

INDUSTRIALLY IMPORTANT ENZYMES FROM MICROORGANISMS

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The presented review aims a short, successive description of all procedures of such complicated and important process as initial selection and further creation of industrially important microbial strains including their genetic manipulations, for large scale production of enzymes from microorganisms. The whole spectrum of operations for the production of industrial enzymes, including selection of strains, their purification from natural samples, inoculums preparation, determination of their belonging to corresponding taxonomic group, genera and family; mode of cultivation and composition of nutrient media for effective growth under Solid State Fermentation or Submerged Cultivation Technology, including selectively chosen organic and ganic sources of C, N, P, metal ions, specific organic additives, etc., scaling up the cultivation process from fl asks level to industrial volume is discussed. Special section is devoted to microorganisms growing in extreme conditions – extremophiles, and quite often producing stable enzymes – extremozymes, with increased resistance against extreme conditions of reaction mixture they catalyze, such as: high and low temperature and pH, high salt concentrations, low water activity, and high hydrostatic pressure. Aqueous ganic and nonaqueous media allowing the modification of reaction equilibrium and enzyme specificity, creating pathways for synthesizing novel compounds. Separately is discussed the perspectives and current application of immobilized enzymes, as the most appropriate ways for their effective, long term, repeated application, in practice. Some data concerning choice of carriers, methods of enzymes coupling, types of bioreactors for long term application of immobilized forms of enzymes also are presented in the review. Perspectives of genetic and protein engineering, manipulations with the strains enzyme producers, for the creation of stable forms of enzymes and cloning of their genes in nontoxic, fast growing organisms, are considered as a future of industrial enzymes production. Finally, enzymes are suggested as best candidates for wide spectrum applications in different nanotechnologies.

GENOMIC CHARACTERIZATION OF TWO NEW *SALMONELLA* BACTERIOPHAGES: vB_SosS_Oslo AND vB_SemP_Emek

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Salmonella are classified on the basis of their surface antigens of which the O-antigen, which is the immunodominant portion of the lipopolysaccharide molecule, is highly variable among different strains. Enzymes modifying O-antigens are often encoded by prophages which represent the genomes of integrated temperate phages. The expression of certain prophage genes by the lysogen can often result in the change in serotype of the host. It was hypothesized that O-antigens 14 and 20 of *Salmonella* strains might be encoded on prophages. This report outlines the isolation and sequencing of two novel bacteriophages, one from each of *Salmonella enterica* serovars Oslo and Emek thought to have given rise to O-antigens 14 and 20, respectively. Further analysis through lysogen isolation and serotyping has proven otherwise.

TOPINAMBUR: BIOENERGETIC AND BIOMEDICAL POTENTIAL

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An overview of actual situation for the primary non-agricultural use of topinambur for production of fructans, ethanol, fructose and other valuable products. The results of the own long-term R&D in Armenia are presented with emphasis to practical implementation.

***Alternaria alternata* F-1120: A NEW EFFICIENT DESTRUCTOR OF 2,4,6-TRINITROTOLUENE**

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Screening among 47 fungal strains to reveal their ability to transform TNT showed *Alternaria alternata* F-1120 to be the most active strain. At a concentration of 100 mg/l, TNT was totally transformed after 7 days of cultivation. Addition of Tween 40 and Tween 80 doubled the transformation rate, enabling the strain to utilize TNT at higher concentrations of 200 and 400 mg/l. Effects of various glucose concentrations on TNT conversion rates were also investigated. The optimal glucose concentration for transformation of TNT by *Alternaria alternata* F-1120 was found to be 20 g/l. Four intermediates of TNT transformation by this strain were identified. Experiments with inoculation of *Alternaria alternata* F-1120 to soil contaminated with TNT showed its ability to convert TNT. Complete removal of this explosive at concentration 100mg/kg was observed after two weeks, at concentration of explosive equal to 200 mg/kg of soil for the same period 63% of contaminant has been degraded.

