BIONANOTOX 2016

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7th International Conference

"Biomaterials and Nanobiomaterials: Recent Advances Safety-Toxicology and Ecology Issues"

Including Russian-Hellenic Workshop and School of Young Scientists

8-15 MAY, 2016 Heraklion, Crete, Greece

HELLENIC SOCIETY OF TOXICOLOGY

M.SHEMYAKIN AND YU.OVCHINNIKOV INSTITUTE OF BIOORGANIC CHEMISTRY

UNIVERSITY OF CRETE

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Final Program/Abstract Book

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Invitation Letter

On behalf of the Organizing Committee of 7th International Congress "Biomaterials and Nano-biomaterials: Recent Advances Safety - Toxicology and Ecology Issues" Including Russian-Hellenic Workshop and School of Young Scientists and Symposium of Nano-toxicology, we are privileged to invite you to grace with your presence and participation the works of the Congress, which is to be held in Heraklion, in the beautiful island of Crete, in May 2016.

Crete is one of Europe's most popular holiday destinations. The island's historic importance as Knossos, Phaistos and Gortys is evidenced by thousands of visitors to these sites each year. Heraklion is located almost in the centre of Crete.

The theme of the Symposium, Bio Nano-toxicology, lie at the interface of many disciplines, from biology to chemistry, toxicology, computational science chemistry, nanotechnology and biotechnology. The Symposium is a continuation of a long term co-operation between Russian and Hellenic scientists in this field that has been ongoing for the last 20 years, in the frame of the bilateral scientific state programs.

It is anticipated that scientists from the Russian Academy of Science, the most prominent Universities as well as Technological Institutes and Companies and distinguished field specialists coming form many countries will attend the symposium. Very low package fees including registration, accommodation, lunch meals and congress material have been secured for participants, in order to enable more young scientists to attend the Symposium.

At this symposium the attendee will have the chance to meet important representatives of research in the field, discuss with them and exchange ideas. This will accomplish the aim of the symposium, which is the generation of new and vigorous interactions between the different aforementioned disciplines, which will have enormous positive effects in our societies.

Co-Chairmen of the Organizing Committee

Aristidis Tsatsakis, PhD, DSc, ERT

Mikhail Shtilman, PhD, DSc

Committees

International Advisory Board

Honorary Chairman	Torchilin Vladimir	Professor, Director of Center of Pharm. Biotech & Nanomedicine, Northeastern University, Boston, USA
Honorary Chairman	Khokhlov Alexey	Academician of RAS, Vice-Rector of M. Lomonosov Moscow State University, Moscow, Russia
	Rakitskii Valerii	Academician of RAS, Head of F.Erisman Federal Center of Hygiene, Moscow, Russia
	Anastasiadis Spiros H.	Professor Director, Foundation for Research and Technology - Hellas (FO.R.T.H.), Institute of Electronic Structure and Laser (I.E.S.L.)
	Berlin Alexander	Academician of RAS, Director of N. Semenov Institute of Chemical Physics of RAS, Moscow, Russia
	Dimostenis Sarigiannis	Professor, Aristole University of Thesaloniki, Greece
	Kabanov Alexander	Professor, Director of Center for Drug Delivery and Nanomedicine, University of Nebraska, Omaha, USA
	Kolesnikov Vladimir	Professor, Rector of D.Mendeleyev University of Chemical Technology of Russia, Moscow, Russia
	Kouretas Demetrios	Professor, Vice Rector, University of Thessaly, Larissa, Greece
	Neufeld Ron	Professor, Queen's University, Kingston, Ontario, Canada
	Ozerin Alexander	Corresponding member of RAS, Director of N. Enikolopov Institute of Synthetic Polymeric Materials of RAS, Moscow, Russia
	Ostrovsky Mikhail	Academician of RAS, N. Emanuel Institute of Biochemical Physics of RAS, Moscow, Russia
	Panarin Eugenie	Corresponding member of RAS, Director of Institute of Macromolecular Compounds of RAS, St. Petersburg, Russia
	Poncelet Denis	Professor, ONIRIS, UMR CNRS GEPEA 6144, Nantes, France
	Syed F. Ali	Ph.D., Fellow ATS, National Center for Toxicological Research/USFDA, USA
	Tkachuk Vsevolod	Academician of RAS and RAMS, Dean of Faculty of Fundamental Medicine, M. Lomonosov Moscow State University, Moscow, Russia
	Ulbrich Karel	Professor, Head of Dept. of Biomedicinal Polymers, Institute of Macromolecular Chemistry, Prague, Czech Republic
	Varfolomeev Sergey	Corresponding member of RAS, Director of N. Emanuel Institute of Biochemical Physics of RAS, Moscow, Russia
	Vladimirov Yurii A	Academician RAMS, Moscow State University
	Zezin Alexander	Corresponding member of RAS, Head of Chair, M. Lomonosov Moscow State University, Moscow, Russia

Organizing Committee

Co-Presidents of the Congress	Tsatsakis Aristidis	Professor, Director of Forensic Sciences & Toxicology Dep., University of Crete, Iraklion, Greece
	Shtilman Mikhail	Professor, Head of Center "Biomaterials", D.Mendeleyev University of Chemical Technology of Russia, Moscow, Russia
	Eremin Sergey	Professor, M.Lomonosov Moscow State University, Moscow, Russia
	Klyachko Natalia	Professor, M.Lomonosov Moscow State University, Moscow, Russia
	Markvicheva Elena	Professor, M.Shemyakin-Yu.Ovchinikov Institute of Bioorganic Chemistry, Moscow, Russia
	Kirill Golokhvast	Professor, Director of SEC in Nanotechnology, Far Eastern Federal University, Vladivostok
	Rizos Apostolos	Professor, Department of Chemistry, University of Crete, Iraklion, Greece
	Shishatskaya Ekaterina	Professor, Head of Chair Medical Biology, Siberian Federal University, Krasnoyarsk, Russia
	Stivaktakis Polychronis	PhD, Research Scientist, University of Crete, Iraklion, Greece
	Tsakalof Andreas	Professor, Medical Chem. Dep., University of Thessaly, Larissa, Greece
	Tzatzarakis Manolis	PhD, Assistant Professor, University of Crete, Iraklion, Greece
	Velonia Kelly	Associate Professor, Department of Materials Science and Technology, University of Crete
	Vynias Dionysios	PhD, Research Scientist, University of Crete, Iraklion, Greece

Sunday, May 8, 2016

Arrival - Registration

20.00 Welcome Cocktail

Monday, May 9, 2016

08.00-09.30 Breakfast

10.00 OPENING CEREMONY

10.00-10.10 WELCOME ADDRESS
Aristidis M.Tsatsakis, Co-head of Organizing Committee
University of Crete, Heraklion, Crete, Greece

10.10-10.20 ABOUT SYMPOSIUM PROGRAM
Mikhail I. Shtilman, Co-head of Organizing Committee
D.Mendeleyev University of Chemical Technology of Russia, Moscow, Russia

10.20-11.00 COMBINATION CANCER THERAPY USING LIPID-BASED NANOPREPARATIONS
V.P.Torchilin, Ph.D., D.Sc.
Center for Pharmaceutical Biotechnology and Nanomedicine, Northeastern University, Boston, MA 02115, USA

11.00-11.30 Coffee Break, Poster Session

11.30-12.30 ***MORNING SESSION***

Chairs: Prof. V.P.Torchilin, Prof. K.B.Dzantiev

11.30-12.00 IN VIVO IMAGING OF NANOPARTICLE'S PASSAGE INTO THE BRAIN
P. Henrich-Noack[1], Q. You[1], N. Voigt[1], W. Hintz[2], T. Hopf[2], E. Zhang[1], B.A. Sabel[1], A. Tsatsakis[3], M. Shtilman[4], C. Götze[5], S. Gelperina[6]
[1]Institute of Medical Psychology, Otto-von-Guericke University, Magdeburg, Germany
[2]Institute of Process Engineering, Otto-von-Guericke University, Magdeburg, Germany
[3]ToxPlus SA, Heraklion, Greece
[4]Amphion Ltd, Innovation Center Skolkovo, Moscow, Russia
[5]arivis AG, Rostock, Germany
[6]Drugs Technology Ltd, Moscow Region, Russia

12.00-12.30 **MODERN ADVANCES IN MOLECULAR PHYSIOLOGY OF VISION**
M.A.Ostrovskii
N.Emanuel Institute of Biochemical Physics of the Russian Academy of Science, Moskow, Russia

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12.30-13.00 **KINETIC CHEMLUMINESCENCE AS A TOOL TO INVESTIGATE OXIDATIVE STRESS**
Yu.A. Vladimirov, D.I. Izmailov
Lomonosov Moscow State University, Moscow, Russia

13.00-14.00 Lunch

14.00-16.30 Break

16.30-18.00 ***EVENING SESSION - Young Scientists Session***

Chairs: Prof. N.L.Klyachko, Prof. S.A.Eremin

16.30-16.50 **SEMICONDUCTOR QUANTUM DOT TOXICITY IN A MOUSE IN VIVO MODEL**
S.V. Bozrova[1], M. Baryshnikova[2], T. Karmakova[3], R. Yakubovskaya[3], I.R. Nabiev[1,4], A.V. Sukhanova[1,4]
[1]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Moscow, Russia
[2]Blokhin Russian Cancer Research Center, Russian Academy of Medical Sciences, Moscow, Russia
[3]Hertcen Moscow Oncological Institute, Moscow, Russia
[4]Université de Reims Champagne-Ardenne, Reims, France

16.50-17.10 **POLYMERIC MICROPARTICLES AS A BASIS FOR REDUCING TOXICITY OF PESTICIDES**
A.M. Shershneva, N.O. Zhila, E.I. Shishatskaya, T.G. Volova
Institute of Biophysics SB RAS, Krasnoyarsk, Russia

17.10-17.30 **MAGNETITE-GOLD MAGNETIC FIELD-SENSITIVE CARRIERS FOR THE IMMOBILIZATION OF BIOMOLECULES: SYNTHESIS AND INVESTIGATION**
M.V. Efremova[1,2], Ya.O. Tsareva[2], A.D. Blokhina[1], A.S. Garanina[2], I.S. Grebennikov[2], M.A. Abakumov[2,3], Yu.I. Golovin[4], A.G. Savchenko[2], A.G. Majouga[1,2], N.L. Klyachko[1]
[1]Moscow State University, Moscow, Russian Federation
[2]National University of Science and Technology «MIS&S», Moscow, Russian Federation
[3]Russian National Research Medical University Moscow, Russian Federation
[4]Tambov State University, Tambov, Russian Federation

17.30-17.50 **THE STUDY OF THE INFLUENCE OF LOW-FREQUENCY ALTERNATIVE MAGNETIC FIELD ON THE COMPLEXES OF LIPOSOMES WITH MAGNETIC NANOPARTICLES BY FLUORESCENT METHODS**
E.O.Kutsenok[1], I.M.Deygen[1], P.G.Rudakovskaya[1,2], A.G.Majouga[1,2], Yu.I.Golovin[1,3], E.V.Kudryashova[1], A.V. Kabanov[1,4], N.L.Klyachko[1,2,4]
[1]M.V. Lomonosov Moscow State University, Faculty of Chemistry, Moscow, Russia
[2]National University of Science and Technology "MISIS" (MISIS), Moscow, Russia
[3]G.R. Derzhavin Tambov State University, Tambov, Russia
[4]University of North Carolina, Chapel Hill, NC, USA

17.50-18.50 Round table workshop: ERA.NET Project "NABUKO"

19.00-20.00 Dinner

Tuesday, May 10, 2016

08.00-09.15 Breakfast

09.30-13.00 ***MORNING SESSION***

Chairs: Prof. A.A. Berlin, Prof. M.A.Ostrovskii

09.30-10.00 COMPUTER MODELING IN MOLECULAR MEDICINE AND IN DRUG DESIGN
S.D.Varfolomeev
Institute of Biochemical Physics of the Russian Academy of Sciences and Department of Chemical Enzymology of Moscow State University

10.00-10.30 PROTEINS ON THE SURFACE OF GOLD NANOPARTICLES: PROPERTIES AND PRACTICAL APPLICATION
B.B. Dzantiev
A.N. Bach Institute of Biochemistry, Federal Research Centre «Fundamentals of Biotechnology» of the Russian Academy of Sciences, Moscow, Russia

10.30-11.00 NEW-GENERATION PESTICIDES WITH TARGETED AND CONTROLLED RELEASE OF ACTIVE INGREDIENTS
T.G. Volova
Siberian Federal University
Institute of Fundamental Biology and Biotechnology, Krasnoyarsk, Russia
Institute of Biophysics of Siberian Branch of Russian Academy of Sciences, Krasnoyarsk Russia

11.00-11.30 Coffee Break, Poster Session

Chairs: Prof. Yu.A.Vladimirov, Prof. P.D.Katsarava

11.30-12.00 «LIVING» CATIONIC POLYMERIZATION OF NITROGEN-CONTAINING CYCLES
A.A. Berlin, E.F. Razvadovskii, A.V. Nekrasov
Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow, Russia

12.00-12.30 ULTRASONIC TREATMENT AS A WAY TO INCREASE THE BIODEGRADABILITY OF FILLED POLYMER BLENDS
I.A. Kirsh[1], T.I.Chalykh[1], Chalykh A.E.[2]
[1]Plekhanov Russian University of Economics,
[2]Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences

12.30-13.00 SPHEROIDIZED GLASSY MATERIALS FOR LOCAL RADIOTHERAPY
V.N. Sigaev, G.N. Atroschenko
D. Mendeleyev University of Chemical Technology, Miusskaya sq., 9, Moscow 125047, Russia

13.00-14.00 Lunch

14.00-19.00 Break

19.00-20.00 Dinner

Wednesday, May 11, 2016

08.00-09.30 Breakfast

09.30-13.00 ***MORNING SESSION***

Chairs: Prof. A.E.Chalykh, Prof. V.N.Rakitskii

09.30-10.00 **NEW BIODEGRADABLE COMPOSITIONS ON THE BASE OF NATURE POLYMERS OF DIFFERENT CLASSES**
S.Z. Rogovina, K.V. Aleksanyan, A.A. Berlin
Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow, Russia

10.00-10.30 **ECOLOGY AND ENVIRONMENTAL ASPECTS BIO-REFINARY OF LARCH**
E.L.Akim
Higher School of Technology and Energy, Saint Petersburg State University of Industrial Technologies and Design, Saint Petersburg, Russia

10.30-11.00 **NEW ARGININE- AND SPERMINE-BASED CATIONIC POLYMERS AS ANTIMICROBIAL AND GENE TRANSFECTION AGENTS**
N.Zavradashvili[1], C.Sarisozen[2], T.Kantaria[1], M.Gurielidze[1], D.Tugushi[1], V.Torchilin[2], R.Katsarava[1]
[1]Institute of Chemistry and Molecular Engineering, Agricultural University of Georgia, Tbilisi, Georgia
[2]Center for Pharmaceutical Biotechnology and Nanomedicine, Northeastern University, Boston, MA, USA

11.00-11.30 Coffee Break, Poster Session

Chairs: Prof. A.M.Tsatsakis, Prof. Prof. E.L.Akim

11.30-12.00 **VITAL ISSUES OF MODERN TOXICOLOGY**
V.N. Rakitskii, T.A. Sinitskaya
Federal scientific center of Hygiene named after F.F. Erisman, Moscow, Russia

12.00-12.30 **RISK ASSESSMENT OF NANOPARTICLES IN THE ENVIRONMENT**
K.S.Golokhvast[1], K.Y.Kirichenko[1], V.V.Drozd[1], A.S.Kholodov[1], A.V.Gridasov[1], V.V.Chaika[1], A.M.Tsatsakis[1,2]
[1]Far Eastern Federal University, Vladivostok, Russia
[2]University of Crete, Heraklion, Greece

