity and attachment as far as the ethical values are concerned are reflected by their actions and judgments. The ethical values of one organization can not be better than those of the employees (the leading positions are included) that create them, that make them work and supervise them! AND All this because there are some organizational factors that contribute to credulous actions such as:

• the inexistence and inefficiency of controls within the company;

• the excessive and inefficient decentralization of the report system;

• the penalizations of some employees that weren't announced to the entire company.

But the employees' ethical manners are not enough. Their abilities are another essential element of the control medium. The ability, that is knowledge and aptitudes necessary in every line of work, must be mentioned by the leaders. It is in the interest of every company to have the best employees.

The managerial philosophy and the leading manner affect the way in which any company is administrated, no matter the field of operation. We can include in this category factors such as: taking the risks, instituted politics and procedures, giving responsibilities, the attitude in regard of financial reports.

In the end, the organizational structure represents the general frame where the necessary activities will be planned, executed, controlled and monitoring, in order to reach the targets. Most often, she is the result of the managerial philosophy and can be centralized, decentralized and structured on a functional base, in comparison with the size of the company and the nature of its activities.

On the next level we find the risk's evaluation. The company must be aware of the risks and must be able to face them. The activities and the risks involved by these activities must be evaluated and hierarchies in such a manner as to allow the company to take only the risks it can afford and in order to avoid the useless ones. But one of the prime conditions in risk evaluation is to establish some well defined and compatible targets with the company's evolution. The risk's evaluation assumes the identification and analyze of those events that can interfere in the reach of those purposes.

The identification and the analyze of the risks are continuous processes that must take place at all the levels of the company and must take into consideration the factors such as the economical changes, the needs of one society, the legislative changes, new technological developments, natural disasters, new hired personnel, new informational systems, the change in the management responsibilities.

After being identified, all the risks are being evaluated. Often enough, this process, which can be more or less formal, includes:

• the evaluation of the importance of every risk;

• the evaluation of the probability or the frequency of risk's appearance;

• The actions that must be taken in order to prevent the risks and the costs involved in these actions...

The well use of the resources assumes that the manager has pertinent data on which he can create the politics of the company. Once introduced, these politics must be monitoring and the manner in which they are followed must be supervised.

One of the most important targets of the leadership is preventing and identification of the errors and frauds. The cost of the possible control measures must be compared with the probability of appearance of such fraud or error and the consequences.

The evaluation system offers the leaders the required data necessary for the administration of that business. But it's still the job of those being in charge to create and launch such a system. In order to make a simple evaluation, an organization must take into consideration every evaluation criteria, to read the 6 levels of scaling and determine which one of the six is better suited for the company's current state. The more important is the process for the company, the higher it is situated on the scale. For example, in a relatively stable commercial environment, the growth maturity of the 13's processes from the "supply and support" field is the one that separates the successful companies from the others. On the other hand, in a very dynamic economic field, successful companies are highly depended on the maturity of the field "planning and organization", "acquisition and implementation".

One must mention the fact that there is a difference between the measurement of the abilities and that of performances. For example, the achievement of the abilities for a certain security or control of practices is one of that decisions that must be taken and done, but the consistent appliance of the abilities, once required, also demands to be measured [1].

Every project can be then labeled with a unique sequential trademark as in fig.1. The purpose in choosing the main projects is that of identification of those projects where one can have quick results and benefits. The most suitable candidates for quick benefits are usually those where the discrepancies are smaller and the closing price and the failure risks are also smaller, and the impact upon the benefits of the business is higher.



Figure 1. The position in relationship with the impact on the business and risk.

The manner in which the priority is being attributed to the projects is through the identification of the rapid benefits that can be achieved. The best candidates for rapid benefits are usually those projects in which the gaps are smaller, where the costs to close a gap are as small as possible, where the risk of failure and the impact of the benefits on the business are higher. The projects could be evaluated for impact and cost/risk on a scale from 0 to 10 for each of these variables. The projects can be pointed on a graphic that can become a support tool for the decision of the manager, showing the relative impact and the costs/risks. The projects that have a bigger impact and a relatively small price are better candidates as well as quicker winners.

CONCLUSIONS

In the recent years, the fact that there is a *need for a reference for a proper frame of work for the safety and control in I.T.* has become more evident for the moderators, users and suppliers of services.

The effective administration of the I.T. has a major importance in the success and survival of the company. For many companies, the data and the technology they have, represent the biggest values. Indeed. The information and the information systems are general for the entire company from the users' platform to the local networks and those of bigger cover, to the servers of the user within the computers. *Many companies recognize the potential benefits produced by technology*. Yet, the successful companies understand this and administrate the associated risks with the introduction of new technologies. Thereby, the administration needs a good appreciation and a basic understanding of the risks and limitations within the I.T. in order to supply adequate controls.

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OXIDABILITY, ALUMINUM AND SULPHATES AT THE RAW WATER SONIC REGIME TREATMENT

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1. INTRODUCTION

Untreated water used in water plants comes mostly from surface water. Surface waters from rivers are often troubled, because the shifting riverbed train and maintain colloidal suspension as fine particles and larger particles that are suspended. Colloidal particles in suspension generally consist from many molecules groups. The size of these particles varies between 1 and 100 μ m. Liquid water particles in suspension more than 100 mm in size [4,5]. To remove these particles drinking water treatment plants use aluminumbased coagulants (aluminum sulfate, aluminum polihydroxicloride). Their use often leads to high concentrations of aluminium in treated water (higher than in raw water).