ANTITUMOR FUNGAL β -GLUCINES FROM OF *Ganoderma lucidum* BY SUBMERGED AND SOLID STATE CULTIVATION

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Ganoderma lucidum original strain MZKI G93 isolated from Slovenian forests was cultivated using submerged and solid state cultivation. Batch cultivation experiments were performed in 10 l Stirred tank reactor proceeded for 10 days, 9.6 g⁻¹ of dry biomass, 4.4 g⁻¹ of extracellular and 1.35 intracellular polysaccharides were isolated from the final cultivation broth. Solid state cultivation was carried out in a horizontal stirred tank bioreactor. Cultivation process in solid state bioprocessing proceeded for 22 days moisture content in the samples was 80 to 72 %. 1.7 g⁻¹ extracellular and 0.45 g⁻¹ intracellular polysaccharide fractions were isolated. Polysaccharides were further separated by ion-exchange, gel and affinity chromatography. The isolated polysaccharides were mainly β -D-glucanes. Immunostimulatory effects of isolates were tested on induction of cytokine TNF- α and IFN- γ synthesis in primary cultures of human mononuclear cells (PBMC) isolated from a buffy coat. Economy of both cultivation processes was compared.

OPTIMIZING THE PURIFICATION OF ENZYMES BY HEAT TREATMENT

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A mathematical model is presented to help the industrial enzyme technologist optimize a simple but sometimes effective early-stage enzyme purification process. This process involves heating a crude mixture to destroy some of the contaminating proteins. The model predicts that an optimum temperature can often be found. An optimum heating time is also possible under more stringent conditions. No real experimental data is available, so the utility of this model must be tested with one or more real systems.

DEVELOPMENT OF BIOCATALYST FOR GLUCOSE-FRUCTOSE ISOMERIZATION PROCESS

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A competitive biocatalyst for continuous process of glucose-fructose isomerization was developed. Cells of urea-adapted native strain *Arthrobacter nicotianae* BIM B-5-MG-1 (B-391 D) or recombinant strain *Escherichia coli* BL21(DE3)/ *pET24bxylA* (BIM B-427 D) immobilized in silica dioxide xerogel with inclusions of insoluble cobalt hydroxycompounds were used as enzymatically active catalytic substance. Performance trials in experiments modeling industrial conditions demonstrated that half-inactivation time of biocatalyst based on immobilized cells of *Escherichia coli* BL21(DE3)/ *pET24bxylA* (BIM B-427 D) exceeded 1000-1200 h, and its overall productivity constituted 1-2 tons of glucose-fructose syrup per 1 kg of biocatalyst. The elaborated biocatalyst in its potential meets the criteria set by manufacturers of glucose-fructose syrups, which states the necessity of scale-up program.

BIOREMEDIATION OF SOILS CONTAMINATED BY POLLUTANTS

L.A. Golovleva

This review describes the role of microorganisms in the degradation and detoxification of pesticides and persistent pollutants. Processes performed by microorganisms in the environment are discussed. Typical pathways of transformation of different pesticides and toxic xenobiotics, especially chlorinated aromatic compounds, are demonstrated. The enzymatic and molecular mechanisms of microbial degradation of chlorophenoxyalkanoic herbicides (2,4-D and 2,4,5-T) and chlorophenols are explained as an example. The possibility of using active strains-degraders for bioremediation of contaminated soil are shown.

STRATEGY OF BIOLOGICAL CONTROL OF PHYTOPATHOGENIC BACTERIA IN GEORGIA

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Plant bacterial diseases and their management strategies are reviewed. Three phages, specific to *Xanthomonas vesicatoria* pathogenic strains spread in Georgia were isolated from diseased tomato and sewage. The efficiency of 7×10^7 p.f.u./ml mixture of the three phages was studied in greenhouse conditions on tomato fruits, artificially infected with 10^9 c.f.u./ml culture of *X. vesicatoria* pathogenic strains. Spraying with phage of artificially infected fruits simultaneously or after 24 hours hindered initiation of bacterial spot disease. Treatment with phage of infected fruits a week later stopped development of the disease. The displayed efficacy of bacteriophages mixture is proved by electron microscopic study and quantitative evaluation of phage and bacteria populations in tomato fruits.

PHYSIOLOGY OF BIOLOGICALLY ACTIVE METABOLITE PRODUCTION BY MEDICINAL MUSHROOMS

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Many higher *Basidiomycetes* demonstrate medicinal or functional properties and various biological activities that may promote human well-being. The medicinal properties are found in various cellular components and secondary metabolites which have been isolated and identified from the fruiting bodies, culture mycelium, and culture broth of mushrooms. Some of these compounds have cholesterol-lowering, anti-diabetic, antioxidant, antitumor, immunomodulating, antimicrobial, and antiviral activities ready for industrial trials and further commercialization, while others are in various stages of development. The purpose of this review is to provide an update of the present state-of-the-art and future prospects of basidiomycetous medicinal mushrooms to produce mycelium and bioactive metabolites and to make a contribution for the research and development of new pharmaceutical products from mushrooms.