12.30-13.00 **HYDROPHOBIC ADHESIVES FOR TRANSDERMAL SYSTEMS**
A.A.Shcherbina, A.E.Chalyh
A.N. Frumkin Institute of Physical Chemistry and Electrochemistry of RASs, Moscow, Russia

13.00-14.00 Lunch

14.00-19.00 Break

19.00-20.00 Dinner

Thursday, May 12, 2016

08.00-09.00 Breakfast

09.30-13.00 ***MORNING SESSION***

Chairs: Prof. T.G.Volova, Prof. V.N.Sigaev

09.30-10.00 TRIPLOIDY DOES NOT DECREASE EDA AND DHA CONTENTS IN FILETS OF HUMBACK SALMON *Oncorhynchus gorbuscha*

M.I.Gladyshev[1,2], V.S.Artamonova[3], A.A.Makhrov[3], N.N.Sushchik[1,2], G.S.Kalachova[1], Y.Y. Dgebuadze[3]

[1]Institute of Biophysics of Siberian Branch of Russian Academy of Sciences, Krasnoyarsk, Russia
[2]Siberian Federal University, Krasnoyarsk, Russia
[3]A. N. Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences, Moscow, Russia

10.00-10.30 EFFECTS OF LOW FREQUENCY MAGNETIC FIELD IN THE PRESENCE OF MAGNETIC NANOPARTICLES ON BIOMOLECULES AND BIOPROCESSES: PROSPECTS AND DRAWBACKS

N.L. Klyachko[1,2,4], Yu.I. Golovin[3,1,2], A.G. Majouga[1,2], M.V. Efremova[1,2], K.Yu. Vlasova[1], M.M. Veselov[1], P.G. Rudakovskaya[1,2], A. Usvaliev[1], E.A. Zaitseva[1], M. Haney[4], I.M. Deygen[1], E.O. Kutsenok[1], A. Petrunin[1], E.A. Markvicheva[5], E.V. Batrakova[4], M. Sokolsky[4], A.V. Kabanov[1,4]

[1]M.V. Lomonosov Moscow State University, Faculty of Chemistry, Moscow, Russia
[2]National University of Science and Technology "MISIS" (MISIS), Moscow, Russia
[3]G.R. Derzhavin Tambov State University, Tambov, Russia
[4]University of North Carolina, Chapel Hill, NC, USA
[5]Shemyakin–Ovchinnikov Institute of Bioorganic Chemistry, Moscow, Russia

10.30-11.00 PREPARATION OF ION EXCHANGERS BASED ON PREPARED BACTERIAL CELLULOSE FOE REMOVAL OF HEAVY METAL CATIONS FROM WASTEWATER

F. Sohair[1], I. Hasan[1], A. Ahmed[1], M. Asker[2], A. El-Shafaee[1]

[1]Textile Research Division, National Research Center, Cairo, Egypt
[2]Microbial Research Division, National Research Center, Cairo, Egypt

11.00-11.30 Coffee break, Poster session

Chairs: Prof. M.I. Gladyshev, Prof. S.Z.Rogovina

11.30-12.00 NATURAL LIPID-TRANSPORTING NANOSTRUCTURES OF BLOOD PLASMA: PATHOGENETIC ROLE IN ATHEROSCLEROSIS AND DIABETES

V.Lankin, A.Tikhaze

Cardiology Research Complex, Moscow, Russia

12.00-12.30 EXPERIMENTAL AND MATHEMATICAL MODELLING OF COMBINED SUBCHRONIC TOXICITY OF MANGANESE (II, III) OXIDE AND NICKEL (II) OXIDE NANOPARTICLES AND ITS ALLEVIATION WITH A COMPLEX OF INNOCUOUS BIOPROTECTORS

I.A.Minigaliyeva[1], B.A.Katsnelson[1], V.G.Panov[2], L.I.Privalova[1], A.N.Varaksin[2], V.B.Gurvich[1], M.P.Sutunkova[1], V.Ya.Shur[3], E.V.Shishkina[3], I.E.Valamina[4], O.H. Makeyev[4], E.V.Grigoryeva[1]

[1]The Medical Research Center for Prophylaxis and Health Protection in Industrial Workers, Ekaterinburg, Russia
[2]Institute of Industrial Ecology, the Urals Branch of the Russian Academy of Sciences, Ekaterinburg, Russia
[3]The Institute of Natural Sciences, the Ural Federal University, Ekaterinburg, Russia
[4]The Central Research Laboratory of the Ural Medical University, Ekaterinburg, Russia

12.30-13.00 **AN OVERVIEW OF MAIN RESULTS OBTAINED IN A SERIES OF ANIMAL EXPERIMENTS ASSESSING ORGANISM'S RESPOMCES TO METALLIC NANOPARTICLES INPACT THE PULMONARY PHAGOCYTOSIS, in vivo CYTOTOXICITY, SYSTEMATIC TOXICITY AND GENOTOXICITY, BIOPROTECTION**

M.P.Sutunkova[1], B.A.Katsnelson[1], L.I.Privalova[1], V.B. Gurvich[1], I.A.Minigalieva[1], V.Y.Shur[2], E.V.Shishkina[2], O.H.Makeyev[3], I.E.Valamina[3]

[1]The Medical Research Center for Prophylaxis and Health Protection in Industrial Workers; Ekaterinburg, Russia

[2]The Institute of Natural Sciences, the Ural Federal University, Ekaterinburg, Russia

[3]The Ural State Medical University; Ekaterinburg, Russia

13.30-14.00 **Lunch**

14.00-19.00 **Break**

19.00-20.00 **Dinner**

Friday, May 13, 2016

08.00-09.00 **Breakfast**

09.30-13.00 ***MORNING SESSION***

Chairs: Prof. S.Krylov, E.A.Markvicheva

09.30-10.00 **IMMUNOASSAY TEST-METHODS FOR DETERMINATION OF FOOD CONTAMINANTS**

S.A.Eremin[1], B.Kabak[2]

[1]M.V. Lomonosov Moscow State University, Faculty of Chemistry, Moscow, Russia

[2]Hitit University, Department of Food Engineering, Faculty of Engineering, Cevre Yolu, Corum, Turkey

10.00-10.30 **KINETIC SEPARATION: A CONCEPTUAL PLATFORM FOR DEVELOPMENT OF HOMOGENEOUS KINETIC AFFINITY METHODS**

S.N. Krylova

Department of Chemistry and Centre for Research on Biomolecular Interactions, York University, Toronto, Ontario, Canada M3J 1P3

10.30-11.00 **CHITOSAN DERIVATIVES IN MODERN NANOBIOTECHNOLOGIES**

V.P. Varlamov

Federal State Institution «Federal Research Centre «Fundamentals of Biotechnology» of the Russian Academy of Sciences», Moscow, Russia

11.00-11.30 **Coffee Break**

Chairs: Prof. S.Krylov, Prof. V.P.Varlamov

Friday, May 13, 2016

11.30-12.00 **MAGNETIC LIPOSOMES LOADED WITH THYMOQUINONE: PREPARATION AND IN VITRO EVALUATION**

A.Gileva[1], A. Petrunin[2], K. Vlasova[2], R. Akasov[1], Yu. Golovin[3], N.Klyachko[2], E. Markvicheva[1]

[1]Shemyakin–Ovchinnikov Institute of Bioorganic Chemistry Rus Acad Sci, Moscow, Russia
[2]Lomonosov Moscow State University, Moscow, Russia
[3]Tambov State University named after G.R. Derzhavin, Tambov, Russia

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12.00-12.30 **CARBON NANOTUBES: CONSEQUENCES OF IMPURITIES ON METHABILIC PATHWAYS**

A.Tsatsakis[1], A.Basak[2], K.Golohvast[3], E.Shishatskaya[4], M.Shtilman[5]

[1]Center of Toxicology Science & Research, Medical School, University of Crete, Heraklion, Crete, Greece
[2]Gazi University, Faculty of Pharmacy, Department of Toxicology, 06330, Ankara, Turkey.
[3]Far Eastern Federal University, Vladivostok, Russia.
[4]Sibirian Federal University, Krasnoyarsk, Russia.
[5]D.Mendeleyev University, Moscow, Russia

12.00-12.30 **CARRIERS OF BIOACTIVE SUBSTANSES BASED ON AMPHIPHILIC POLYMERS**

M.I.Shtilman, A.N.Kuskov, A.V.Goryachaya, P.P.Kulikov

D.Mendeleyev University of Chemical Technology of Russia, Moscow, Russia

CLOSING CEREMONY
Farewell Address – Closing Remarks

13.00-14.00 **Lunch**

19.00-22.00 **Farewell Dinner**

Saturday, May 14, 2016

Saturday, May 14, 2016

08.00-09.00 **Breakfast**

10.00-13.00 **Excursion**

13.00-14.00 **Lunch**

19.00-22.00 **Dinner**

Sunday, May 15, 2016

Sunday, May 15, 2016

08.00-09.00 **Breakfast**

Departure of Participants

List of Posters

P01
APPLICATION OF METAL NANOPARTICLES AS BIOLOGICAL CONTAMINATION/HAZARD SENSOR IN FUILDS
V.V.Kurakov, D.A.Skadnev, V.V.Sorokin
"Pharm-Region" OOO,
Winogradsky Institute of Microbiology of the Russian Academy of Sciences

P02
BIODEGRADABLE ENZYME CONTAINING BIOMATERIALS FOR WOUND HEALING
N.S.Markvichev, E.E.Dosadina, M.A.Kulmetyeva, N.Y.Evdokimenko, E.E.Savelyeva, A.A.Shagaev, V.I.Panfilov, A.A.Belov
Mendeleev University of Chemical Technology of Russia, Department of Biotechnology, Moscow, Russia

P03
EVALUATION OF THE WATER FLUORIDE EXPOSURE IN URBAN AREAS IN THE PROVINCE OF BLIDA, ALGERIA
A.Zouani[1], B.Guerfi [2], F.Mezdroud[1], I.Kermout[1], A.Talailef[1]
[1]Laboratory of Toxicology, Department of Pharmacy, University Saad Dahlab, Blida,Algeria
[2]Laboratory of Therapeutic Chemistry, Department of pharmacy, University Saad Dahlab, Blida, Algeria

P04
CHARACTERIZATION AND MICROBIOLOGICAL ANALYSIS FOR QUALITY CONTROL OF AN ANTI-PSYCHOTIC DRUG SUBSTANCE, OLANZAPINE
B. Guerfi[1.2], A. Zouani[3], M.Derourche [1]; A.Hadjadj [1]; Y.Chakal [1]
[1]Laboratory of therapeutic Chemistry, Faculty of Medicine, University Saad Dahlab, Blida, Algeria
[2]Principal Pharmacy, anti-cancer center, Zabana, 09000, Blida, Algeria
[3]Laboratory of toxicology, Faculty of Medicine, University Saad Dahlab, Blida, Algeria

P05
TOXICOLOGICAL STUDY OF NANOKOMPOSITE SILVER AND HYDROGEN PEROXIDE COMBINATION
M.V. Bidevkina, A.L. Karayev, T.Z.Rysina, A.V. Limantsev
Federal budgetary institution of a science "Scientific Research Disinfectology Institute", 117246, Moscow, Russian Federation

P06
ECO-FRIEDLY GREEN SYNTHESIS OF TITANIUM DIOXIDE NANOPARTICLES USING EGIPTIAN BACTERIAL CELLULOSE/ITS APPLICATION SUCH AS ANTIMICROBIAL, SELF-CLEANING AND PHOTOCATALYTIC EFFECT COMPARED WITH SOL-GEL SYNTHESIZED
S. Farag[1], A. Amr[1,] H. M. Ibrahim[1], M. S Asker[2]
[1] Preparation and finishing of cellulosic fabrics, National Research Center, Cairo, Egypt
[2] Microbial Biotechnology Dept., National Research Center, Cairo, Egypt

P07
AG-TiO_2 NANOPARTICLES FOR LEATHER SURFACE FINISHING AND THEIR CYTOTOXICITY EFFECT ON HUMAN LUNG EPITHELIAL CELLS
C.Gaidau[1], M. Calin[2], M.Ignat[1], A. Petica[1], D. Stan[2], C. A. Constantinescu[2]
[1] R&D National Institute for Textiles and Leather (INCDTP)–Leather and Footwear Research Institute (ICPI) Division, Bucharest, Romania
[2]Institute of Cellular Biology and Pathology "Nicolae Simionescu", Bucharest, Romania

P08
POLYMER MINERAL-CONTAINING NANOCOMPOSITE FOR WOUND DRESSING
M.V. Uspenskaya[1], Ju.A. Ignatyeva[1], K.N. Kasanov[2], R.O. Olekhnovich[1], I.E. Strelnikova[1]
[1]ITMO University, St. Petersburg, Russia
[2]Military Medical Academy named SM Kirov, St. Petersburg, Russia

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Abstract Book

COMBINATION CANCER THERAPY USING LIPID-BASED NANOPREPARATIONS

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Tumor therapy, especially in the case of multidrug resistant cancers, could be significantly enhanced by using siRNA down-regulating the production of proteins, which are involved in cancer cell resistance. Even better response could be achieved is such siRNA could be delivered to tumors together with chemotherapeutic agent. This task is complicated by low stability of siRNA in biological surrounding. Thus, the delivery system should simultaneously protect siRNA from degradation. We have developed several types of lipid-based nanosystems, which can firmly bind non-modified or reversibly-modified siRNA. Additionally, these nanopreparations can be loaded with chemotherapeutic agents. It was shown that such co-loaded preparations can significantly down-regulate target proteins in cancer cells, enhance drug activity, and reverse multidrug resistance.
In order to specifically unload such nanopreparations inside tumors, we made them sensitive to local tumor-specific stimuli, such as lowered pH, hypoxia, or overexpressed certain enzymes, such as matrix metalloproteases. Using pH-, hypoxia-, or MMP2-sensitive bonds between different components of nanopreparations co-loaded with siRNA and drugs, we were able to make the systems specifically delivering biologically active agents in tumors, which resulted in significantly improved therapeutic response.
Such lipid-based nanopreparations can also be combined with other means of cancer therapy, such as radiofrequesncy ablation or plasmoinic resonance, to provide a synergistic effect in cancer therapy.

COMPUTER MODELING IN MOLECULAR MEDICINE AND IN DRUG DESIGN

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The fundamental basis of molecular medicine is the human genome transcript, the study of the molecular polymorphism of proteins (the individual structural diversity of the same protein), the advances in the study of three-dimensional molecular structure of proteins and the development of supercomputer computing systems and technologies.
The report discusses:
- The computer-aided design of drugs, the bases of the approach and the examples;
- Identification of the mechanisms of reactions and the calculation of the reactivity of enzymes on the basis of quantum-chemical approach;
- Molecular mechanical and molecular dynamic approaches with regard for dynamics of conformational changes, a new class of antimiastenic drugs;
- Molecular polymorphisms - the genetic predetermination of various diseases, the basis is the structural variants of the same protein;
- Supercomputer calculations, the basis of methodology, the predictions of the impact of polymorphic substitution for the structure and the catalytic activity of enzymes;
- The molecular basis of diseases as a result of single substitution in the structure of the key enzymes in the example of aspartoacilase – the studies of the Kanovan disease;
- The molecular nature of individual sensitivity to the drugs by the example of cholinesterase inhibitors. The role of the "remote" substitutions.