High levels of aluminum in drinking water is a concern worldwide due to the potential association of aluminum with serious diseases affecting the nervous system (Lan Gehrig's and Parkinson's disease, Alzheimer's disease) or may affect other medical conditions: anemia, osteomalacia, etc. [9].

Untreated water may be cloudy and unpleasant appearance and the presence of microorganisms over the allowable limits and bacteria, and people who use untreated drinking water can become sick. To determine the germ, etc. streptococci the bacteriological analysis of water are made. Since processing in terms of bacteriological tests takes between 36 and 72 hours to remove possible contamination and rapid intervention in the process, determine the chemical "oxidability" water - oxidizable organic substances in water. The sample for this indicator of water quality and immediately processed according to the result may occur in the process water treatment. This indicator of water quality is very important for each stage of the process technology of drinking water. Current technologies [4,5,9] attempt to obtain low values for these quality indicators, and one of them is a new technology [2,3] done with sonic installations for treating raw water.

2. SONIC INSTALLATION FOR RAW WATER TREATMENT

Sonic treatment plant raw water is an experimental installation designed water plants containing only the first phase of the raw water treatment process of drinking waters, namely: clarification. Sonic installation for raw water treatment is the experimental equipment (Fig. 1) for



Figure 1.Sonic installation for raw water treatment :1-*settler; 2- coagulant tank; 3- decanted water tank; 4- sewerage; G-sonic generator; D- coagulant dozer; R_1- coagulant flow control valve; C_1-coagulant monitoring meter; R_2-raw water regulating valve; C_2- meter raw water monitoring; <i>T- turbocharger; R_3- air pressure regulating valve; M- manometer; R_4- sludge discharge control valve.*

drink water plants. It is containing only the first phase of the treatment of raw water for drinking, namely clarification. The experimental sonic settler (Fig. 2) with the volume of 4 m³ is fed raw water (the Danube) by a pipeline which are mounted a valve and a meter for controlling and monitoring of raw water.

Sonic settler is powered aluminum sulfate solution through a system (Fig. 3) which are mounted a control valve and a meter to monitor coagulant. Coagulant used to treat raw water in the pond is aluminum sulfate AL2 (SO4) $3 \cdot 16$ H2O, an inorganic coagulant for water produced according to European Standard EN 878/2004 and is marketed in the form of solid with a density of 2.71 g / cm³. In



Figure 2. Sonic settler (top view).



Figure 3. The aluminum sulfate solution input system of sonic settler (dozer, pipe, valve, meter)

plant technology was used as aluminum sulfate solution with a density of 1.032 g/dm³, it provided for the classic settlers corresponding raw water turbidity ranging between 18 and 21 degrees NTU and water temperature ranging between 24 and 26° C.

Pressurized air supply comes from a sonic generator turbocharger (SRD type 20, flow of 220 m3 / h, working pressure 0.05 MPa) through a pipe on which are mounted a control valve and a



Figure 4. The air supply pressure of the sonic generator (pipe, valve, gauge).

manometer to monitor air pressure, Fig. 4. The airjet sonic generator used in this installation is shown in Fig. 5. The generator is one with two frequency



Figure 5. The two-frequency sonic generator

(sound-ultrasound) and have the following parameters: sound frequency of 10.76 kHz and ultrasound frequency of 21.520 kHz. Acoustic emission intensity level at the sound frequency of 109.88 dB, is slightly bigger on the 1.8 dB than acoustic intensity of 108.09 dB for ultrasound frequency. The overall sound intensity produced by the generator is 112.32 dB. The sonic generator is placed inside the mixing chamber (see Fig. 6) of



Figure 6. Reaction chamber (mixing chamber is situated inside)

experimental settler at the depth of 0.75 m above the water level. Based on prior research was considered a duty cycle for an hour (depending on the speed of ascent in the raw water clarifier) with effective operating and alternating periods of rest. Based at the experimental measurements carried out it was chosen the optimum operating cycle for 5 minutes with 15 minutes break. Effects of sonic generator take place in reaction chamber (Fig. 6), which leads to amplification of physical- chemical reactions that produced at the molecular level and accelerates the process of coagulation - flocculation.

Decanted water is taken by pipeline taking V (Fig. 1) from the top of the sonic settler. The floccules results from the process of coagulation - flocculation is deposited at the bottom of the sonic settler and the certain time periods are discharged through a discharge pipe IV on which is mounted a valve for controlling maneuvers.

3. SONIC TREATMENT EFFECT ON THE WATER OXIDISABILITY

It is considered one hour running time consists of three cycles, each for 5 minutes of effective operation of the generator followed by a 15-minute break. The principle method for determining water oxidisability (oxidizable organic matter in water) is synthesized as follows: organic substances are oxidized with potassium permanganate in acidic or alkaline at boiling. Excess unused potassium permanganate oxidation reaction is reduced and the excess oxalic acid oxalic acid is titrated, hot potassium permanganate to the persistence of weak ties pink [6]. Oxidisability value of raw water, the Danube for the period in which these determinations were made was of 3.36 mg O_2 / l_1 while the water was decanted in decanter experimental 1.84 mg O_2 / l . From Fig. 7 it is observed that the oxidisability value of sonic



Figure 7. Oxidisability value for sonic decanted water and for raw water (SOOab - raw water oxidisable organic substance; SOOx – sonic decanted water oxidisable organic substance).

treatment decanted water decreased and is 1.826 times smaller than the value determined for the raw water. Replacing sonic generator with an aerator the showed the average increased oxidisability decanted water (Fig. 8)

The decanted water oxidisability value when the sonic generator was replaced with an aerator is the 2.40 mgO / 1. This value is at 1.3 times higher than for using sonic generator case, which





shows the pure effect of two frequency acoustic field on the water treatment. Determinations were carried out and where the raw water was treated only with coagulant, sonic generator is stopped. The oxidisability value of water in this case was 2.48 mg O_2 / l . In Figure 9 shows that this value is about 1.35 times higher than that obtained with using sonic generator.