MONOOXYGENASE AND PEROXIDASE MECHANISMS OF XENOBIOTIC METABOLISM

M. Sh. Gordeziani

It has been considered the resemblance and difference between the mechanisms of xenobiotics oxidation, catalyzed by monooxygenases and peroxidases of plant cell. It has been shown, that plant cytochrome P450 has the ability to change the monooxygenase mechanism of oxidation into the peroxidase mechanism, which is the result of conversion of P450 into P420. Based on experimental data, the mechanism of cytochrome P450 transformation, has been stated and has been determined the biological phenomenon of cytochrome P450 transformation via chemical modification.

ASSIMILATION AND TRANSFORMATION OF LOW MOLECULAR COMPOUNDS OF WINE BY YEASTS DURING SECONDARY ALCOHOLIC FERMENTATION

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Based on literary data and almost 40-year long own researches, the results of transformation for carbon dioxide, monoatomic alcohols, glycerol, acetaldehyde, volatile and involatile organic acids and amino acids of wine performed by industrial yeast strain of *Saccharomyces cerevisiae* var. *vini* at secondary alcoholic fermentation (wine champagnization) have been discussed. By applying of ¹⁴C-radioactive compounds, major products of metabolism both in the cell and in fermentation medium have been studied. Usage peculiarities of each carbon atom of ethyl alcohol, glycerol, acetic and succinic acids in yeast cell were revealed. Analysis of publications and received results are of great importance for biotechnology of sparkling wines, promoting improvement of their quality.

MEDICINE, GENETIC THERAPY AND PERSPECTIVES OF TREATMENT WITH STEM CELLS

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In the article is given the results of modern investigation of estimation of gene therapy treatment with stem cells.

SCREENING OF CAROTENESYNTHESIZING YEASTS ISOLATED FROM DIFFERENT REGIONS OF GEORGIA

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37 strains of carotenesynthesizing yeasts belonging to the genera of *Rhodotorula* were isolated from different regions of Georgia (Kakheti, Kartli, Imereti and Racha). As a result of screening it is revealed *Rhodotorula* sp. str. 419 which accumulates 1348 mkg/g of carotenoids during 72 hours. A complex of carotenoids of *Rhodotorula* sp. str. 419 contains β -carotene ($\lambda_{\max}=451\text{nm}$), γ -carotene ($\lambda_{\max}=461\text{ nm}$) and torulene ($\lambda_{\max}=486\text{ nm}$). Addition of a sunflower oil in the nutrient medium in concentration of 1ml/l, causes stimulation of biomass accumulation and process of carotenogenesis by 60 %, and addition of molasses - by 15 and 60 %, accordingly.

NANOTECHNOLOGY IN AGRICULTURE

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This short essay considers the overlap between two very large fields, nanotechnology and agriculture. The numerous indirect applications of nanotechnology -- those developed in other spheres of industrial activity

that can be applied in agriculture -- are not given detailed consideration. The ways in which nanotechnology is presently finding specific applications in agriculture are described. The most important of these would appear to be the upgrading of marginal soils enabling food production to become a feasible proposition in such regions. A discussion of worthwhile future areas for research and, hopefully, exploitation concludes the essay.

SOLUBLE DRY EXTRACTS RICH IN BIOLOGICALLY ACTIVE COMPOUNDS FROM BULBS AND LEAVES OF TOPINAMBOUR (*Helianthus tuberosus* L.) SPREAD IN GEORGIA

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Several solvable dry extracts have been made on the basis of topinambour spread in Georgia. It is shown that these extracts are rich in inulin as well as other biologically active compounds.

SOIL-ECOLOGICAL CHARACTERISTICS OF MOUNTAIN-MEADOW SOILS OF THE NORTH-EASTERN SLOPE OF THE GREAT CAUCASUS OF AZERBAIJAN

G. Sh. Mammadov, N.N. Sirajov

The complex soil ecological research of the main subtypes of mountain-meadow soils spreading on the given territory, including the study of morphological, physical, chemical peculiarities of the soil on the basis of the field, fund and laboratorial investigations has been carried out for determination of the present condition of soil cover of the north-eastern slope of the Great Caucasus.