MODERN ADVANCES IN MOLECULAR PHYSIOLOGY OF VISION

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Provides an overview of the current state of a new direction in the physiology of vision and ophthalmology, based on optogenetics techniques. Optogenetics is a new interdisciplinary technique that combines genetic engineering, optics and physiology. Optogenetics allows using light-activating protein, a gene which is delivered and is expressed in a particular cell of the retina, to regulate by light (activate or inhibit) the physiological activity of the cell. This new approach extremely promising both for fundamental researches of the retina, as is currently the case with regard to the brain, and for degenerative retinal prosthetics.
Ontogenetics prosthetics is based on the fact that the loss of photoreceptors are usually not accompanied by loss of the nerve cells of the retina and visual pathways in the brain. Therefore giving by optogenetics methods to the preserved cells of the retina, namely bipolar or ganglion cells, light sensitivity, may allow to restore the visual functions of degenerative retina [1]

Recently we were able to converse the cationic channelrhodopsin to anion (chlorine)-conducting one, express it in the cultured nerve cells and, for the first time, in vivo in whole mouse brain, and demonstrate its ability to supress cells firing under illumination with visible light [2]. Having cation and anion-conducting channelrhodopsin one can try to reconstruct on-off receptive fields of the ganglion cells what is important for the prosthetic of degenerative retina.
Thus, having cation and anion-conducting channelrhodopsins, one can try to recreate on-off receptive fields of the ganglion cells what brings us to possibility of prosthetics of degenerative retina.
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Key words: optogenetics, retina, retinal prosthesis, channelrhodopsin, degenerative diseases of the retina.

KINETIC CHEMLUMINESCENCE AS A TOOL TO INVESTIGATE OXIDATIVE STRESS

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Oxidative stress (OS) is a disbalance between free radical level and antioxidant defense in living bodies. A large body of evidence has been accumulated about the role of OS in development of a variety of human diseases. Although the free radical damage of cells and tissues occurs in different regions of our body and is directed to specific cells in each particular case of pathology, the level of free radicals and antioxidants in the blood follows or precede free radical formation in specific locations, due to the fact that the blood circulates anywhere and its components are in equilibrium with all cells in the organism, not only in respect to oxygen or nutrients, but also in respect to antioxidants, reactive species and mediators that determine OS level. Free radicals are extremely reactive and have very short lifetime. They cannot be determined by routine chemical methods like chromatography, mass spectrometry, NMR etc. Chemiluminescence is a unique method to determine the rate of free radical reactions in chemical and biochemical systems. The essence of the kinetic chemiluminescence approach is the comparison of the chemiluminescence kinetic curves with those calculated on the basis of proposed reaction scheme, with reaction rate constants adjusted manually or automatically. A data obtained in our laboratory in studies of the reactions of free radicals' formation and their scavenging by antioxidants are considered, along with the instruments and computer programs developed for this purpose.

«LIVING» CATIONIC POLYMERIZATION OF NITROGEN-CONTAINING CYCLES

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The kinetics and mechanism of the cationic polymerization of six-, four-, and three-membered nitrogen-containing bicycles (triethylenediamine, quinuclidine, conidine, and 1-azobiocyclo-(3,1,0)-heptane) under action of Bronsted acids (HCl, HBr, HI, $HClO_4$, etc.), haloalkyls (RCl, RBr, RI), quarternary ammonium salts, Lewis acids (BF_3, etc.) in alcohols, water and other organic media are studied. It is shown that the polymerization proceeds in most of cases as "living" continuous process with fast or slow initiation depending on the initial initiator (catalyst). The structure of the polymerization active centers is studied and it is shown that they represent ions or ion pairs. The kinetic parameters of the initiation and chain growth reactions on ions and ion pairs are determined. It is illustrated that depending on the monomer structure both the ion pairs and free ions can be more active. The found independence of the chain growth activation entropy on the cycle size and established kinetic regularities of the growth reaction correspond to the nucleophilic substitution N2 mechanism. The polymerization of triethylenediamine is governed by the regularities of the reversible heterogeneous reaction (similar to the cationic polymerization of trioxane). In this case the supramolecular structure of the forming polymer depends on the monomer concentration: at low (lower than the equilibrium one for the dissolved polymers) concentration well faceted crystals are formed, at high – poorly structured globules. The thermodynamic and kinetic analyses are performed, the reasons of impossibility of the five-membered cycle polymerization under similar conditions are explained. Nowadays polytriethylenediamine is the foundation for production of some synthetic vaccines.

NEW BIODEGRADABLE COMPOSITIONS ON THE BASE OF NATURE POLYMERS OF DIFFERENT CLASSES

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Biodegradable polymers based on renewable raw material resources are very attractive for researchers, that is connected with existing ecological problems. Among the polymers of nature origin is of special interest a polylactide – a linear aliphatic polyester forming by the polymerization of the lactic acid resulting from the fermentation of renewable natural products.
Polylactide has mechanical properties such as synthetic polymers (polyethylene, polypropelene, etc.) and in the same time capable to biodegradation, but the velocity of polylactide biodegradation is low. The addition of natural polymers accelerates the biodegradation of polylactide as they undergo the destruction firstly, thus, initiating following degradation of polymer matrix. Of the special interest are the blends of polylactide with polysaccharides which are more widespread nature polymers, however they have such disadvantages as low mechanical characteristics and poor water resistance. The creation of composites based on polylactide and polysaccharides promotes removal of these disadvantages and allows one to obtain the materials with improved properties and increased biodegradability.
Under conditions of shear deformation in solid phase by ecologically pure method the blends of polylactide with cellulose, ethylcellulose, chitosan and starch were obtained. In order to improve plasticity and biodegradability of the obtained compositions, low-molecular polyethylene glycol (PEG) of various molecular mass is added. The mechanical and thermophysical properties of composites as well as their capacity to water and moisture absorption are studied. Using different physiochemical and biological methods the morphology and biodegradability of the composites is investigated and the influence of PEG on their structure and capacity to biodegradation is showed.
This work was supported by the Russian Science Foundation, project no. 14-13-00803.

ECOLOGY AND ENVIRONMENTAL ASPECTS BIO-REFINARY OF LARCH

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The Siberian larch (*Larix sibirica*) and Dahurica larch (Larix dahurica Turcz) are widely spread in western, central and trans-Ural Russia and may have practical applications not only as renewable cellulose-containing raw material, but also as a source of other biologically active polysaccharides. The presence of large amounts of arabinogalactan (AG) in larch wood (up to 30 wt%) necessitates developing complex waste-free technology of larch wood processing. This technology should allow obtaining purified wood cellulose along with AG and other water-soluble hemicelluloses on an industrial scale.
Currently, AG used in medicine (as biologically active additive etc.) is obtained from vegetable raw materials by water extraction of wood chip followed by precipitation. During the production of wood market pulp from larch the obtained water extracts containing water-soluble polysaccharides (including AG) are recyclable materials. The isolation of AG from solution by means of precipitation by large amount of ethanol is unpractical since the cost price of the main product (market wood chemical pulp) increases considerably in the process. Therefore, the search of possible areas of application of AG water solutions of various purity and concentration is of scientific and practical interest.
The "Larch" project. It is a first real example of public-private partnership in the Russian pulp and paper industry - a joint project of JSC "Ilim Group" and the Saint Petersburg State Technological University of Plant Polymers (TUPP): "Development of innovative technologies for complex processing of larch wood with conclusion a new kind of pulp on the world market". The project is designed for 2010-2014, with total project cost over U.S. $ 10 million (300 million rubles). Larch Project can be considered as innovative component of the priority investment projects currently implemented by OJSC Ilim Group, Big Bratsk Project in particular. **Innovative aspect** of this Project lies in creation of a conceptually new innovative technology for biorefining and integrated processing of larch wood, and launching new types of products in the global markets. The technology is developed based on the principles of information technology, nanotechnology, and biotechnology.
Scientific results. It was found that arabinogalactan located in the wood has liquid state - as aqua-complex «arabinogalactan-water». This state gives opportunity to extract this complex from wood easy.
Practical results. In 2014 new innovative technologies for complex processing of larch wood was realized on the Bratsk Pulp & Paper mill; on this technologies was produces more 600. 000 ton of Market Pulp. This innovative technologies based on 19 patents RF (**www.freepatent.ru)**.
Innovative R&D organization methods involve utilization of the public-private partnership mechanism, simultaneous implementation of fundamental, engineering, and R&D efforts, special-purpose development of laboratory

facilities, transition from laboratory research to trial runs at manufacturing facilities, system analysis of the current state of and trends in global markets both in pulp and paper and related industries. These methods also imply integration of the research potential of Russian universities (2) and research institutes (11) with the potential of foreign researchers and engineers, including Russian researches working abroad; utilization of latest technology laboratory equipment at the domestic and international research centers; broad utilization of the potential of university students (90), post-graduates (9), and young scientists.

Information technology. Information technology is used for development of geo-information systems which receive and process data from satellites on actual larch resources, and for development of the most effective harvesting logistics based on the principles of sustainable forest management. Modern development of satellite sounding of the Earth helps to do continuous monitoring of conditions and dynamics of large territories of forests. Web-service VEGA based on automated technologies of satellite data processing opens up fundamentally new possibilities for remote monitoring of forest resources in Russia, including larch. This possibility is due to specific seasonal color changes of larch forests, and its individual trees (specific orange needles before to its fall). The data obtained can be used in carrying out the project "Larch".

It is shown that to obtain relevant information about the state of forests the most effective way is to use remote sensing data. Method of decoding data from the satellite SPOT (France) was developed to determine the species composition of forest stands. Introduction of new information technologies, combined with modern features remote sensing space systems of the Earth will be a significant step in providing reliable information on forest areas, to assess the growing stock and species composition and obtain the necessary data to determine the stock of larch. The data obtained can be used in carrying out the project "Larch".

Nanotechnology. Nanotechnology is used to develop a scientifically proven technology to extract from larch wood its key component – arabinogalactan – which is localized in the nanostructure of larch wood. Biotechnology is used to create a commercial biorefining technology.

Biotechnology. Biotechnology involves application of targeted control of processes such as biodestruction, chemical reactions, and mechano-chemical reactions in combination with membrane methods for concentration and separation of non-fiber polysaccharide larch components, and combination of these methods with separation of multi-component systems by flotation. Methods for extracting arabinogalactan from chips: Water extraction of arabinogalactan; Water extraction with high pH; Steam extraction; Black liquor extraction of arabinogalactan.

IMMUNOASSAY TEST-METHODS FOR DETERMINATION OF FOOD CONTAMINANTS

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Several toxins, which could be in different contents and concentrations, must be detected for quality food control. The analysis of food contaminants like mycotoxins, pesticides, antibiotics must be in global scale with high-throughput screening (HTS). The methods of assays at this time are gas and liquid-chromatography mass spectrometry and immunoassays, mainly enzyme-linked immunosorbent assays (ELISA), Lateral Flow Immunochromatographic Assay (strip-test) and Fluorescence Polarization Immunoassay (FPIA). The advantages and limitations for applications of these methods for simultaneous detection of several toxins in food will be presented and discussed.

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IN VIVO IMAGING OF NANOPARTICLE'S PASSAGE INTO THE BRAIN

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Objectives:
Nanoparticles (NP) are used for very different functions, ranging from plastic manufacturing to drug transport. Regarding all these various applications, the blood-brain barrier (BBB) is of importance: environmental exposure to NP from manufacturing should definitely not lead to unintended passage of such nanomaterials across the BBB, whereas for drug delivery the opposite may be true: to treat diseases of the central nervous system we specifically want nano-carriers to cross the BBB in order to release their active compound. From this rational 3 main tasks are deduced: (i) define parameters which prevent BBB passage of NP, (ii) define parameters which allow BBB passage of NP (iii) test toxicity of NP on neural tissue
Methods:
As a model for BBB passage of NP we use in vivo confocal imaging of the retina (ICON). With this technique we can visualise online in alive rats the distribution of fluorescent NP in the retina, which is a structure of the brain. Briefly, anaesthetised rats are placed on a confocal laser scanning microscope with a large probe space and a long working distance objective lens with an additional plan concave lens on the rat's eye. The NP are injected i.v. into the tail vein while the rat is on the microscope table. In our experiments we used polybutylcyanoacrylate NP which are synthesized by a mini-emulsion polymerisation process using different surfactants and Rhodamine123 as a marker.
Results:
In our hands, the surfactant rather than the size or zeta-potential decided about the BBB passage. Whereas NP produced either with non-ionic tensides (Tween80) or with anionic tensides (SDS) could cross the BBB, the combination (Tween80 + SDS) resulted in NP which were seen only within the retinal vessels. However, different production protocols (adsorption vs inclusion) may lead to different results.
After weekly injection of NP with Tween80 we did not see any loss of neurons in the retina after 1 month, indicating that these NP are well tolerated.
Conclusions:
With appropriate protocols, it seems to be possible to produce NP especially designed for being excluded from the brain and other NP with substantial BBB passage ability. However, further investigations are needed to better understand the connection behind NP surface and BBB passage, to investigate cellular damage/stress with more sensitive methods and to better quantify NP's BBB passage. The current ERA.NET funded network NABUCO will envisage these tasks by improving techniques, use of synergistic competences and new developments.

VITAL ISSUES OF MODERN TOXICOLOGY

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The important tasks of protecting human health and optimizing the environment have been put to toxicology, both fundamental and applied, in "The strategies of national security of the Russian Federation up to 2020".
In Russia a separate branch of hygienic science - pesticides hygiene and toxicology had been created and it has been intensively developing for recent decades on the basis of the Institute for hygiene, pesticides toxicology and chemical safety as a part of FSCH named after F.F. Erisman.
Introduction of innovative technologies in Russia stimulated development of more than 50 methodical documents on prevention of nanoparticles and nanomaterials adverse effect on human body.
Intensive production and wide use of new in their properties and biological effect nanomaterials are connected with solving a number of medical-biological and ecological problems. The most urgent issues are development, standardization and application of methods for nanoparticles monitoring in environmental and safety assessment for

nanotechnologies and nanomaterials. In this connection a new branch of toxicology has appeared – nanotoxicology. The most important issues of the new discipline are investigation of regularities in biological and toxic effects of nanoparticles depending on their chemical nature, form, size, surface area, charge and other physical-chemical features of their structure and besides the doses, ways of administration, concentrations in target organs and duration of the effect.

The important stage in this country toxicology is the realization of national and departmental programs on introduction of GLP OECD principles etc.

Currently the main directions in safe circulation of chemicals in Russia are the following:

– improvement of legislative and standard-methodical basis in prophylactic toxicology including the requirements harmonization with the international approaches;
– study of regularities and mechanisms of formation of responses of human body and warm-blooded animals to adverse effects, their combinations and conjunctions at bodily, systemic, organ, tissue, cellular, subcellular and molecular (geneous) levels using specific, biomarker and integral values including universal mechanisms of developing adaptation responses, evaluation of immune, neurohormonal, antioxidant and other protective systems;
– exploration of toxicokinetics and metabolism of chemicals;
– further development of toxicogenomics;
– etiopathogenetic grounds for prophylactic and medical-prophylactic measures;
– toxicological ensuring of innovation techniques (nano GMO etc) inculcations;
– further improvement of toxicological basis of methodology of hygienic standardization and risk assessment;
– improvement of analytical control methods and the state of the appropriate material and technical basis;
– establishment of toxicologists training and further training system;
– consecutive introduction of good laboratory practice principles.

NEW ARGININE- AND SPERMINE-BASED CATIONIC POLYMERS AS ANTIMICROBIAL AND GENE TRANSFECTION AGENTS

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Prevention and treatment of antibiotic-resistant infectious diseases is an important problem. Among various synthetic antibacterials, cationic polymers are considered as one of the most powerful weapon against pathogens. Cationic polymers (**CPs**) are also of interest as gene transfection agents to be used both, in gene therapy and biotechnology. The main limitations for therapeutic applications of the commercially available cationic polymers [polyethylenimine (**PEI**), poly-L-lysine(**PLL**), poly-L-arginine (**Poly-Arg**), and others] as either antibacterials or gene transfection agents are their high cytotoxicity, relatively low or nonselective transfection activity and non-biodegradability. The present study deals with the design of new biodegradable **CPs** - polyamides and polyureas, which can be cleared from the body.