In order to appreciate the effect of sonic treatment compared with conventional technology, parallel determinations were made in the two types of settlers, shown in the figure below From figure 10 it is observed that water oxidisability





obtained by the classic settler is a 1.5 times higher than that obtained by the experimental sonic settler. The value of water oxidisability decanted by classic settler is 2.76 mg O_2/l .

4. EFFECT OF SONIC TREATMENT ON THE CONTENT OF ALUMINUM IONS IN WATER

As in the previous cases was considered an hour of operation consists of three cycles: five minutes of actual operation of the generator followed by a 15 minute break. The generator submerged depth is also the 0.75 m above the water surface. The principle method for determining the content of aluminum ions in the water, can be summarized as follows: aluminum ions form with aluminona at pH = 4 red colored complex whose absorbance is measured at wavelength of 525 mm [8]. The value of aluminum ion content of raw water (Danube) was 0.03 mg / 1 (30 mg / 1). The test results showed (Fig. 11) that the decanted water content of aluminum ions obtained by sonic settling (Al-x = 0.12 mg / 1)) is 1.66 times smaller than the



Figure 11. The content of aluminum ions from water obtained by sonic technology and with a classical treatment

value obtained at the classic settling (Al-d = 0.14 mg / l). It should be noted that the effect of reducing the content of aluminum ions sonic treated water is beneficial to aquatic ecosystems and human health.

5. EFFECT OF SONIC TREATMENT ON THE CONTENT OF SULFATE IONS IN WATER

They kept the same working conditions as before: three cycles of 5 minutes of operation of the generator followed by a 15-minute break. Depth of immersion of the generator was 0.75 m. The principle method for determining the content of sulfate ions in water can be synthesize as follows: the average alcohol sulphates in the presence of barium sulfate barium chloride are titrate using Thorin as indicator to turn color from yellow to pink, persistent [7]. The experimental results showed (Figure 12) that the sulphate ion content



Figure 9. The amount of water oxidisability decanted after the shareholders obtained from the generator without the generator drive.

obtained with sonic settling (SO4-x = 100 mg / 1) is lower than determined value for classic settling (SO4-d=110 mg/l). The value of sulfate ion content in the raw water (Danube) was 70 mg/l.

6. CONCLUSIONS AND RECOMMENDATIONS

On the platform of Braila water treatment plant the experimental installation for treat the raw water was made, that contains: vertical settler, twofrequency sonic- ultrasonic type air-jet generator. and necessary systems for raw water supply, for air pressure, for coagulant solutions. Were studied physic-chemical indicators of water quality: oxidisability, content of aluminium and sulphate It was considered an hour of operation ions. consists of three 5-minute cluri effective operation of the generator followed by a 15-minute break at a depth of 0.75 m above the water level in the settler. Thanks to the two-frequency acoustic field (sonic frequency of 10.76 kHz, 21.520 kHz ultrasonic frequency, the overall sound intensity of 112.32 dB) were obtained the following effects:

- decreased the water oxidisability value (oxidizable organic substances) in 1.5 times compared with that obtained by classical technology and at 1.826 times compared the raw water;
- reduced water content of aluminum ions in 1.66 times compared with classical technology;
- decreased from 110 mg / 1 to 100 mg / 1 the sulfate ion content in water for sonic decantation compared to the classic decantation.

Replaced the sonic generator with an aerator in experimental settler was observed that value of decanted water oxidisability becomes more than 1.3 times compared with water treatment with generator. This confirms that parallel aeration and degassing by bubbling water take place and the cavitation processes.

Results confirm the beneficial effects of the water treatment with two-frequency sound - ultrasound acoustic field and finally on the environmental and public health systems, given that drinking water is part of the daily needs of each individual.

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MICRO-HYDROPOWER STATIONS FOR CONVERSION OF KINETIC ENERGY OF RIVER WATER WITHOUT BUILDING BARRAGES

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1. INTRODUCTION

To avoid the construction of dams, the kinetic energy of rivers can be utilised by means of exploiting water stream turbines. This type of turbines is easily mounted, is simple in operation and maintenance cost is suitable. The 1m/s current velocity represents an energetic density of $500 W/m^2$ of the crossing section, but only a part of this energy can be drawn off and converted into useful electrical or mechanical energy. This fact depends on the type of rotor and blades. Velocity is especially important as a double increase in the water velocity can result in an eight times rising of energetic density. Prut river has a section equivalent to 60 m^2 and an average velocity in explorable zones of (1 - 1,3) m/s, which is equivalent to an approximate theoretical energy of (30-65) kW. Taking into account the fact that the turbine can occupy only a portion of the river bed



Figure 1. Conceptual diagram of the water wheel with rectilinear profile of blades.

the generated energy might be much smaller. There are various conceptual solutions, but the issue of increasing the conversion efficiency of water kinetic energy is in the view of researchers. The analysis of constructive versions of floatable microhydro power stations previously examined did not satisfy at all from the point of view of conversion efficiency of water kinetic energy. In a classical hydraulic wheel horizontal axle (fig. 1) the maximum depth at which one of blades is sunk makes approximately 2/3 of the blade height *h*. Namely, only this area participates in the transformation of water kinetic energy into mechanical one. As well, the prior blade covers approximately 2/3 of the blade surface sunk utmost in the water $(h'' \approx 2/3h')$. This fact reduces significantly the water stream pressure on the blade. The blade that comes next to the blade that sunk maximally into water is covered completely by it and practically does not participate in the conversion of water kinetic energy. Therefore, the efficiency of such hydraulic wheels is small.