INFLUENCE OF SOME PARAMETERS OF THE IRRIGATIVE MEADOW-SEROZEM SOILS ON PRODUCTIVITY IN THE SALYAN STEPPE

S.M. Talibi

The detailed information about results of the complex investigations in the irrigative meadow-serozem soils of the Salyan steppe are adduced in the article. It was established that the salt quantity, and mineralization of subsoil waters in the soils are different. The places where these parameters increased, the plant productivity reduced. With the purpose of improvement of soil condition the recommendation has been prepared for it.

MODELING OF THE STRATEGY OF THE DEVELOPMENT OF NATURAL RESOURCES AND BIOSPHERE PRESERVATION

B.A. Shahnazaryan, M.A. Grigoryan

The growing human impact on ecological systems in preserving the Earth's biosphere is one of the most pressing global problems. The search of the strategy for its solution is carried out in the direction of creating

the most benign biosphere of “ closed “ low-waste technological process and environmentally “clean “ energy sources, etc. The suggested probability is the development of eco-economic system, spending limited biosphere resource for business purposes, provided the cost of developing high technology, as well as the protection and partial recovery of the biosphere. The trajectory of evolution of the system and conditions for admitting high technology are described.

PHYTOPLANKTON AS A COMPONENT OF FOOD JUVENILE OF CRUCIAN CARP *CARASSIUS AURATUS GIBELIO* (BLOCH., 1783) OF LAKE SEVAN

N.E. Barseghyan, A.S. Mamyan, T.V. Vardanyan, L.R. Hambaryan

The feeding of juvenile of Crucian carp of Lake Sevan was investigated in 2011. As a result of investigation it was reported 22 genera of planktonic algae, the diatoms are 45,5 %. It was found out that on the coast of nearby wetlands of Thovazard village, algae of the genus *Scenedesmus* quantitatively dominated in the phytoplankton community and among a variety of plant organisms which were the food of carp. This was explained by the fact, that Crucian carp prefers mainly the food, which is abandoned. That is why these algae had the most important role among other plant organisms.

EPIZOOTOLOGICAL SITUATION REGARDING THE INFECTIOUS DISEASES OF ANIMALS IN SOME REGIONS OF REPUBLIC OF ARMENIA

S.L. Grigoryan, A.R. Mkrtychyan, M.A. Sargisyan, S.G. Egoyan

Epizootological investigations in the different regions of RA have revealed that the most spread infections from 2007 to 2011 are cattle brucellosis and pig's African fever. This fact can be explained by absence of immune-preventive remedies against these diseases and by low standard of veterinary-sanitary measures.

SEPARATION OF TOLUOL FROM SILICATE-ORGANIC LIQUIDS CONSIDERING MASS TRANSFER PROCESS

R.A. Baklachyan

For determining of mass transfer coefficients which are taking into account heat flows during rectification processes, liquid mixtures are to be consisting of toluol and oligethylsilicate organic liquids. The calculated results which have been got for kinetics of simultaneously mass transfer and rectification processes, are applied for investigation of given rectification column's operating principles. As a result some offers have been given which can improve the product quality and increase the column efficiency

PRODUCTION AND USE OF LIQUID SUGAR

N. Sh. Baghaturia, N. V. Chitashvili, N. A. Begiashvili, L. Z. Kotorashvili, B.N. Baghaturia

The work deals with the results of investigation physical-chemical indicators of sugar beet grown in Georgia. The paper shows the expediency of liquid sugar producing for industrial purposes. It also shows physical and

chemical indicators of different kinds of liquid sugar. The paper analyses economic efficiency of liquid sugar production for sugar producer enterprises as well as for sugar consumer factories (production of alcoholic and nonalcoholic drinks, cannery and confectionary).

EDUCATIONAL REFORMS: PROBLEMS AND PROSPECTS

A.P. Tarverdyan, S.A. Daveyan, V.E. Urutyanyan

The analysis of educational reforms due to Bologna process is considered in state agrarian university of Armenia. Optimal model of qualitative agrarian education is represented by example of Center of agribusiness education.

THE LAND MARKET AND THE STATE REGULATION OF LAND RELATIONS IN THE REPUBLIC OF ARMENIA

M. E. Badalyan, T. S. Ghulinyan

As a result of the study of the land market condition in the Republic of Armenia, as well as the international experience of land and rent relations, a conclusion has been made, that to increase the utilization efficiency of state and municipal reserved agricultural land it is necessary to process and invest complex means for the improvement of the system of state regulation of land relations in the republic, especially rent relations, to adopt the RA laws "About market" and "About rent", to increase the role of the organs of local government in the selection of competent customers and renters of lands taking into account the demands of agricultural sector.