New **CPs** were synthesized on the basis of naturally occurring building blocks, such as aminoacid arginine and endogeneous multi-amine spermine. To render cationic polymers biodegradable, we synthesized various polysuccinamides, which are able to hydrolyze (biodegrade) in physiological environment with releasing free spermine utilizable by the organism.

The cytotoxicity of the new **CPs** was evaluated *in vitro* using mammalian cell-lines such as **4T1** (murine mammary carcinoma), **HeLa** (human cervical adenocarcinoma), **NIH3T3** cells (mouse broblasts) and **CCD-27SK** (human fibroplasts). The polymers revealed a high cell compatibility within the concentration range 0.04-10.00 mg/mL, compared to **PEI**. The **CPs** were highly water soluble (≤ 200 mg/mL), that is important for subsequent practical applications, formed nanocomplexes with **pDNA** (38.0 – 312.0 nm) at rather low **CP/pDNA** weight ratios (WR = 5/1-25/1). The complexes were positively charged (zeta potentials up to +57.4 mV) confirming their stability. The ability of the new **CPs** to deliver **pDNA** was investigated by flow cytometry (FACS) analysis (Becton Dickinson, San Jose, CA, USA) using GFP-modified **pDNA**, as well as by confocal microscopy (Zeiss Confocal LSM 700). Some of the tested **CPs** revealed significantly higher transfection efficiency than the commercially available transfection agents, such as Dharmafect and Lipofectamine. The new **CPs** showed also selective transfection activity towards certain cell lines, which is important for their potential applications in gene therapy. The polymers revealed also rather high antimicrobial activity (tested against *Bacillus cereus, Staphylococcus aureus*, *E.coli, Salmonella enterica*).

Hence, the new **CPs** we have synthesized, have a potential for the applications in gene therapy and biotechnology as nontoxic and effective agents for intracellular delivery of nucleic acids (gene carriers), as well as nontoxic antimicrobial agents for numerous applications.

NEW-GENERATION PESTICIDES WITH TARGETED AND CONTROLLED RELEASE OF ACTIVE INGREDIENTS

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The newest trend in research is development and agricultural use of environmentally safe new-generation pesticides with targeted and controlled release of active ingredients embedded in biodegradable matrices or covered with biodegradable coatings, which are degraded in soil and other biological media by soil microflora to form products that are harmless to living and nonliving nature and which are gradually released into the environment. The use of such formulations can reduce the amounts of the chemicals added to the soil and enable their sustained and controlled delivery over a growing season, preventing sharp releases into the environment that occur in the case of using free chemicals. The crucial part of constructing such preparations is the availability of appropriate materials with the following properties: degradability, ecological compatibility with the environment and global biospheric cycles; safety for living and nonliving nature; long-term (weeks and months) presence in the natural environment and controlled degradation followed by formation of non-toxic products; chemical compatibility with pesticides and fertilizers; processability by available methods, compatible with pesticide and fertilizer production technologies. The objective of the работы было is to work out scientific foundation for construction of environmentally safe and targeted formulations of fertilizers and preparations for protection of cultivated plants against pests and disease agents with a targeted and controlled release of the active ingredient. As a polymer matrix investigated polyhydroxyalkanoates (PHAs) - the type of thermoplastic linear polyesters synthesized by microorganisms under specialized synthesis conditions.

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EFFECT OF LOW FREQUENCY MAGNETIC FIELD IN THE PRESENCE OF MAGNETIC NANOPARTICLES ON BIOMOLECULES AND BIOPROCESSES: PROSPECTS AND DWOWBACKS

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Electromagnetic field was always interesting for scientists studying external physical factors influencing biological objects. In the last decades, effects of magnetic field on magnetic particles containing cells or different cell's components attracted close attention in respect to the benefits giving both for different applications (drug delivery, diagnostics, for example) and fundamental studies (structure - mechanisms of biological processes). In the work presented, effects of magneto-mechanical actuation of magnetic nanoparticles containing proteins (enzymes), biological membranes (liposomes, exosomes) or whole cells in low frequency magnetic fields will be discussed with their major challenges and offering opportunities.

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TRIPLOIDY DOES NOT DECREASE EDA AND DHA CONTENTS IN FILETS OF HUMBACK SALMON *Oncorhynchus gorbuscha*

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Triploid fish become an important constituent of commercial aquaculture, but data on their fatty acid (FA) composition are still controversial, especially regarding essential polyunsaturated fatty acids, eicosapentaenoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA). We studied FA composition and content of diploid and triploid pink (humpback) salmon *Oncorhynchus gorbuscha*, reared in aquaculture in a bay of the White Sea (Russia). Diploid

and triploid fish had significant differences in FA composition, measured as percentages of total FA. Specifically, diploids had higher percentage of EPA and DHA in their muscle tissue (filets) compared to that of triploids. Nevertheless, contents of EPA and DHA per mass of the filets (i.e., in edible product) in diploid and triploid specimens were similar. The reciprocal ratio of percentages and contents of EPA and DHA in biomass of fish is discussed. In conclusion, triploid pink salmon had nutritive value regarding EPA and DHA contents similar to that of the diploid form. No special efforts to improve EPA and DHA content in filets of triploids is necessary.

PROTEINS ON THE SURFACE OF GOLD NANOPARTICLES: PROPERTIES AND PRACTICAL APPLICATION

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Conjugates between gold nanoparticles (GNPs) and different protein molecules are widely used to locate various compounds and structures, to mark reactants in analytical systems, to affect in vivo processes. However, the questions about structural state of immobilized molecules, changes of their functional properties (such as efficiency of specific ligands binding and transformation) remain open. Although recent nanotechnological progress provides a variety of methods to study individual molecules on the surface of GNPs, results of their application often do not match each other.

The report provides a comparative assessment of existing approaches for characterization of proteins on the surface of GNPs, capabilities and shortcomings of these approaches. The factors that cause changes in the binding capacity of immobilized antibodies and other bioreceptors are considered; the contribution of steric hindrance and conformational rearrangements to the observed changes is discussed. Physical fundamentals of the surface density influence on the immobilization processes are discussed, as well as opportunities and necessary conditions for multilayer immobilization. The experimental data for adsorptive immobilization of various proteins on the surface of GNPs are presented in coupling with the developed protocols for spectrophotometric characteristics of these processes. Common artifacts in similar optical studies and ways to overcome them are discussed. The measured maximal values of loading for different proteins are compared with geometric estimations of their distribution on the GNP surface. Approaches for oriented immobilization of adsorbed protein molecules are described and compared, Benefits of indirect (bioaffine) oriented immobilization are considered, properties of various proteins used for this purpose are compared.

On the example of antibodies as bioreceptor molecules, their binding properties in different modes of immobilization are characterized. Applicability of the "functional equivalent" of antibodies to estimate changes in their antigen-binding properties after binding with the GNPs is considered. The concentration dependences of the antigen-binding properties for the GNP-antibody conjugates of different composition are presented and compared for macromolecular (proteins) and low molecular weight (antibiotics, mycotoxins) antigens. Taking into consideration these data, the choice of the most effective conjugates for their use in various types of bioanalytical systems is discussed. Possibilities to improve analytical performance of such systems by varying the composition of the conjugates and modes of antibodies immobilization on the surface of the nanoparticles are demonstrated.

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SPHEROIDIZED GLASSY MATERIALS FOR LOCAL RADIOTHERAPY

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Glassy microspheres and seeds are widely and successfully used in local radiotherapy for the treatment of liver tumors, prostate cancer and synovectomy. In the present work, well-known Y_2O_3-Al_2O_3-SiO_2 (YAS) system is discussed and microspheres of YAS glass with a high content of Y_2O_3 (more than 20 mol.%) and a small amount of γ-emitting isotope ^{177}Lu and ^{166}Ho as a source of diagnostic γ-rays are reported. Developed industrial line of glass melting, working, grinding, optimization of powder size distribution and spheroidizing for nuclear medicine is described. The technology allows to produce a wide variety of bulk, hollow and porous microspheres with a core–shell structure for nuclear medicine.

ULTRASONIC TREATMENT AS A WAY TO INCREASE THE BIODEGRADABILITY OF FILLED POLYMER BLENDS

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It is known that the introduction of polysaccharides into the nonpolar synthetic polymers increases their biodegradation degree.
In the paper recyclable polyethylene film with agribusiness waste, in particular cocoa vella, sunflower and rice husks, sugar beet pulp, which contains cellulose, hemicellulose, protein and nitrogenous substances, lignin, pectin, and others.
Based on the rheological, and morphological structural, physical and mechanical studies have found that ultrasonic treatment of melts of compositions results in a more uniform distribution of the filler in the polyethylene of natural origin, a significant increase of strength properties of the compositions. Ultrasonic processing of melts of polymeric compositions filled agribusiness waste, contributes to the creation of biodegradable polymeric materials with rapid period of expansion. It was found that the term of the decomposition test compositions is 1 year.
Biodegradable polymeric compositions based on polyolefin waste and waste agricultural sector have complex physical and mechanical properties of fully satisfying the conditions of the creation of high-quality recycled plastics, which can serve as an independent raw material for manufacturing.
Recommendations on technological modes of producing biodegradable polymeric compositions. Created draft of technological requirements for the production of raw materials and products made of biodegradable polymer materials. Expert methods established in application as a packaging material for non-food products.
The technique of rapid biodegradation of the polymer compositions: a feature of the method is to evaluate the biological degradability of polymeric compositions under the simultaneous action of the microflora and mechanical load.

HYDROPHOBIC ADHESIVES FOR TRANSDERMAL SYSTEMS

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The results of the sorption studies, rheological properties, adhesion performance, deformation and strength properties of hydrophilic polymers and their solutions with oligomeric glycols and water were summarized.
Nomograms of changing the adhesive, rheological and relaxation properties are constructed for poly-N-vinylpyrrolidone, polyvinylcaprolactam, polyvinyl alcohol and their copolymers with vinyl acetate, acrylic acid, butyl acrylate as a function of the degree of plasticization. It is shown that for all chosen hydrophilic adhesive the strength of adhesive joints, including the transdermal therapeutic systems, varies with the degree of plasticization (system compositions) along a curve with a pronounced maximum. The extreme character of the changes in the adhesive properties is concerned with both the extreme nature of changes of the deformation work of adhesive within the area of joint fracture, as well as with the decrease in cohesive strength, and viscosity of the plasticized polymers.
The algorithm of formulations search of hydrophilic adhesives with the improved strength properties in terms of migration of human waste products in adhesives was suggested. These properties distinguish hydrophilic adhesives from hydrophobic systems, in which waste products are accumulated at the interface "skin - adhesive" that leads to a dramatic loss of adhesive strength of transdermal systems.
The mechanisms of formation and debonding of the transdermal adhesive systems were suggested.

CHITOSAN DERIVATIVES IN MODERN NANOBIOTECHNOLOGIES

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An important properties of chitosan derivatives is practically unlimited potential for targeted chemical and enzymatic modification, which allows to obtain substances of a variety molecular weight from 1 000 000 Da up to D-Glucosamine (by chemical or enzymatic hydrolysis), and with a variety of groups and substituents. Finally, through certain physical and chemical impacts it is possible to obtain stable nanoparticles (10-200 nm) with a zeta potential between +30 and -30 mV. It should be emphasized an ability of chitosan derivatives to form complexes and composites with other polysaccharides, proteins, nucleic acids, melanins, metal ions etc. These allows to obtain different polyelectrolyte complexes and composites for targeting drug delivery, for transfer of genetic information, for removing of allergens from milk whey, for receiving dietary supplements with medicinal plants extracts, biopesti-

cides with elicitor activity etc. Of particular note is the opportunity of creation of effective biologic wound coverings and medical implants.
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CARRIERS OF BIOACTIVE SUBSTANSES BASED ON AMPHIPHILIC POLYMERS

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Methods for the synthesis of water-soluble amphiphilic polymers of N-vinylpyrrolidone, acrylamide, acrylic acid, vinyl alcohol containing one alkyl terminal group were worked out. It was shown that these polymers can modify the liposomal membrane, increasing the stability of the liposomes to various destructive factors. Obtained amphiphilic polymers are capable to form in aqueous media a stable nanoscale aggregates suitable for use as carriers of substances poorly soluble in water. Methods are described for introducing different functional groups in amphiphilic polymers that allows them to bind various ligands. Amphiphilic N-vinylpyrrolidone polymers possess of high biocompatibility. They do not affect the rheological properties of the blood; do not cause lysis of erythrocytes.

CARBON NANOTUBES: CONSEQUENCES OF IMPURITIES ON METHABILIC PATHWAYS

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Carbon nanotubes (CNT) are unique nanomaterials regarding their strength and stiffest, and widely used in industry and medicine. However, due to their high specific surface area and penetration ability, potential harmful impacts of these nanoparticles on humans and wildlife become contentious. Under various conditions, these heterogenous nanomaterials may easily enter into the cells, accumulate within cytoplasm, mechanically damage the cellular structures, stimulate inflammatory processes, oxidative stress, resulting in cell death. It is believed that metallic impurities may play a role in the toxicity profile of multi walled CNT (MWCNT). On the other hand, it has been shown that functionalization of CNT with groups such as carboxy- or hydroxyl-, may lead to diverse effects in both humans and environment. In our studies, we have observed that unpurified, Fe, Co, Mg containing MWCNT produced twice as high levels of oxidative stress than the purified CNT and induced more intense mitochondrial dysfunction in human peripheral blood mononuclear cells. Also, unpurified MWCNT induced the inflammation via the activation of NFkB pathway in lung epithelium and keratinoma cells. Therefore, their affect intensity on altering the metabolic pathways is directly related to the amount of impurities, as well as functional groups in the CNTs. These results suggested that for the safe use of these nanomaterials, appropriate information including the preparation, characterization protocols of CNTs, exposure routes, and toxicokinetics data should be provided.

RISK ASSESSMENT OF NANOPARTICLES IN THE ENVIRONMENT

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The work presents the results of the study of the size of particles appearing in the different technological processes. For example, it is shown that welding aerosol is the source of nano-and micro-sized particles extremely dangerous for human and animal health. Particle size distribution in the microrange was from 1 to 10 μm and up to 100%. It is shown that in 9 cases out of 28 with the use of various welding modes, welding rods and components the emission of aerosol with nano-sized particles (from 45.5% to 99.4%) is observed. It is shown that in terms of morphology the particles are hollow and solid balls, sometimes covered with easily chipped off shell. There are also objects of other forms – ovals, polygons and needles. Fragments of the shell of hollow spheres have the size of up to 10 μm (PM_{10}) and jagged edges, making them and nano-sized particles the most potentially dangerous to human health components of welding aerosol. It is found that the aerosol particles are mainly composed of Fe> Mn> Zn> Ti, but there are minor components of Si, Cl, Zr, Co, Cr, Br, Al, Ca, Mg, K, C, S.
It was found that vehicle mileage, age and the respective emissions class have almost no effect on the size distri-

bution of the exhaust gas particulate released into the environment; about half of the examined vehicles with low mileage were found to release particles of aerodynamic diameter above 10 μm. The exhaust gas particulate detected in the Exhaust Gas Suspension of all cars can be classified into three major size classes: (1) 0.1–5 mm – soot and ash particles, metals (Au, Pt, Pd, Ir); (2) 10–30 mm – metal (Cr, Fe, Cu, Zr, Ni) and ash particles; (3) 400–1,000 mm – metal (Fe, Cr, Pb) and ash particles.