The insistent searches of authors lead to the elaboration and patenting of some advanced technical solutions for floatable micro-hydro power stations, based on the hydrodynamic effect, generated by the hydrodynamic profile of blades, and their orientation at optimum positions concerning the water streams with account of energy conversion in each phase of the turbine rotor rotation (fig. 2) [1]. Therefore it was necessary to perform a large volume of multi-criteria theoretical research concerning the selection of optimum hydrodynamic profile of the blades and the design of the orientation mechanism towards the water



Figure 2. Conceptual diagram of the rotor with hydrodynamic profile of adjustable blades concerning the water streams.

streams.

The basic advantages of these types of microhydro power stations are as follows:

• Small impact on the environment;

- It is not necessary to carry out civil constructions;
- The river does not change its natural course;
- The possibility to utilise local knowledge in order to produce floatable turbines.

Another important advantage consists in the fact that along the river course it is possible to mount a series of micro-hydro stations at small distances (approximately 30-50 m) because the influence of turbulence provoked by the adjacent installations can be excluded.

The results of the carried out research by the authors concerning the water flow rate in the location selected for the micro-hydro power stations mounting, the geological prospecting of the river banks in the place of anchoring foundation mounting, the energetic needs of the consuming potential, represent initial data for the conceptual design of the micro-hydro power stations and its working element.

Conceptual design of the micro-hydro power station constructions with hydrodynamic profile of blades was carried out on the basis of three conceptual schemes:

- micro-hydro power station with pintle and blades mounted on vertical axles anchored by the metallic structure;

- floatable micro-hydro power stations with pintle and blades mounted on vertical axles;

- floatable micro-hydro power stations with horizontal spindle and blades mounted on horizontal axles.

Aiming at an increase of the conversion coefficient of the water kinetic energy (Betz coefficient), a number of structural diagrams of floatable micro-hydro power plants have been designed and patented [1-4]. They comprise a rotor with pintle and vertical blades, and hydrodynamic profile in normal section. The blades are interconnected by an orientation mechanism towards the direction of the water streams. The motion of rotation of the rotor with pintle is multiplied by a mechanical transmission system and is transmitted to an electrical generator or to a hydraulic pump. The mentioned knots are fixed on a platform, mounted on floatable bodies. The platform is linked to the bank by a hinged metallic truss and by straining cables.

A very important aspect in the functional optimization of micro-hydro power plants is the selection of optimum hydrodynamic profile of the blades which allows increasing the conversion coefficient (Betz coefficient). Due to the hydrodynamic upward forces the increase in the conversion level is reached by means of ensuring the optimum position of the blade towards the water streams in various phases of rotor rotation by utilizing blades orientation mechanism. Thus, practically all blades (even those which move opposite the water streams) participate simultaneously in the generation of summary torque moment. The blades which move along the water streams utilize both hydrodynamic forces and water pressure exercised on blade surfaces for the generation of the torque moment. The blades which move opposite the water streams utilize only hydrodynamic upward forces for the generation of the torque moment. Due to the fact that the relative velocity of the blades toward water streams at their motion opposite water streams is practically twice bigger, the hydrodynamic upward force is relatively big and the generated torque moment is measurable to the one generated by the water pressure. This effect forms the basis of all patented technical solutions.

In the process of designing industrial prototypes of micro-hydro power plants for the conversion of river water kinetic energy, the following criteria and requirements have been taken into consideration:

- the elimination of dam constructions and implicitly, of the negative impact on the environment;

- minimal costs;

- construction simplicity and operation;

- high reliability at dynamic overstressing caused by operating conditions;

- utilization of resistant composite materials including increased humidity conditions;

- automatic control of micro-hydro power plant platform position at water level variation;

The adopted technical solutions have resulted in an ample theoretical and experimental research carried out at the Centre for Renewable Energy Conversion Systems Design, Department of the Theory of Mechanisms and Machine Parts. To justify the constructive and functional parameters, supplementary digital modelling and simulation have been carried out by utilizing ANSYS CFX5.7 software. Subprograms developed by authors for the MathCAD. AutoDesk MotionInventor. etc. software, have been utilized, namely simulation of the interaction "flow-blade" of the floatable steadiness and also the optimization of blades hydrodynamic profile, with the purpose to increase the river water kinetic energy conversion efficiency for different velocities by using 3, 4 and 5 blade rotors. In the process of micro-hydro power plants design, the experience gained at research-designmanufacturing of the pilot plant was utilized.

The efficiency of micro-hydro power plant operation by private consumers for special purposes depend on the right selection of micro-hydro power plant constructive configuration and of the functional characteristics of the component aggregates participating in the process of flowing water kinetic energy conversion into useful energy.

In order to satisfy the objectives and consumers demand for micro-hydro power plants, and also for the increase in the flowing water kinetic potential conversion efficiency in the certain zone of the river, the authors have designed the following constructive and functional concepts based on modular assembling:

1. micro-hydro power plant with hydrodynamic rotor for river water kinetic energy conversion into mechanical energy - for water pumping (MHCF D4x1,5 M);

2. micro-hydro power plant with hydrodynamic rotor for river water kinetic energy conversion into electrical and mechanical energy (MHCF D4x1,5 ME);

3. micro-hydro power plant with hydrodynamic rotor for river water kinetic energy conversion into mechanical energy at small rotations (MHCF D4x1,5 ME);

4. micro-hydro power plant with hydrodynamic rotor for river water kinetic energy conversion into electrical energy (MHCFD4x1,5 E).

The mentioned micro-hydro power plants, conceived as modular ones, allow the modification of destination and functional characteristics by replacing certain aggregates with other (generator, pump, blades with different hydrodynamic profile, 3-5 blades rotor).

Micro-hydro power plants have similar resistance structure as constructions calculated from the point of view of resistance and rigidity at dynamic demands. Floatability and maintenance of the perpendicularity of micro-hydro power plant rotor spindle for a variable river water level are ensured by technical solutions protected by patents [1-4]. The instant orientation mechanism of blades for a constant entering angle concerning the direction of the water flow represents Know-How and it is not described. The main working element on which the quantity of kinetic energy converted into useful energy depends is the blade with the hydro-dynamic profile NACA 0016, developed on the basis of the performed digital modelling. Two types of rotors with 3 and 5 blades have been designed for the mentioned micro-hydro power plants. The installed capacity of micro-hydro power plants with diameter D = 4 m, water-submersed blade height h = 1, 4 m and the length of the blade cord l = 1,3 m for water flowing velocity V = 1...2m/s can be within P = 2...19 kW.

2. MICRO-HYDRO POWER PLANT WITH HYDRODYNAMIC ROTOR FOR RIVER WATER KINETIC ENERGY CONVERSION

The micro-hydro power plant with constructive configuration MHCF D4x1,5 ME for river water kinetic energy conversion into electrical and mechanical energy (fig. 3) is poli-functional and can be utilized for street illumination, heating, water pumping for irrigation by weeping, for drainage of agricultural areas adjacent to rivers.

The assembling of blades 1 with NACA 0016 profile in hydrodynamic rotor 2 and its mounting on the inlet shaft of the multiplier 3 are done in the same manner as for micro-hydro-power plant. The kinematics and constructive peculiarities of micro-hydro plant are the following: rotation motion of hydrodynamic rotor 2 with angular speed ω_l , by



Figure 3. Micro-hydro power plant with hydrodynamic rotor river water kinetic energy conversion into electrical and mechanical energy (rotor diameter D = 4m, water-submersed blade height h = 1, 4m, length of the blade cord l = 1, 3m) (MHCF D4x1,5 ME): 1. hydrodinamic NACA 0016 profile blades; 2 - 3-blade rotor; $3 - planetary multiplier with multiplication coefficient <math>i = 112; 4 - belt drive with multiplying coefficient <math>i = 1, 9; 5 - generator with permanent magnets (characteristics - p. 5.4); 6 - impeller pump CH - 400 (characteristics - pumping flow rate <math>Q = (20-40) m^3/h$ la at pumping height 15...32m); 7 - plastic mass pontoons, 8 - guide path, 9 - space case.

means of multiplier 3 and of belt drive 4 having an effective multiplying coefficient i = 212,8, is being multiplied up to angular working speed of the generator with permanent magnets with small rotations 5:

$$\omega_3 = \omega_1 \cdot i_1 \cdot (s^{-1}).$$

Torque moment T_3 , applied to rotor 5, is:

$$T_3 = \frac{T_1 \cdot \eta_1 \cdot \eta_2 \eta_r}{i}, (Nm),$$

where: η_l is the mechanical efficiency of the multiplier ($\eta_l = 0, 9$);

 η_2 - mechanical efficiency of the belt drive ($\eta_1 = 0,95$);

 η_r - mechanical efficiency of the hydrodynamic rotor bearings ($\eta_l = 0,99$).

i – effective multiplication coefficient equal to the composition of multiplying ratios of the planetary multiplier and of the belt drive. Diagrams of the summary torque moment T_1 at the hydrodynamic rotor shaft with blades for different water flow velocities is shown in fig. 4.

The electric energy produced by the generator with permanent magnets 5 (fig. 4) can be utilized



Figure 4. Micro-hydro power plant MHCF D4x1,5 ME kinematics.

both for private consumer needs of power and for supplying electricity to impeller pump 6 (CH 400), for water pumping into irrigation systems by means of weeping or drainage of agricultural areas adjacent to the rivers (by relocation of the impeller pump 6). In the fig. 5 the dependence of the torque moment T_1 at hydrodinamic rotor shaft at one rotation is presented. In the case of electric energy production, the energy utilization efficiency with account of mechanical losses in the kinematics chain of the micro-hydro power plant and in the generator with permanent magnets makes up (at generator terminal):

$$\eta_{\Sigma} = \eta_{I} \eta_{2} \eta_{r} \eta_{g} = 0, 9 \cdot 0, 95 \cdot 0, 99 \cdot 0, 87 = 0,736,$$

and in case of water pumping (at the shaft of the pump):

 $\eta_{\Sigma} = \eta_{l}\eta_{2}\eta_{r}\eta_{g}\eta_{me} = 0,9\cdot 0,95\cdot 0,99\cdot 0,87\cdot 0,91 = 0,67,$

where: η_g is generator efficiency; η_{me} – efficiency of the hydraulic pump of the electric motor.