SEMICONDUCTOR QUANTUM DOT TOXICITY IN A MOUSE *IN VIVO* MODEL

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Quantum dots (QDs) are increasingly more used in clinical medicine. Their most promising potential applications are cancer diagnosis, including *in vivo* tumour imaging and targeted drug delivery. In this connection, the behaviour of QDs in living organisms is of special interest. Certainly, the main questions are whether or not QDs are toxic for humans and, if yes, what concentration is relatively harmless.
Here, we carried out *in vivo* experiments with the fluorescent semiconductor CdSe/ZnS core/shell QDs, which are currently the most widely used in research. QDs were coated with polyethylene glycol (PEG) to make them soluble in water and aqueous buffer solutions and protect them from clustering. Several stages of purification were performed so as QDs not to bear any toxic admixtures. The stability of QDs in different solutions was accurately measured before the experiments.
About 70 DMA/B6 hybrid mice were used to estimate the QD toxicity *in vivo.* A QD solution was injected intravenously. Pure solvent and PEG solution were used as negative controls. The mice were observed for about one month after QD injection. The survival rate was estimated throughout the study.
During the experiment, we visually accessed the state of health of every animal and measured its weight. It was found that mice tolerated QDs well even at a concentration as high as 10 mg/kg. The mouse hair, teeth, and eyes looked like those of healthy animals. One month after the injection, internal organs were investigated. Their morphology was the same as in healthy control mice. These results allow us to conclude that CdSe/ZnS QDs have no considerable toxic effect in the mouse *in vivo* model used at the concentrations up to 10 mg/kg.
Otherwise, the QDs were found to be toxic at the highest concentration studied, 20 mg/(kg body weight) when two-thirds of the animals in this group died shortly after the experiment was started. Further investigations will be performed to determine the correspondence between the single doses used in these experiments and the minimal therapeutic dose for these mice, so that we be able to use this mouse model for testing clinical applications of QDs.

MAGNETIC LIPOSOMES LOADED WITH THYMOQUINONE: PREPARATION AND *IN VITRO* EVALUATION

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Liposomes are widely used as delivery systems of antitumor drugs. The aim of the study was to develop magnetic liposomes (MLs) for remote drug release and to study their cytotoxicity and accumulation in tumor cells using different in vitro models. We have synthesized a series of MLs based on the egg lecithin and loaded with anticancer drug thymoquinone (TQ) and/or NileRed dye (NR). Magnetite (Fe_3O_4) nanoparticles (MNPs) were entrapped in the liposomes, in order to provide the remote drug release under low frequency alternating magnetic field (10 kHz). To prepare MLs, MNPs, phosphatidylcholine and cholesterol were dispersed in chloroform. The mixture was lyophilized to get a film which was re-dispersed in PBS (pH 7.4), sonicated, and the obtained free MNPs were separated by passing the emulsion through an extruder with pore size filter of 400 nm. Several MLs samples with addition of the cholesterol and/or DSPE-PEG were also prepared. An excess of the drug was removed by centrifugation through NAP-25 desalting column. The MN content was determined by Ferrosine assay after previous liposome destruction, while TQ quantity was measured by spectrophotometry and HPLC. The mean liposome diameter was 160±14 nm. The ζ-potential values of all obtained samples were also measured. Accumulation and localization of the MLs loaded with NR in human breast adenocarcinoma cells (MCF-7) were studied in 2D (monolayer culture) and 3D (multicellular tumor spheroids) by confocal microscopy. Cytotoxicity effect of MLs loaded with TQ will be evaluated by MTT-test.

EXPERIMENTAL AND MATHEMATICAL MODELLING OF COMBINED SUBCHRONIC TOXICITY OF MANGANESE (II, III) OXIDE AND NICKEL (II) OXIDE NANOPARTICLES AND ITS ALLEVIATION WITH A COMPLEX OF INNOCUOUS BIOPROTECTORS

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Nanoparticles (NPs) of metal oxides constitute a substantial proportion within the particle size distribution of the aerosols generated by arc-welding and various metallurgical technologies. In these cases they act mostly in different combinations, that of manganese and nickel containing NPs being one of the most typical.
Suspensions of NiO-NPs and/or of Mn_3O_4-NPs with a mean diameter of 16.7 ± 8.2 nm and 18.4 ± 5.4 nm, respectively, were prepared by laser ablation of 99.99% pure metals in de-ionized water. They were repeatedly injected IP to rats at a dose of 0.50 mg or 0.25 mg 3 times a week up to 18 injections, either separately or in different combinations. A group of rats was so injected with this combination at the highest dosage against the background oral administration of a "bio-protective complex" (BPC) comprising pectin, vitamins A, C, E, glutamate, glycine, N-acetylcysteine, selenium, iodide and omega-3 PUFA, this composition having been chosen based on mechanistic considerations and previous experience.
After the termination of injections, many functional indices and histological features of the liver, spleen, kidneys and brain (with morpometric assessment) were evaluated for signs of toxicity, and the RAPD test on nucleated blood cells served for evaluating NPs' genotoxicity. The accumulation of Ni and Mn in organs was measured with AES and EPR methods. Both nano-oxides proved adversely bio-active, but NPs of Mn_3O_4 were more noxious in most of the toxicity manifestations. Moreover, they induced a marked damaging effect in the neurons of the caudate nucleus and hippocampus which may be considered an experimental correlate of manganese-induced Parkinsonism. The comparative solubility of the Mn_3O_4-NPs and NiO-NPs in a biological medium measured *in vitro* is discussed as one of the factors underlying the distinctions between both their toxicokinetics and their toxicities.
Mathematical analysis based on the Response Surface Methodology (RSM) revealed a diversity of combined toxicity types depending on particular effects these types are assessed for and on the effect's level as well. The subadditivity of unidirectional action proved to be the most frequently, while the synergism - the least frequently occurring type. In this respect, there is no essential distinction between the combined toxicity of these NPs and that of Mn and Ni soluble salts studied by us earlier. The prognostic power of the RSM model proved satisfactory.
The BPC tested by us significantly attenuated both the organ-systemic toxicity and the *in vivo* genotoxicity of Mn_3O_4-NPs in combination with NiO-NPs.

PREPARATION OF ION EXCHANGERS BASED ON PREPARED BACTERIAL CELLULOSE FOE REMOVAL OF HEAVY METAL CATIONS FROM WASTEWATER

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Herin we prepared BC as ion exchanger to be used in pollution prevention via Preparation of bacterial cellulose using Egyptian bacteria isolated in our laboratory from rotten apple, Preparation of ion exchanger based on prepared BC and functionalized by succinic anhydride and then measure Adsorption of heavy metal cation from waste water and Desorption cycles for reusability

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NATURAL LIPID-TRANSPORTING NANOSTRUCTURES OF BLOOD PLASMA: PATHOGENETIC ROLE IN ATHEROSCLEROSIS AND DIABETES

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Low density lipoproteins (LDL) are a natural lipid-transporting nanostructures of blood plasma. The development of atherosclerosis accompanied by the the appearance of oxidative stress, resulting in the accumulation of oxidized LDL, which rapidly accumulate in the blood vessel cells, causing their injury. The secondary oxidation products of polyene lipids and glucose - low molecular weight dicarbonyls like malondialdehyde, glyoxal and methylglyoxal play the important role in oxidative modification of LDL particles. It is found that the cooxidation of LDL lipids and glucose followed by the intensification of free radical peroxidation processes and methylglyoxal produces superoxide anion-radical in the process of interaction with amino compounds. Studies carried out on patients with vary-

ing severity of atherosclerosis showed that the atherogenic cholesterol-rich LDL are more oxidized. Oxidation of LDL in patients with type 2 diabetes is significantly higher than in patients with atherosclerosis. It has been found that the normalization of the blood glucose level in patients with type 2 diabetes during the sugar-lowering therapy accompanied by simultaneous significant reduction of LDL oxidation. Natural dicarbonyls inhibit the activity of antioxidant enzymes - Cu,Zn-SOD and Se-containing GSH-peroxidase of red blood cells. The activity of erythrocyte Cu,Zn-SOD reduced in diabetic patients, but the sugar-lowering treatment is accompanied by increasing in the activity of this enzyme.

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EXPERIMENTAL AND MATHEMATICAL MODELLING OF COMBINED SUBCHRONIC TOXICITY OF MANGANESE (II, III) OXIDE AND NICKEL (II) OXIDE NANOPARTICLES AND ITS ALLEVIATION WITH A COMPLEX OF INNOCUOUS BIOPROTECTORS

I.A.Minigaliyeva[1], B.A.Katsnelson[1], V.G.Panov[2], L.I.Privalova[1], A.N.Varaksin[2], V.B.Gurvich[1], M.P.Sutunkova[1], V.Ya.Shur[3], E.V.Shishkina[3], I.E.Valamina[4], O.H. Makeyev[4], E.V.Grigoryeva[1]

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Nanoparticles (NPs) of metal oxides constitute a substantial proportion within the particle size distribution of the aerosols generated by arc-welding and various metallurgical technologies. In these cases they act mostly in different combinations, that of manganese and nickel containing NPs being one of the most typical.

Suspensions of NiO-NPs and/or of Mn_3O_4-NPs with a mean diameter of 16.7 ± 8.2 nm and 18.4 ± 5.4 nm, respectively, were prepared by laser ablation of 99.99% pure metals in de-ionized water. They were repeatedly injected IP to rats at a dose of 0.50 mg or 0.25 mg 3 times a week up to 18 injections, either separately or in different combinations. A group of rats was so injected with this combination at the highest dosage against the background oral administration of a "bio-protective complex" (BPC) comprising pectin, vitamins A, C, E, glutamate, glycine, N-acetylcysteine, selenium, iodide and omega-3 PUFA, this composition having been chosen based on mechanistic considerations and previous experience.

After the termination of injections, many functional indices and histological features of the liver, spleen, kidneys and brain (with morpometric assessment) were evaluated for signs of toxicity, and the RAPD test on nucleated blood cells served for evaluating NPs' genotoxicity. The accumulation of Ni and Mn in organs was measured with AES and EPR methods. Both nano-oxides proved adversely bio-active, but NPs of Mn_3O_4 were more noxious in most of the toxicity manifestations. Moreover, they induced a marked damaging effect in the neurons of the caudate nucleus and hippocampus which may be considered an experimental correlate of manganese-induced Parkinsonism. The comparative solubility of the Mn_3O_4-NPs and NiO-NPs in a biological medium measured *in vitro* is discussed as one of the factors underlying the distinctions between both their toxicokinetics and their toxicities.

Mathematical analysis based on the Response Surface Methodology (RSM) revealed a diversity of combined toxicity types depending on particular effects these types are assessed for and on the effect's level as well. The subadditivity of unidirectional action proved to be the most frequently, while the synergism - the least frequently occurring type. In this respect, there is no essential distinction between the combined toxicity of these NPs and that of Mn and Ni soluble salts studied by us earlier. The prognostic power of the RSM model proved satisfactory.

The BPC tested by us significantly attenuated both the organ-systemic toxicity and the *in vivo* genotoxicity of Mn_3O_4-NPs in combination with NiO-NPs.

AN OVERVIEW OF MAIN RESULTS OBTAINED IN A SERIES OF ANIMAL EXPERIMENTS ASSESSING ORGANISM'S RESPOMCES TO METALLIC NANOPARTICLES INPACT THE PULMONARY PHAGOCYTOSIS, *in vivo* CYTOTOXICITY, SYSTEMATIC TOXICITY AND GENOTOXICITY, BIOPROTECTION

M.P.Sutunkova[1], B.A.Katsnelson[1], L.I.Privalova[1], V.B. Gurvich[1], I.A.Minigalieva[1], V.Y.Shur[2], E.V.Shishkina[2], O.H.Makeyev[3], I.E.Valamina[3]
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Nanoparticles (NPs) of metals and of their oxides are of special interest in the light of health risks assessment because, along with engineered NPs, there exists a substantial fraction of nanoscale metallic particles as fraction of condensation aerosols generated by arc-welding and metallurgical technologies. During 2009-2015 we carried out many experiments on white rats exposed to either a single intratracheal instillation or repeated intraperitoneal injections of silver, gold, iron oxide (Fe_3O_4), copper oxide (CuO), nickel oxide and manganese oxide (Mn_3O_4) NPs and respective microparticles (MPs) in stable water suspensions as well as a long-term inhalation experiments with Fe_2O_3 NPs.
Based on results obtained in these experiments and some corroborating data of other researchers we maintain that metallic NPs (Me-NPs) are much more noxious on both cellular and systemic levels as compared with their one micrometer or even submicron counterparts. However, within the nanometer range the dependence of systemic toxicity on particle size is intricate and non-unique due to complex and often contra-directional relationships between the intrinsic biological aggressiveness of the specific Me-NPs, on the one hand, and complex mechanisms that control their toxicokinetics, on the other. Among these mechanisms, those associated with the more or less significant solubilization of Me-NPs in biological milieus proved very important, which fact is taken into consideration by a multicompartmental toxicokinertics model proposed and identified by us.
Given a certain size of the Me-NPs, both integral and specific adverse effects caused by them depend on the particular metal's properties, but toxic impact on liver, spleen and kidneys as well as polyorgan genotoxicity proved virtually obligatory. Of a special interest is a marked neuronal damage to the striatum and the hippocampus of rats subchronicall exposed to NPs of CuO or Mn_3O_4.
Our data testify to the high activity of the pulmonary phagocytosis of Me-NPs deposited in low airways. This fact suggests that safe levels of exposure to airborne nanoparticles are possible in principle. For workroom air, such permissible levels of metallic NP can be proposed at this stage, even if tentatively, based on a sufficiently conservative approach of decreasing approximately tenfold the exposure limits officially established for respective MPs.
It was shown that against the background of adequately composed combinations of some bioactive agents the systemic toxicity and even genotoxicity of Me-NPs could be markedly attenuated.

INVESTIGATION ON BIOSAFETY OF MEDICAL DEVICES

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Medical devices are classified according to the potential risk they might have, such as indwelling time in the body, properties of the material (its nature, localization in the organism, functional conditions, manufacturing technology) being implanted, type of the contact and its character and etc.
Approaches for testing of medical devices should be standardized, from one hand, and, from another hand, it's really impossible to forecast all risks that may arise at this formalized approaches. Until recently each country has its own rules and demands to medical tests. But development and adoption of international standard ISO 10993 have become the starting point in harmonization of standards that is being used in biosafety confirmation of medical devices. And this work has been being conducted since 1998. In Russia international standards have recommendatory character but they help us to choose methods of risk estimation.
We, being an accredited laboratory, are obliged to prove biosafety of medical devices with regard of their use (place, localization, time, durability, bioresorption), having the right to use any method, including international ones. But we realize that each position of potential risk that polymer implant might have, should be explored and proved by qualified specialists in the field of chemistry, biotechnology, physics and mathematics.

POLYMERIC MICROPARTICLES AS A BASIS FOR REDUCING TOXICITY OF PESTICIDES

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The rapid development of chemistry and intensive farming has facilitated the production and use of a vast variety of chemicals intended for protecting crops from pests, weeds, and pathogens. For instance, only small percentages of pesticides applied to crops reach their targets, while the major part of these substances kills useful organisms, accumulates in biological objects, unbalances natural ecosystems, and pollutes soil, water, and air. Therefore, alternative means and methods of crop protection, which would be more effective and harmless to humans and the whole environment, need to be developed. The purpose of the study was to investigate activity of pesticides (metribuzin, tebuconazol) embedded in the polymer matrix of degradable poly-3-hydroxybutyrate (P(3HB)) incubated in different laboratory systems.