On the basis of the conceptual diagram designed above, technical documentation was developed and industrial prototype of micro-hydro power plant for river water kinetic energy conversion into electrical and mechanical energy was manufactured (fig. 5). Thus, micro-hydro power plant MHCF D4x1,5 ME provides



Figure 5. Industrial prototype of micro-hydro power plant river water kinetic energy conversion.

conversion of up to 73,6% and 67% of useful energy for electricity production and for water pumping from the energy potential of flowing water entrapped by the hydrodynamic rotor.

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TYPES AND FORMS OF CREATIVITY

It is well known that creativity is manifested in various forms of human activity. For this reason, creativity has always had a specific character. Some authors believe that there exist as many forms of creativity as there are distinct occupations, as well as many aspects as the human nature has. It is easy to guess how the mechanism of structuring the creativity forms works as every creative potential needs to take some specific form to become concrete. Following this idea we should establish the forms and the types of creativity. A consequent analysis of referential literature which treats forms of creativity has been done.

Creativity is seen as a set of specific intellectual skills, integrated in a unitary intellectual structure defined on three dimensions: *individuality, content* processed by intellectual processes and the *products* of such processing. The specific continuity that features it is a divergent thinking, seen by the diversity of orientation of sequences of operations, seeking different solutions to problems. The phrase is used by J.P. Guilford by analogy with the concept of imagination. Variants of processing knowledge progress on the direct-indirect cognition dimension, in the following sequence: perceptual knowledge \rightarrow storing \rightarrow convergent thinking \rightarrow divergent thinking \rightarrow evaluation.

criteria of classification Treating every separately it can identify different forms of creativity. According to criteria: the subject potential and abilities we may distinguish: mental *creativity, practical / praxiological creativity;* the creating aspect - individual creativity, group creativity; the domain in which creativity manifests scientific creativity, technical creativity (technological creativity, technico-technological creativity), artistic creativity; the creative process approach – spontaneous (inspired) creativity, stimulated (organized) creativity; the performance - scientific, technical, technological, economic, literary, socio-political, sports, creative performing, pedagogical (educational), managerial, etc.; to which social category the subject belongs *pupil* creativity, student creativity, teacher creativity, engineer creativity, etc.; the biological factor - adult creativity, teenager creativity, preadolescent creativity, pre-school creativity, ante preschool creativity.

The explanation of the process of creation is based on psychoanalytical concepts pointed out by S. Freud, A. Adler and K.G. Jung. Thus, in order to explain the process of creation to students we resort to the fundamental principles issued by S. Freud: 1. *Psychic Determinism*: there exist in psychological acts relations of causality, interdependence, continuity; random psychological acts do not exist

2. *The Unconscious*: it has major importance for the mental activity. It is governed by certain laws; between the conscious and the unconscious there is a barrier which is called censure, acting as a filter.

3. *Motivation*: human behavior is always driven by motivation: any act, expression, action has a logical significance, and is grounded on hidden motivation on the unconscious level.

4. *Evolution of the individuality*: the character is born out of *pregenital pulses*, and develops under social pressure, capable of changing its object.

K.G. Jung's research in determining the individuality structure has acquired special significance in explaining the developing of students' creative abilities within the process of technological creativity.

In K.G. Jung's opinion the individuality structure includes: the psyche; the consciousness of the Self; the personal unconsciousness which includes various complexes; interactions between individuality structures; individuality dynamics and development; psychological types; the place of symbols and dreams in the individuality structure.

The consciousness of the Self, the personal and the collective unconsciousness manifest in an especial way within the creative process. The consciousness is that part of the brain which can be known by the individual through its four basic mental functions: thinking, affections, sensitiveness, and intuition. The prevailing of one of the functions will stamp the individual character with some specific qualities: thoughtfulness, sentimentality, sensitiveness, intuition. or The personal *unconsciousness* is that part of the individual which stores from one's birth all personal and conflict experiences, moral problems, the unsettled ones, the ones which seem to have little importance, everything that is sensed, thought, felt, and forgotten. The irrational includes the psychological functions of the major importance for the creative process, such as intuition, feeling, and occurrence.

The intelligence pattern – a fundamental ability of the creator. It is necessary to identify the peculiarities of the creative people. Two categories of factors can be distinguished within the human abilities context, a general factor – which participates in performing all activities, and numerous special factors – which correspond only to concrete conditions of one form of activity (engineering, pedagogy, artistic, managerial, etc.), it is considered that creative people possess intelligence and specific thinking.

Intelligence is a complex phenomenon and therefore its defining is difficult. Definitions made so far have not yet met a unanimous acceptance. However, *intelligence* can be defined as a general cognitive function, based on abstraction, pattern construction and problem solving. In our research intelligence is treated as the general ability to solve problems optimally that is the ability to meet all obligations that require some adjustment capability, and a spirit of observation and logical deduction, etc.

Basic functions of the intelligence are: *abstract* thinking, mathematical skills, verbal expression, ability to diagnose and resolve memory and creativity. Thurstone established the following factors of intelligence: reasoning (deductive and inductive), memorizing, capacity, perceptual quickness, spatial operation, understanding of words and verbal fluency. Intelligence can be assessed. Empirically it can be evaluated by: efficiency, learning ease and depth of understanding, difficulty and novelty of the issues which the subject is able to solve. The best-known parameter for determining the level of creativity is intelligence quotient IQ (measured in points), which differs from person to person. Research shows that the vast majority of people (except those who have a pronounced degree of debility) possess creative skills. Statistical surveys have shown that IQ ranges in average between the extremes of 60 and 140 with the majority placed between 90 and 110.