Formulations of metribuzin (MET) or tebuconazol (TEB) embedded in the P(3HB) microparticles, with different pesticide loadings (10, 25 and 50%), were prepared by emulsion method. The size of microparticles was influenced by pesticide loading. However, no relationship was found between the value of the zeta-potential and pesticide loading. The yield of particles from emulsions with different pesticide loadings was rather high, more than 60%. The encapsulation efficiency of TEB in microparticles was 86%, but MET encapsulation efficiency was low, no more than 33%. In a laboratory model system (sterile water), we showed stability of P(3HB)/MET, P(3HB)/TEB formulations and studied pesticides release kinetics from the polymer matrix.

The herbicidal activities of P(3HB)/MET microparticles and commercial formulation Sencor Ultra were tested on the *Agrostis stolonifera* and *Setaria pumila* plants. In the early phases of the experiment, the herbicidal effect of P(3HB)/MET formulations with the lowest MET loading (10%) was comparable with that of the commercial formulation Sencor Ultra. The herbicidal effect of P(3HB)/MET formulations with higher MET loadings (25 and 50%) at later stages of the experiment was stronger than the effect of Sencor Ultra.

The fungicidal activities of P(3HB)/TEB microparticles and commercial formulation Raxil Ultra were tested on the *Fusarium moniliforme* and *Fusarium solani* fungi. It was shown that TEB efficiently diffused from the polymer microparticles into a culture medium with a significant reduction in fungal colony area compared to the commercial formulation Raxil Ultra.

ACKNOWLEDGEMENT
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MAGNETITE-GOLD MAGNETI FIELD-SENSITIVE CARRIERS FOR THE IMMOBILIZATION OF BIOMOLECULES: SYNTHESIS AND INVESTIGATION

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During last decades magnetite nanoparticles attract deep interest of scientists due to their potential application in therapy and diagnostics. However, magnetite nanoparticles are toxic and non-stable in physiological conditions. To solve these problems, we decided to create two types of hybrid systems based on magnetite and gold which is inert and biocompatible.

For the 1st type hybrid nanoparticles synthesis, magnetite nanoparticles with an average diameter of 9±2 nm were obtained, and then they were covered with gold shell. According to the TEM, ICP MS and EDX data, final nanoparticles had an average diameter of 31±4 nm and they contained iron. However, iron signals were not localized so we can't speak about one single magnetic core. Also it was discovered by HRTEM that all nanoparticles had small (3-4 nm in diameter) incorporations that are likely magnetite clusters. Thereby, this type of structure should be called «cluster-shell». Described nanoparticles covered with mercapto-PEG acid were non-toxic for human prostate cancer cells and had high R2-relaxivity rates (>190 $mM^{-1}s^{-1}$). They were also used for chymotrypsin immobilization and its activity regulation by means of external magnetic field.

For the 2nd type hybrid nanoparticles synthesis, spherical gold nanoparticles with an average diameter of 9±2 nm were synthesized; then they were used as seeds during magnetite synthesis. As a result, so called dumbbell-like structures were obtained where magnetite (cubes with 25±6 nm diagonal) and gold nanoparticles were connected together pairwise. By HRTEM method an epitaxial growth of magnetite nanoparticles on gold surface was discovered. These nanoparticles were covered with Pluronic F127 and also loaded with doxorubicin and PSMA - vector. Obtained nanoparticles were found to have moderate toxicity for human prostate cancer cells and got into the intracellular space (according to fluorescence microscopy data).

Thereby, in this work hybrid nanoparticles based on magnetite and gold which have a strong potential for biomedical application, particularly in targeted drug delivery and magnetic resonance imaging, were synthesized and characterized

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THE STUDY OF THE INFLUENCE OF LOW-FREQUENCY ALTERNATIVE MAGNETIC FIELD ON THE COMPLEXES OF LIPOSOMES WITH MAGNETIC NANOPARTICLES BY FLUORESCENT METHODS

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Nowadays, liposomes are known to be an effective drug delivery system. They are biocompatible and non-immunogenic. Due to their structure, liposomes can transfer both hydrophobic and hydrophilic drugs. The current studies are concentrated on studying the trigger drug releasing possibility by using recently suggested low frequency alternative magnetic field. In this work, complexes of liposomes with magnetic nanoparticles (nanorods) were used. These particles can oscillate in magnetic field on the surface of liposomal lipid bilayer membrane changing its permeability; thus, the drug incorporated in can easily be released.

One of the classical approaches to the study of changes in liposomal structure is using fluorescent labels. In this work, we utilized pyrene, 1,8-ANS and BODIPY-containing lipid (B9PPC). The aim of the present research was to study the influence of low-frequency alternative magnetic field on the complexes of liposomes with magnetic nanorods non-covalently attached to the liposome surface by measuring fluorescence or fluorescence polarization. According to the literature, pyrene exists in two forms: monomer and excimer. If the liposomal membrane fluidity increases leading to the disturbance of the bilayer membrane integrity, the probability of forming excimer will increase as well as the ratio of signals excimer/monomer. We observed this effect for the complexes exposed to the LF MF. In case of 1,8-ANS and B9PPC, analytical signal is fluorescence polarization. We found out that when the liposomal membrane integrity is lost under LF MF action, the decrease in fluorescence polarization for both labels was observed, but more pronounced in the case of B9PPC. Thus, B9PPC was chosen as the most informative and perspective label.

This work was supported by **RSF 14-13-00731** and K1- 2014-022 grants (nanorods magnetic properties).

NEW NONIONIC SURFACTANTS BASED ON POLY(ETHYLENETEREPHTHALATE) WASTE

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In this paper recycling of techogenic waste of poly (ethyleneterphthalate) (PET) was implemented and established on their basis new biodegradable polyfunctional reagents with a complex action. PET waste was depolymerized by ethylene glycol into bis(2- hydroxyethyl)terephthalate. New reagents were synthesized by reaction of catalytic esterification between glycolysed product and ethoxylated alcohols in presence of aprotic organic solvent.

Using physicochemical methods (FTIR, UV, NMR, DSC) structure was proven and physicochemical characteristics was investigated.

It was established that this reagents nonionic surfactants of oligomeric type can be applied as demulsifier for breaking oil emulsion and also as a corrosion inhibitor for protection carbon steel surface and prevention deposition of salt sulphates of calcium and carbonate of calcium, magnesium on oil field equipment. New demulsifier and based on them compositions showed high efficiencies in high viscous oil emulsion, which consist asphaltens, resin and paraphins.

New reagents was tested as inhibitor in mineralized water in different temperature conditions and different inhibitor dosages, the degree of corrosion protection corresponding to the requirements imposed on reagents in various technological processes of extraction and refining crude oil.

NEW USES OF ACRYLIC COPOLYMERS EUDRAGIT®

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Copolymers of the Eudragit family are widely used as components of dosage forms and delivery systems of biologically active compounds. Amine-containing copolymers Eudragit able to dissolve in many organic solvents such as methylene chloride, chloroform, acetone, ethanol, or have pH-dependent solubility in water, which opens up the possibility of their recycling from mixed solutions of other biocompatible polymers and fibrous materials by the method of electrospinning.

The influence on the structure and physico-chemical properties of polymer films compatibility and phase equilibria in the system poly-ε-caprolactone (PCL) – Eudragit RS (a copolymer of ethyl acrylate, methyl methacrylate and and a low content of a methacrylic acid ester with quaternary ammonium groups (trimethylammonioethyl methacrylate chloride) in methylene chloride. Marked the formation of a "sandwich" structure film contains 75% Eudragit. It is shown that the specific orientation of crystallites of polycaprolactone in the process of evaporation of the solvent for forming films from a mixture of PCL and Eudragit RS determines its morphology and pharmacodynamic properties of the medicinal forms.

The regularities of the processing in fiber aminoalkylmethacrylate copolymer and ammonio methacrylate copolymer udragit E and Eudragit RS, which is allowed to create on their basis new materials for medicine (wound dressings, systems with controlled selection of medicinal compounds) and the environment (sorbents and biosorbents). Method of electrospinning from solutions obtained drug-filled fibrous material with programmable allocation of anaesthetic substance. The efficiency of using the ultra-thin fibers udragit E and udragit RS for removal of metal ions and the decontamination of solutions with low levels of radioactivity.

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Posters

P01

APPLICATION OF METAL NANOPARTICLES AS BIOLOGICAL CONTAMINATION/HAZARD SENSOR IN FUILDS

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Biological hazard tests and sterility assessment for the presence of microorganisms, viruses, cell debris and large molecules are important procedures in pharmacy, medicine and ecology. Rapid contamination tests of biological liquids can be vital in making the correct diagnosis and providing the right treatment. Commonly used methods for the sterility assessment involve incubation of liquid samples on solidified indicator media that allows to distinguish one microorganism type from another. However, this method can take up to 14-18 days and can require another repetition.
In order to determine the contamination source polymerase chain reaction (PCR) method is used predominantly. This method requires relatively expensive equipment, reagents and qualified personnel. Being very sensitive, however, it allows to identify specific contaminations within a short period of time (1.5-3.0 hours).
Because of the time-consuming nature of the incubation on solid media method and the limitations to specificity of the highly sensitive and rapid PCR method, both methods are unable to reliably determine the presence of biological objects in the liquid sample.
We developed a novel universal method to identify the presence of biological objects – cells microorganisms or their debris, viruses and large molecules – using metal nanoparticles *in situ*. It was shown that the formation of nanoparticles is catalysed in the presence biological objects that accumulate a reductive potential on their surface. Upon the contact with such surface metal cations are reduced to their neutral atomic state and coalesce into nanosized clusters within 30-40 minutes. Depending on the nature of the biological object – a microorganism, a virus or a large molecule – nanoparticles of a specific size will be formed. In case of the presence of large molecules, nanoparticles of 1.5-2.0 nm in diameters are observed. Viruses and microorganisms catalyse the formation of nanoparticles of 5-6 nm and 15-30 nm, respectively. The size of the resulting nanoparticles can be rapidly determined by using various spectroscopy methods, such as Raman or fluorescent spectroscopy.
Our method can be applied *in situ* universally to various biological objects and allows a rapid contamination assessment of a given sample.

P02

BIODEGRADABLE ENZYME CONTAINING BIOMATERIALS FOR WOUND HEALING

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Nowadays the ideal wound dressing material should have different properties such as cleansing property (thanks to proteinases activity), antibacterial, antioxidants properties etc. This ideal wound dressing still does not exist. In our laboratory we design new wound healing materials with all those properties and apply them to medical practice in Russia.
Our materials are based on periodate oxidized cellulose with immobilized chitosan-containing compositions with therapeutic agents. As therapeutic agents we use natural proteinases complexes (collitin, proteolytic complex for hapetopancreas of crab, bromelain etc.), different antibacterial compounds (chitosan, Miramistin etc.) and antioxidants (Taxifolin, mexidol etc.).
In our research we studied the effect of immobilization process, drying and storing on the biological activity of our systems; as a result we determined optimum conditions for these stages. Also we studied the effect of gamma irradiation (Co^{60}) on our materials and stated that doze of 25 kGr is sufficient for the sterilization of our compositions keeping biological activity unchangeable.
Thermal inactivation of obtained materials in model conditions (37C, 1/15M phosphate buffer, pH 6.2 – the conditions of wound care products exploitation is lower than that of the non-modified proteinases (solutions of enzymes).
We studied antioxidant properties of our systems (antioxidant activity was determined with the 2, 2-Diphenyl-1-picrylhydrazyl (DPPH)). We stated that cellulose carriers (oxidized cellulose especially) and chitosan as well as products of hydrolytic destruction of oxidized cellulose and immobilized materials possess prolonged antioxidant activity. Product of hydrolytic destruction of dialdehyde cellulose (oxidized cellulose) matrix appear to not contain

reducing compounds but possess antioxidant activity.
The release of therapeutic agent in the process of hydrolytic destruction starts immediately after bringing our materials in the fluid. This statement allowed us to suggest the following structural scheme of immobilized materials: there are 3 types of bonds between carrier and therapeutic agent:
1 – mechanically inserted enzyme (or any biologically active compound) stays after evaporation of the moist in carrier, it forms so-called knock-out doze and is the first to be released from the immobilized composition.
2 – sorbed enzyme that is bonded with carrier due to ionic, hydrogen, Van der Waals forces and non-specified sorption. This fraction is the largest in our systems, it provides prolonged action of immobilized materials.
3 – covalently bonded enzyme forms azomethine bond with aldehyde groups of modified carrier. This type of enzyme can releases in the fluid due to hydrolytic destruction of carrier as dissoluble or indissoluble high-molecular conglomerates.

P03

EVALUATION OF THE WATER FLUORIDE EXPOSURE IN URBAN AREAS IN THE PROVINCE OF BLIDA, ALGERIA

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Objective: Fluorine (F-) is a carioprotecteur element, but it is toxic in high doses. In Algeria, tooth decay is the most common pathology in schools, on the other hand, the fluorosis problem, affecting many areas of southern and even northern Algeria. Our study focuses on evaluating the water exposure F- in the population of Blida, based on the determination of F- in network of communal water distribution, in order to predict a possible risk of fluorosis, or orient public health programs related to the fluoride supplementation.
Methods: 30 water samples were collected during the period from 31/03 to 02/04/2014 in three regions of Blida. We performed the assay F- by a colorimetric method (Belcher West) that we validated by SFSTP'92.
Résultats : The contents of F- recovered through Blida (in 2014)are below the standard of Algeria (<2 mg / L), the lowest values were observed in the East (L' Arbaa) with 60% of the values <0.05 mg /Ll, followed by the central region (Blida) with 70% of the values <0.17 mg / L and finally the Western Region (Elafroune) with 60% of the values <0.17 mg / L.
Conclusion: Based on these results we can conclude that there is s no risk of fluorosis, on the contrary the values found are very low hence the need for the establishment of a fluorine supplémentaion program.

P04

CHARACTERIZATION AND MICROBIOLOGICAL ANALYSIS FOR QUALITY CONTROL OF AN ANTI-PSYCHOTIC DRUG SUBSTANCE, OLANZAPINE

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OBJECTIVES:
Olanzapine, an atypical anti-psychotic drug with a thienobenzodiazepinyl structure is indicated for the treatment of schizophrenia. Our present work deals with the identification and characterization of the active pharmaceutical ingredient Olanzapine and its related substances by HPLC and the evaluation of its microbiological quality.
METHODS:
Olanzapine was identified through its organoleptic characteristics, its melting point and by an infrared absorption using Spectrum One **FTIR** spectrometer. The determination of its purity, identification and the dosage of related substances of olanzapine were carried out using a SHIMADZU® LC-2010 C_{HT} HPLC, equipped with a UV detector at 260 nm and Phenomenex C8 column (150 mm X 4.6 mm X 5 µm) which is maintained at room temperature. The flow rate was about 1.5 ml per min for Assay and about 1 ml per minute for related substances. A mixture of acetonitrile and 6.9 g/l sodium monohydrate phosphate, pH= 2.5 (1: 1) was used as mobile phase for the assay and a gradient mobile phase elution consisting of (**A**): acetonitrile: purified water (20:80, V/V) and (**B**): acetonitrile: purified water (60:40, V/V) for related substances. Microbiological control was based on enumeration of total viable bacteria and on the search of specified germs « Escherichia Coli ».

RESULTS:
The identification of olanzapine active substance and the evaluation of its chemical quality showed conformity with Eur. Ph. 8.0 norms. (Results of the stydy carried out on june 2015). The percentage content of Olanzapine calculated was about 99.93%. The analysis of this substance by HPLC showed one non specified impurity, its relative retention time was 0.81 and its percentage content was 0.03%.
Microbiological analysis showed that it is free of total viable aerobic bacteria, yeasts, molds and Escherichia coli.
CONCLUSION:
Our drug substance is therefore consistent with the standards required by the pharmacopoeia, reflecting its good chemical and microbiological quality.