One of the great issues of intelligence is related to the factors that determine it fundamentally. Is intelligence innate, congenital or acquired? Some specialists established that human intelligence is a which quantitative aspect, has а double determination - genetic and environmental. According to these theories, the man is born with a certain *potential* intellectual genotype, whose realization depends on the environment, favorable unfavorable. Intelligence is genetically or determined in the ratio of 60...70%, the environment having a 30-40% of influence.

It is to be accounted that measured intelligence increased up to 15 points from one generation to another. It can not be explained by the increase of the *"informational*" bombing upon subjects, or it can not be explained essentially from this point of view.

Age has also an influence on intelligence, research and innovation. There are views and the assumption that scientists have produced their best works at the age between 30 and 40 years. Most important discoveries were made at the age between 30 and 70 years, although the maximum number of major work was done at the age of 45-50 years.

The sequencing pattern of the creative process. The first phasing of the creative process belongs to J.Wallas and differentiates four phases: preparation, incubation, illumination/inspiration, evaluation. *Preparation* is a phase which preponderantly takes place at the level of conscious structures and lies in successive definitions and redefinitions of the problem, as well as in organized and consequent data collecting which may lead to finding a solution.

Incubation, the most controversial phase of creation, takes place preponderantly at the level of the unconscious structures, where spontaneous, unconscious processing of problem data take place, as well as of information which was collected consciously in order to solve it in terms of a certain criteria.

Illumination represents the moment of growing aware of a relation, more or less expected, between the problem data and a certain informational structure, which results from conscious and unconscious data processing, simultaneous and consecutive.

Evaluation consists in conscious examining of the ways of equilibrating the informational corpus *problem* with the informational corpus *solution* in one or more concrete situations.

Alongside with the creativity patterns based on the process, specialty literature proposes patterns of creativity as a product.

The hierarchy pattern of creative plans. Analysis of definitions and approaching creativity vertically claim examining the idea that all persons are potential creators to some extent and the idea that there exist several levels of structuring creativity. These ideas allowed Irving A. Taylor to develop, a pattern which may be considered operational enough to evaluate creative products of different levels of complexity. I. A. Taylor describes five different creativity plans, in hierarchal succession: expressive creativity plan; productive creativity plan; inventive creativity plan; innovative creativity plan; emergency creativity plan.

Column written by professor Valeriu Dulgheru, Ph.D. Dr. Sc. from Technical University of Moldova

PERSONALITIES FROM THE MERIDIANS OF THE ENGINEERING UNIVERSE

Albert Einstein was born on the 14th of March 1879 in Ulm, Germany. His father, Hermann, was a small enterpriser in the domain of electrical equipment, and his mother, Paulina, was a person in



love with music. Albert had his first violin classes with her. He was six, but he kept on playing the violin all his life: for his own pleasure, when his experiments

didn't have the expected results or for philanthropic events.

History tells us that he didn't utter any word until he was three. Parents got worried, but to their happiness and astonishment, he started to speak fluently one day, using the vocabulary of an adult. He accumulated, analyzed and ... communicated. He did like this all his life. When he was 11 he started to attend a secondary school in Munich. In 1896 he applied for the Polytechnics of Zurich, one of the best universities during that time in order to get a diploma as a physics teacher. He liked more the experimental part of his teaching activity and this is why he was spending a lot of hours in the lab. History tells us that he wanted to continue his activity in the labs of the Polytechnics as an assistant, but, because of the antipathy of a professor, all his hopes vanished. He took a job as a teacher in a secondary school, he gave private lessons at home and published original theories in scientific journals. Although his ideas were inedited, they weren't paid any attention. He was asking at that time: How would it be if we could control light and travel through it? One year after his graduation, he defended his dissertation, but the scientific committee not only that they weren't impressed by the subject, but also they didn't give him the diploma which would have allowed him to work. With the help of an acquaintance, he gets, from 1902, a job as a clerk at the Swiss Office for Patents. It is supposed that the analysis and the classification of the usage of several devices stimulated his preoccupations related to space and time. He worked here for two years. Although he had plenty of ideas, he could not find any lab in which he could check his theories. Because of these conditions, he had to develop a method that he called "theoretical experiment". History says that when asked "Where is your lab?" he opened a drawer where there were a pen and a sheet of paper and said "for the theoretical experiment all you need is a pen and a sheet of paper".

In 1905, after a period of one hundred days, he published three articles, in different fields, but all having a revolutionary importance for science. The third one. On the electrodynamics of moving bodies represented the first expression of what it was called later the special theory of relativity. The scientific world remained indifferent. Only after Mark Plank, who had already written the revolutionary theory of the quantum, invited Einstein at the University of Berlin, the scientific community reacted and showed their astonishment: an examiner of inventions, of only 26 years old, unknown, with no scientific titles, can not formulate a revolutionary theory! It was only in 1919, during a total eclipse of sun, when the notes of the astrologist Sir Arthur Eddington, confirmed Einstein's theories regarding the time relativity and the space deformation. After this event Albert Einstein became more and more famous all over the world. He was invited to deliver speeches at conferences all over the world. In Japan he visited many cities, from north to south, including Hiroshima. In Germany, after 1921, Hitler became more and more powerful, and the anti-Semitism extended. In these conditions it was created a committee in Berlin for denigrating Einstein's theories and which published the book One hundred of writers against Einstein. Einstein answered to this book with only one sentence: "If my theories are really full of errors, then all it is needed is only a scientist to demonstrate this thing." In 1933 he went to America for ever. Although Einstein is known for his theory of relativity, he received the Nobel Prize in 1921 for his contribution to the quantum theory from the second article written in 1905. The news was brought to him during his return travel from Japan to America. He enjoyed the news with restraint. He expected to be given the prize for the theory of relativity! His Fame involved him in the activity of President Franklin Roosevelt, trying to hurry the construction of the atomic bomb which started "The Manhattan Program" for fabricating the atomic bomb before the Germans. As an irony, on the 6th of August 1945, he was in his house from Princeton and he heard on the radio the news about launching the atomic bomb over the Japanese city of Hiroshima. He shouted in vain "What a horror!" He remembered that during his visit in Japan in 1923 he had declared: "If all people of the world were so smiling as Japanese, we would never have wars again!" He died on the 18th of April, 1955 in a hospital from Princeton, the USA. He died of heart failure and he was burnt in Trenton, New Jersey, and his ashes was scattered in an unknown place. Albert Einstein opened a new window for the mankind! He loved children! He hated war! "I don't know what weapons will be used in World War III, but in World War IV they will fight with sticks and stones."