P05

TOXICOLOGICAL STUDY OF NANOKOMPOSITE SILVER AND HYDROGEN PEROXIDE COMBINATION

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To improve the efficiency of silver as a means for disinfection of water is usually used together with other well-proven disinfectant. Investigated the aqueous colloidal solution (pH 7.5±1.5) of composite silver nanoparticles chloride (0.25±0.01%), in a solid matrix comprising metallic silver clusters subnanometer size of 60-100 nm and hydrogen peroxide with a mass fraction of 2.8±0.2% with a view to its application for water disinfection of swimming pools. Studies of toxicity and danger of funds carried out on white rats and rabbits, in accordance with Directive 2010/63/EU.
It is found that in rats when administered in DL_{50} per os exceeds 5000 mg/kg, when applied to the skin – 2500 mg/kg, the agent does not penetrate into the body through intact skin in amounts that cause symptoms of poisoning, does not irritate the skin and mucous membranes of the eyes rabbits.
We studied the combined effect of the body on the disinfected water white rats for 28 days: 5 times a week was administered to animals treated water into the stomach at a dose of 3 g/kg, then placed for 15 minutes in a pool of water at a temperature of 25-27°C. During this period the concentrations tested the consumption standard and increases in 10 and 100 times (0.05, 0.5 and 5 mg/l for residual silver) not detected influence the function of the nervous and respiratory systems, liver, peripheral blood in rats. Catalase activity is involved in the metabolism of hydrogen peroxide, was not changed.
However, the registered changes in kidney function in rats under the influence of the treated water in concentrations means 0.5 and 5 mg/l (residual silver). In these groups noted increasing urea in urine (714±63.9, 597±45.3 mM/l, $p<0.05$) compared with control (420±60.8 mM/l). Nevertheless, its concentration in the serum did not change. Water treatment agent in elevated concentrations increased the standard clearance of urea, while the highest concentration increased and maximum ground clearance of endogenous urea almost in 2 times (0.204±0.21 ml/min, in control 0.144±0.12 ml/min, $p<0.05$). The content of protein in the urine is left at the source level.
Based on these data it can be concluded that the concentration of funds in 10 standards of consumption (0.5 mg/l for residual silver) is the threshold for effects on kidney function. Therefore, the tool safely for water disinfection of swimming pools when the concentration of residual quantity of silver ions at the level 0.05-0.04 mg/l.

P06

ECO-FRIEDLY GREEN SYNTHESIS OF TITANIUM DIOXIDE NANOPARTICLES USING EGIPTIAN BACTERIAL CELLULOSE/ITS APPLICATION SUCH AS ANTIMICROBIAL, SELF-CLEANING AND PHOTOCATALYTIC EFFECT COMPARED WITH SOL-GEL SYNTHESIZED

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The green synthesis process an economically cost and eco-friendly to environmental, so, Egyptian bacterial cellulose has been developed for the synthesis of titanium dioxide nanoparticles and characterized by transition electron microscopy (TEM) with an average particles size x nm, where, Egyptian bacterial cellulose as reducing and capping agent without using any chemical reducing agent. The synthesis occurred into Autoclave combustion of ethanolic solution of titanium tetraisopropoxide at 120 °c /30 min. the resultant TiO_2 NPs applied such as antimicrobial action on both Escherichia colei (E-coli) and staphococus. Aureus (S. aureus), self-cleaning and photocatalytic effect. This application can be evolution after treated the different types of fabrics linen, viscose, 100% cotton and blend 50/50% cotton /PET.

P07

AG-TiO_2 NANOPARTICLES FOR LEATHER SURFACE FINISHING AND THEIR CYTOTOXICITY EFFECT ON HUMAN LUNG EPITHELIAL CELLS

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Ecologic and health effects of applying materials with advanced functions for leather surface finishing are priorities for the European leather industry and contribute to the increase of added value and durability of leather and fur articles. The innovative properties of Ag-TiO_2 nanomaterials on leather surface are due to their antimicrobial, self-cleaning and flame retardant characteristics. Furthermore, it leads to a reduction of chemicals with high pollutant potential such as volatile organic compounds, biocidal chemicals and halogenated solvents. The cytotoxicity study of the Ag-TiO_2 nanomaterial's efficiency for leather functionalization related to the dose response on human health is very important for their large scale application in footwear industry.
In our research work we have prepared the Ag-TiO_2 nanoparticles using an electrochemical method for deposition of 0.53-1.62% Ag on nano TiO_2. The main characteristics of Ag-TiO_2 nanoparticles such as: particle size and Zeta potential (DLS) in water dispersion, powder morphology and elements identification on surface (SEM, EDX), absorption properties due to the doping concentration (DRS), photocatalytic degradation of Orange II dye under UV/Vis light, as well as the antibacterial resistance were evaluated. The potential risk of inhaling the Ag-TiO_2 nanoparticles in the leather manufacturing process was evaluated by performing cytotoxicity studies using human pulmonary epithelial cells (A549 cells). The cells were exposed to various concentrations of Ag-TiO_2 nanoparticles (between 0.01-1 mg/ml) for 48 hours and the cellular viability was determined by MTT assay.
The results showed that all Ag-TiO_2 nanoparticles formulations investigated at concentration up to 0.2 mg/ml were well tolerated by the cells (viability above 80%) but starting with 0.3 mg/ml the viability decreased below 60% attaining viabilities below 10-20% at concentrations higher than 0.5 mg/ml. The Ag-TiO_2 nanoparticles were embedded in film polymeric composites and were used for leather surface finishing. The main properties of leather surface treated with Ag-TiO_2 nanoparticles showed multifunctional characteristics suitable for use in footwear lining, upholstery leather or other applications.

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P08

POLYMER MINERAL-CONTAINING NANOCOMPOSITE FOR WOUND DRESSING

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Wound dressing are a separate class of means for local treatment of wounds. The atraumatic products, capable to take the necessary form, possessing sorption and medical ability, allow to accelerate process of recovery of the infected and purulent wounds. Today improvement of receiving techniques polymeric matrixes for wound dressing, including the use of nanostructural materials and fillers, allows to expand a range of their opportunities considerably.
In the conditions of local inflammatory process (purulent wounds, decubituses, trophic ulcers) there is a congestion and reproduction of different bacteria therefore one of necessary characteristics of created dressings is their antiseptic activity. Particles of silver possess antiseptic properties therefore can be used at creation of polymeric composition of medical appointment. As a filler of a polymeric matrix and as the carrier of ions of silver the modified particles of montmorillonite were used.
We used the acrylic hydrogel synthesized by radical polymerization in the water at temperature 40 - 45 °C as a polymeric matrix. The polymeric matrix was received on the base of sodium salt of acrylic acid and the acrylamide taken in various ratios. Degree of neutralization of acrylic acid made α = 0,8. Ammonium persulphate – tetramethylethylenediamine was used as initiator oxidation-reduction system, and N,N '- methylene-bis-acrylamide as the crosslinked agent. Reaction time is varied from 1 till 3,5 h.
Addition of a bioactive filler – the montmorillonite modified by silver particles was at a stage of synthesis of hydrogel polymer. For achieving uniform disclosure of layered structures and montmorillonite distribution in polymer was used ultrasonic dispergator. Thus, received the bioactive wound dressing representing nanocomposite with intercala-

tion structure, owing to introduction of chains of acrylic polymer in interpackage space of particles of montmorillonite.
At a concentration choice of preparations considered various sorption ability of matrixes on the base of a hydrogel nanocomposite, and also results of research of extraction of silver ions in solution. An immobilization of bioactive components made on the basis of 100 ml of exudate on 1 g of a matrix of the dressing for ensuring the dosed and prolonged medical action.
It was shown that polymer materials modified by silver ions possess biocidal activity concerning reference and hospital strains of microorganisms, in particular golden staphylococcus, already at the contents a mineral - a containing filler – 2 mass. %. Application of new polymer composition at creation of wound dressing allows to support level of a bacterial insemination of a wound lower than 10^3, (colony-forming unit) for 5-7 days of in vivo.

P09

MODELLING OF SOLID-PHASE SYNTHESIS ON THE PHASE BOUNDARY

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The model of solid-phase synthesis on the example of divalent carboxylats of the metals received in the device of extrusion type is offered.
All chemical interactions in solid-phase synthesis happen on the phase boundary i.e. reactions are heterophase. For the quantitative assessment of speed of solid-phase reactions use extent of transformation. Feature of the offered model consists that the extruder allows to reach high extent of mixture of reagents that leads to updating of a layer of a product therefore the phase of a product does not form the continuous layer. Then the speed of interaction is defined by the size of the available boundary surface of reagents and process is topochemical. Communication of extent of transformation with process duration:
1. Reaction rate does not depend on concentration of reagents, and depends on a contacting area of phases.
2. Reaction rate is controlled on the phase boundary.
3. Reaction rate is proportional to a surface of the reagent which did not react.
4. The nucleation occurs almost instantly.

P10

MODIFYING OF PROPERTIES OF SUSPENSION POLYVINYLCHLORIDE IN THE COURSE OF POLYMERIZATION OF VC

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The continuous increase in production of PVC extremely sharply puts a problem of stabilization of this polymer in the course of processing and operation as distinctiveness of polymers of vinyl chloride is low stability. Padding chemicals - additives without which neither processing of PVC in products, nor operation of these products is impossible are surely entered into composition of PVC of compositions. Treat such aids first of all thermo - sacred, mechanoinhibitors. An effective way of improvement of processing behavior of PVC is increase of its characteristic heat stability introduction of the stabilizing additives in the course of its receiving.
We investigated a possibility of modification of processing behavior of suspension PVC maintaining in a polymerization compounding of VH fluid complex calcium – the zinc stabilizer received on the basis of the highest isomeric acids (HIA). Tests of the stabilizer carried out in the 17 m3 reactors. Into a compounding of polymerization of VH the complex stabilizer was entered after loading of an aqueous phase, before loading of vinyl chloride in number of 0,0357-0,0625% of the mass of VC.
It is received that use of the fluid complex stabilizer, well soluble in a monomer promotes the best penetration and more uniform distribution of the entered additive in a boundary layer of droplets of an emulsion, and allows to receive porous PVC, with high characteristic heat stability, morphological uniformity. It is established that processing of the modified PVC in the plasticized and rigid materials demands use of smaller number of stabilizers.

P11

COMPLEX STABILIZERS FOR PVC OF PLASTIC COMPOUNDS

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In development of production of polyvinylchloride (PVC) and the continuous expansion of areas of its application the leading place is taken by achievements in area of creation of the stabilizing additives which are applied in the course of processing and operation of polymer as PVC processing, in view of it anomalously low heat stability, is impossible without efficient stabilization.
For stabilization of PVC compositions in the course of processing lead the containing connections which application does not meet the imposed ecological requirements are most often used toxiferous. Now lead the containing connections gradually are forced out by chemicals additives, safe for health.
Stabilizers on the basis of the mixed organic salts of calcium and Zinc are perspective for replacement of toxiferous heat stabilisers, their effectiveness is in many respects reached by use of a combination of the corresponding additives – the secondary stabilizers operating on various mechanisms.
We developed nontoxical fluid complex stabilizers of PVC compositions on a basis the coprecipitated calcium – zinc salts of the KCO-M oleinic acid and 2-ethylhexane acid – KSE-M. The structure of complex stabilizers switched on secondary stabilizers: antioxidants, phosphites, epoxystabilizers and structural softeners.
The assessment of effectiveness of new complex stabilizers is carried out on workability and a number of production characteristics of non-combustible plastic compound. It is shown that new complex stabilizers provide compliance of non-combustible plastic compound to standards of technical specifications, also promote improvement of its frost resistance. At the same time value of indexes "heat stability time" and "melt flow rate" is higher, than at the exemplar received with use of tribasic lead sulfate that indicates facilitation of process of processing of PVC composition at presence calcium – the zinc complex stabilizer.

P12

SYNTHESIS OF CHEMICALS BY THE ACTIVATION METHOD ON DEVICES OF THE VORTEX SHEET

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One of the directions of development of devices of a vortex sheet is their uses in engineering chemistry. There is a set of chemical processes, for which realization a large amount of energy and time is spent. Prospects of use of activation fields of devices of a vortex sheet, which can lead to change of conditions of course of such chemical processes allow to solve this problem. The effect in such devices is reached thanks to impact of electric local fields, magnetic fields on chemicals and existence of cavitational effect. Such effects are created at the expense of moving ferromagnetic particles in the device. Considering huge traveling speed of an electromagnetic field and sufficient density of ferromagnetic non-isotropic particles, the number of impacts in a short time term is huge, from here the number of the activated mother substances is also big.
On the example of the carried-out synthesis of dioctylphthalate from a 2-etilgesanol and a phthalic anhydride in the device of a vortex sheet we drew a conclusion that this method of activation of chemicals is possible, and in the long term it can be used for receiving other products having both a natural and simulated origin.

P13

REGULARITIES OF CARRYING OUT SINGLE-STAGE SYNTHESIS OF CALCIUM STEARATE IN THE SOLID PHASE

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The need for stabilizers of synthetic and vegetable polymers on the basis of stearates of divalent metals annually in proportion increases. Global manufacturers of stearates of metals focus in technological registration of process of synthesis of carboxylats of divalent metals on outdated nowadays two-stage power-intensive and resource-in-

tensive technology.
Features of conducting process of synthesis of stabilizers for vegetable and synthetic polymers on the example of calcium stearate by interaction of a feed stock in a solid phase during which the innovative technology of single-stage synthesis of calcium stearate is offered were studied. The proposed technological solution represents interaction of reagents, namely oxyhydroxide alkaline metal with stearic acid, in a reference state, directly, without participation of the solvents and the intermediate stages rendering adverse effect both on termination products, and on the subsequent acts of carrying out synthesis. On the basis of the revealed regularities and conditions of behavior of the interacting reagents on the interface caused by an instrument and technological complex properties of the product received experimentally were investigated.

P14

THE ADSORPTION PROPERTIES OF CELLULOSE OF ANNUAL PLANTS

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The modern structure of a delivery of the person is characterized by a lack of consumption of the food fibers (FF), vitamins and mineral substances. The adequate food allowance has to include various food fibers and biologically the active materials. The role in a delivery of the person of PV – the polymer substances of a phytogenesis (cellulose, hemicellulose, pectic substances, gum and a lignin), which are not digested by a human body and intended for normalization of functions of a digestive tract is especially important. PV do not bear in themselves irreplaceable feedstuffs, however their consumption is necessary for maintaining of health of an organism. PV reduce risk of development warmly - vascular diseases, a diabetes mellitus, promote deduction from an organism of heavy metals, radionuclides, positively influence functioning of a rectum, reducing risk of development of an obesity. Development and realization of technologies of receiving PV and searches of paths of their completion in food are a constituent of a complex solution of the problem of the balanced delivery.
The purpose of researches – determination of the adsorption properties in relation to water and oil of the cellulose emitted from one-year the plants and cereals.
The analysis of the data presented in tab. 1 shows that adsorption in relation to water and oil at cellulose from straw of rice, a buckwheat and oats is higher, than at cellulose from a peel of the same cultures. This results from the fact that in cellulose from straw of any culture there is a larger quantity of amorphous regions in comparison with a peel that promotes more mild penetration and deduction of liquids.
It should be noted, that the adsorption properties of cellulose are interdependent also to the content of α-cellulose. The largest content of α-cellulose in cellulose from rice straw, respectively, and at this cellulose and the greatest adsorption in relation to water and oil. The maintenance of a lignine in the specified quantity practically does not influence the adsorption properties.
Conclusions:
It is established that the adsorption properties of cellulose of annual plants in relation to water and fats increase with increase in content of α-cellulose;
It is shown that the adsorption properties of cellulose from straw are higher, than from a peel that is caused by higher content of amorphous regions.