Alexandru Proca was born on the 16th of October, 1897 in Bucharest, in a family of intellectuals. He graduated Gheorghe Lazar Highschool in 1915. Although he chose the scientific qualification, he could speak fluently French, English and German at graduation. In the same year he started to attend the Faculty of Sciences.

department of mathematics, but because of the beginning of the war he attended only the first year. In 1917 he is enrolled, he attended the School for reserve officers from Iaşi afterwards being sent to war as engineer lieutenant, where he fought until June 1918 when he was discharged. He restarted to attend The National School for Bridges and Roads, as a student, and when this school was transformed into The School of Polytechnics he chose the department of electromechanics. As a student he became known due to his bright intelligence, due its intuition and general view of technical phenomena. He preferred the theoretical research, namely mathematics. When still a student, he collaborated with professors Tudor Tănăsescu and E. Abason in order to write the Bulletin of theoretical and applied mathematics and physics, published by the School of Polytechnics from Bucharest. He delivered some lectures about the theory of relativity which had been made known by Einstein recently. He started his activity as engineer in 1922 at the Electrical Society in Câmpina, where he worked only for a year, but where he managed to begin the implementation of the electrical equipment for oil and mining gears. The results were presented in the paper "The Use of Electricity in oil Industry" published in 1924. At the same time he started his teaching career as an assistant at the Department of Electricity and Electrotechnics.

He was keen on the theoretical study of physical phenomena and, in 1925, he was sent to University of Sorbona, Faculty of Sciences. Although he had to attend all the courses he graduated until 1928, namely in less than three years, with an average mark of 17.50, the maximum average being 20. After defending his B.A. paper he was employed at the Institute of Radium which was managed by the famous Marie Curie. Here is what Marie Curie was saying about Alexandru Proca: "Every time when I have a difficult scientific problem, that needs a lot of patience, competence, experimental ability and meticulousness I go to Mr. Proca. Every time he provides solutions that I like, that satisfy me and the results are always very precise. You, Romanians, can be proud that you have a scientific researcher as valuable as Mr. Proca." During that time the Institute of Mathematics "Henri Poincaré" for promoting the theoretical physics in France was set up. Marie Curie

encouraged him to get a job at this institute. Here he wrote his Ph.D. thesis that combined researches from two top fields of physics: the theory of relativity elaborated by Einstein and the theory of electrons elaborated by Dirac. In 1929 Albert Einstein delivered a conference at Henri Poincaré Institute, and Alexandru Proca was among very few invited at the talks with Albert Einstein. The destiny wanted that the two men to meet in Paris: Einstein, the author of the theory of relativity and Proca who, as a student at the School of Polytechnics in Bucharest, had delivered some lectures about Einstein back in Romania. In 1933 he got his Ph.D. diploma in physics, demonstrating in this thesis the existence of some subatomic particles, with positive or negative load, with a very short life and with a mass approximately two hundred times bigger than the mass of an electron. He called these particle "mesons". After obtaining these particles artificially in particle accelerators, Alexandru Proca became an indisputable authority in the study of mesons. The Ministry of Foreign Affairs form France financed him one year grant in Berlin where he worked together with the famous physicist Schrödinger. Later, he worked in Copenhagen with Niels Bohr. With the help of his theoretical research he established a link between the electromagnetic theory and the quantum theory of the photon. During 1936 - 1940, he extended Maxwell's equations in vacuum, writing the relativist equations of the boson vectorial field that established his reputation completely and that are known in scientific world as "Proca's Equations". He wanted to become a professor, but his attempts to get a teaching load were defeated by the envy of the most important people during that period who could not accept their theories to be contradicted by Alexandru Proca's scientific proofs. It was only in the summer of 1943 when he managed to teach the course on theoretical physics at the University of Porto, Portugal. Although he was the first person who proved the existence of mesons before the Japanese Hideki Yukava, the latter received the Nobel Prize for physics in 1949. Although he received a lot of praises for his valuable work, he was affected by the injustices. He was unable to understand the envy and the bad things coming from his fellows. He kept quiet. He suffered. His enthusiasm faded as well as his physical strength and he got ill. At the beginning of 1953 he was diagnosed with throat cancer. He kept on fighting. He fought writing. His last article was written on the 18th of October, 1955. After two months, on the 13th December 1955, the disease killed him. He was 58. In 1990 he was chosen the honored member of The Romanian Academy post-mortem.

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