P15

RECEIVING CELLULOSE FROM NOT WOOD RAW MATERIALS

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Cellulose – the most widespread substance which was since ancient times used in various spheres of activity of the person. Its main sources are wood and cotton. Perspective raw materials for production of cellulose are annual plants as their use promotes preservation of forest resources and favorably affects a condition of an ecosystem in general.
The new technology of receiving technical cellulose of different function, about use of the device of extrusion type is offered. On the first stage of manufacture there is a multistage cooking of cellulose by means of which when heating there is a process of disolution of a lignine and receiving unbleached cellulose. After-treatment in an extruding machine promotes more complete selection of a lignine and other impurity, and also gives the chance to regulate a form and the size particle size of the received cellulose. At the same time it is possible to receive as fibrous cel-

lulose (fiber length up to several millimeters), and ultradispersible (particle size to hundreds of nanometers). After washing out cellulose weight has, depending on a feed stock, various coloring: from light yellow to brown, and for achievement of the required whiteness it is directed to whitening. Further cellulose dries and packed.
The cellulose received in such a way can be used for medical (cotton, bandage, powders), household (biodegradable materials, paper, packing materials) and other appointments. The technology prime and high capacity also opens possibilities of its wide use.

P16

OPTIMIZATION TEST OF EXPERIMENTAL CONDITIONS OF DEACETYLATION OF CHITIN: APPLYING DESIGN OF EXPERIMENTS

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Introduction :
Long, exploration of nature, often in the plant kingdom, was for the pharmaceutical industry an area of research of new molecules that may have therapeutic value. regenerable energy source and raw material for industry, biomass is mainly composed of cellulose (about 50%). The second compound is from another polysaccharide, Chitin, produced by marine animals, insects and fungi, it is traditionally extracted from the shells of crustaceans. Chitin is increasingly popular, it owes its popularity to two of its derivatives: chitosan and glucosamine.
Objective :
The objective of this study is to optimize the conditions of deacetylation of chitin 's crabs to chitosan : find the optimal conditions leading to a degree of deacetylation (DD%) previously fixed for an application without consuming a lot of energy or reagents.
Material and methods :
Chitin is extracted from crustacean shells: arcinus aestuarii (crabs of the Algerian coast), purified and then analyzed by infrared spectroscopy ($4000cm^{-1}$ $400cm^{-1}$). Chemometric analysis by applying the experimental design on samples of chitin treated under different conditions was used to estimate the factors influencing , the effect of each factor and building a predictive model of DD% depending on the purpose.
Results and discussion:
Factors influencing DD% are : radiation dose, % NaOH, reaction temperature, incubation time and the reaction time (10 /2013) .To study the influence of five factors, we opted for a fractional factorial design. which allowed us to reduce the number of tests: $2^{(5-2)} = 8$ trials. Using a full factorial design with 2 levels would have required the realization of $2^5 = 64$ trials. The examination of the values of contrasts and experimental error $\sigma_e = 1.00775$ allowed us to identify influential factors. The predictive mathematical model is a classic model of first degree polynomial established after calculation of the main factors with $\sigma_e = 1.00775$: DD%= 36,363 + 6,23 (NaOH %) + 19 ,871 (T° de R°) + 4,516 (tps R°) - 2,17 (dose d'irradiation) +7,876 (tps d'incubation) . (12 /2013)
Conclusion:
The application of design of experiments allowed us to minimize the number of trials necessary to achieve our goal which provides a saving in time and costs.

P17

METAL-CONTAINING NANOSCALE SYSTEM BASED ON AMPHIPHILIC POLYMERS

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On the first stage of the research a few samples of amphiphilic polymers were one-step synthesized by radical polymerization method in the presence of a chain transfer agent (alkyl-thiols). For this polymers the critical micelle concentrations (CMC) and the average molecular weight were determined. The structure of synthesized polymers was confirmed by using NMR (13C, H1) and IR-spectroscopy.
On the second stage the different metal ions (Fe3+, Mn2+, Au3+ etc.) were linked to the polymers. The concentration of the ions were determined by the atomic absorption spectroscopy method. Such metal-containing complexes were successfully used as a biodegradable additive to the polyolefins and as a contrast agent for MRI.

P18

TOXICOLOGICAL STUDIES OF POLYMER VENOUS VALVE ENDOPROSTHESIS WITH DELIVERY SYSTEM

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Toxicological studies of the experimental models of polymer venous valve endoprosthesis including the delivery system were carried out in order to assess the risk that is constituted by migration of various potentially hazardous products from the materials contacting with the human body in the course of applying the endoprosthesis. The examined devices came in several variants differing by design and materials used. The toxicological experiment allowed to compare these versions and find the one most suitable toxicologically-wise.
The investigation was carried out on the two levels: the chemical and the toxicological. On the first level, the extraction modeling the stay of investigated device in the human body was carried out in order to investigate the migration of monomers, technological impurities and the products of degradation of the materials in device into the model media. The extracts were analyzed by the integrated methods (pH measurement, UV spectroscopy and determination of the reducing agents) as well as the methods assigned to identify the individual substances and compare their concentration with the safe levels (high performance liquid and gas chromatography, atomic absorption spectroscopy).
The second level of investigation was taken to evaluate the combined impact of the products of migration with the help of toxicological methods. Cytotoxicity, hemolytic action and pyrogenicity of the extracts were studied. Tests on the animals (rats) were taken including irritation, skin sensitization tests and the investigation of acute systemic toxicity and repeated exposure systemic toxicity.
The examined samples were found to be nonhazardous, with every criteria applied to evaluate the toxicological risk being within the safe range. The most significant difference between the variants of the devices was observed in the brand of polymer used for the manufacture of endoprosthesis and the material and construction of the frame in the delivery system.

P19

DEVELOPMENT OF NOVEL AMPHIPHILIC POLYMERS AND DOSAGE FORMS ON THEIR BASIS

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At present, the development of new drugs, substances with its own biological activity and forms of administration in the body plays an important role in the modern global studies. The most optimal form of application of biologically active substances is to create systems with controlled release. Such systems are micro- or nanocapsules, comprising at its core or cladding predetermined biologically active substance; such systems are the basis of natural polymers or synthetic origin.
In this study, as new carrier of biologically active substances used polymeric nanoparticles amphiphilic derivatives of a biocompatible polymer - poly-N-vinylpyrrolidone, and the copolymer thereof with acrylic acid, which allows the introduction of additional lateral macromolecular chain functional groups. Such polymers along with the main hydrophilic chain has one terminal aliphatic hydrophobic group different structures, different optimal molecular weight distribution, containing, if appropriate in the main chain of the hydrolysable groups that define the possibility of their biodegradation ensuring complete elimination of the polymers and their degradation products from the body when injected. Low molecular weight polymers indicates a complete lack of toxicity of delivery systems based on them.
The ability to create nanoparticles with a given biologically active compound, irrespective of its solubility in water, due to the structure of the amphiphilic molecules and the presence of side functional groups of the synthesized polymers. In particular, the biologically active substance in different cases were aqueous extracts of plants, labels for computer diagnostics, antibiotics and anti-inflammatories. Polymeric nanoparticles derived from the above polymers have a sufficiently small size and narrow size distribution, regardless of the preparation method.

P20

EFFECT OF HYALURONIC ACID ON STRUCTURE AND PROPERTIES OF MACROPOROUS CHITOSAN HYDROGELS

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The presence of reactive groups of chitosan and hyaluronic acid (HA) and the ability of chitosan to form polyelectrolyte complexes (PEC) with a HA allows to obtain materials that combine optimal biological properties of both components. In order to obtain biocompatible and biodegradable polymeric matrices for tissue engineering, interactions of chitosan with HA in solution as well as in heterogeneous conditions were studied. An addition of chitosan powder to the HA solution resulted in the interaction between the functional groups of the polyelectrolytes only at the particle surface leading to the surface layer formation of the swollen PEC. The PEC presence significantly slowed down diffusion of HA macromolecules and the reaction inside the particles. Chitosan/HA solution complex formation was accompanied by an increase in viscosity of the system, or phase separation, in function of the polymer ratio. As a result, transparent or turbid hydrogels with rather low mechanical strength were formed. To increase the hydrogel mechanical stability, genipin which is a natural compound, was proposed for hydrogel crosslinking. The composite porous matrices based on chitosan and its complexes with HA were obtained in two ways. The first way was carried out by lyophilization of the chitosan hydrogel crosslinked with genipin. In this case, the PEC formation occurred at the surface of the chitosan hydrogel during a frontal flowing reaction. The second approach was conducted by lyophilization of the dispersion of the chitosan-HA polyelectrolyte complex in the chitosan hydrogel crosslinked with genipin. All obtained hydrogels were tested as biocompatible scaffolds in vitro. Cytotoxicity of the matrices was studied by MTT-assay using mouse fibroblast L929 cells, while cell morphology and cell growth were monitored by optical and laser confocal microscopy.
The work was financially supported by Russian Foundation for Basic Research (grant № 15-04-07669 A).

P21

COPOLYMERS OF N-VINYLPYRROLIDONE AND VINYL ALCOHOL

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The radical copolymerization N-vinylpyrrolidone and vinyl acetate was investigated, copolymerization constants and the relative activity of the monomers was defined in this process. The obtained copolymer was subjected to alkaline hydrolysis and acid hydrolysis to form a copolymer of N-vinylpyrrolidone and vinyl alcohol.
The one is soluble in water, can be crosslinked by the action of sulfuric acid and epichlorohydrin to form hydrogels with a high water absorption. Oxidation process of the copolymer N-vinyl pyrrolidone and vinyl alcohol was investigated. The structure of the resulting products was established with a nuclear magnetic resonance method, as well as ultraviolet and infrared spectroscopy.
Copolymer of N-vinylpyrrolidone and vinyl alcohol must be biodegradable, unlike polyvinylpyrrolidone. This will help reduce the requirements to the control of molecular weight and molecular weight distribution, when it is used as a blood substitute solutions with detoxifying action. This copolymer also may be used to bind certain metal ions in water solutions.
The study was financially supported by the Ministry of Education and Science of the Russian Federation within the framework of fulfillment of the base part of the state task.

P22

NEW FORMULATION: ENCAPSULATION OF INSULIN IN NANOPARTICLES FOR ORAL ADMINISTRATION

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The objective of this study was to develop alginate/chitosan nanoparticles to deliver model protein drug insulin to protect it from gastric passage, using ionotropic pre-gelation method of an alginate core with calcium chloride followed by chitosan complexation.

The characterization of different properties of prepared nanoparticles, such as particle size, zeta potential value, morphology, stability, structure, and drug loading was studied. The release of insulin from nanoparticles at acidic and alkaline environment was also evaluated. The results indicate that the insulin loaded mucoadhesive nanoparticles was a key factor in the improvement of its oral absorption. Microencapsulation of peptides and proteins and the preparation of sustained-release forms have been widely studied in order to improve the therapeutic efficacy of these bioactive molecules. However, the difficulties mentioned above concerning the properties of the protein, reduce the choice of an encapsulation process and imposing a strict control of operating conditions to ensure the continued integrity of the protein during all stages of production. To this end, we propose to use an encapsulation technique based on ionic gelation between two oppositely charged polymers at room temperature polymers at room temperature. The ionotropic gelation method is very simple and mild. In addition, reversible physical crosslinking by electrostatic interaction insteas of chemical crosslinking avoids the possible toxicity of reagents and other undesirable effects. The use of polysaccharides and specially natural biopolymers has attracted particular interest due to their desirable biocompatible, biodegradable, hydrophilic and protective properties.

In this study, two polysaccharides, alginate and chitosan were used as polyionic polymers to associate with the model protein drug insulin. The use of chitosan in complex with alginate is a promising strategy if we consider the biocompatibility of two polyelectrolytes. Chitosan has an amino group which gives it a character of polycation and the ability to form complexes with acids or polyanions. It is a biocompatible and biodegradable polymer and is used in many biomedical applications. Sodium alginate is a polysaccharide found in all brown algae, it is water soluble, biodegradable and biocompatible. In the presence of calcium ions (Ca), interaction between the bivalent ions and guluronic acid residues causes the alginate to form a gel. The solubility characteristics of the alginate network are also affected by the pH of the medium.

P23

PROPERTIES OF GUAR FILMS FILLED WITH POLYSACCHARIDE NANOCRYSTALS

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Polysaccharide nanocrystals are highly crystalline nanoparticles produced by hydrolysis of amorphous regions of native polysaccharides. Depending on source of biomass the nanocrystals have various dimensions and morphology. Rod-like nanocrystals derived from cellulose and chitin possess many unique properties and could be successfully used to prepare nanocomposite drug carriers, cell scaffolds; for pollution decontamination; as reinforcing fillers to modify polymeric materials, etc. One of promising application of polysaccharide nanocrystals is a development of edible films with improved mechanical and barrier properties. Literature data showed a number of papers described effect of polysaccharide nanocrystals filling on properties of edible films based on agar, various types of starch, alginate, chitosan, etc.

This work was aimed to prepare and investigate properties of film samples casted from guar (Aqualon, USA) or hydroxypropyl guar (Rhodia, France) filled with various amount (0-10 wt.%) of polysaccharide nanocrystals. According to atomic-force microscopy data, both types of nanocrystals possessed rod-like morphology with a mean diameter of 85±39 nm and length of 158±89 for cellulose nanocrystals and 93±41 nm and 131±94 nm for chitin nanocrystals, respectively. The film samples were prepared as followed: a weighted amount of freeze-dried nanocrystals was added to 1 wt.% water solution of guar or hydroxypropyl guar; the dispersion was subjected to ultrasound treatment for 2 min and cased on polystyrene Petri dish to dry at RT in a dust-free chamber. Mechanical properties of film samples were tested using Instron 5965 (USA) at speed of 2 mm/min. Effect of filling on sorption properties was evaluated gravimetrically as equilibrium sorption rate of samples kept under saturated solution of $(NH_4)_2SO_4$ for a week.

Effect of nanocrystals addition on mechanical properties and sorption rate was depended on type and content of polysaccharide nanocrystals as well as on chemical structure of polymer material (guar or hydroxypropyl guar). We assume that it could be caused by various arrangements of nanocrystals and, therefore, percolation threshold formation as a function of filler/matrix interaction.

P24

COMPARATIVE TOXICOLOGICAL STUDY OF SIX ACTIVE SUBSTANCES OF DITIOCARBAMATE CLASS PESTICIDES

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Introduction. At present there are more than 50% of the pesticides authorized in Russian Federation are generic pesticides, which are analogs of original pesticides with the expiring registration. For the registration of new generic pesticides that are produced in different countries (China, India, Malaysia) and differ in their purity, contaminants amount and nature their comparative toxicological investigation is mandatory.
Objectives: Evaluation of toxicological bioequivalence for active ingredients of six samples of carbamate pesticide desmedipham from different manufactures.
Materials and method: LD50s of these compounds were estimated according to the approved Standard operational procedures [1]. Toxicological effects of the investigated samples were evaluated in male rats after single oral administration of 1/10 LD_{50} dose.
The studies results. It was found out that LD_{50} of the investigated active ingredients at after oral administration was in the range of 7682 - 9413 mg/kg of body weight. At simultaneous per-oral the substances administration of 1/10 LD_{50} dose, unidirectional pattern of changes in the animals' behavior reactions was noticed, those animals received samples № 4 and № 6. Analysis of changes of summation - threshold value (STV) showed its decrease in animals that had got samples № 4, № 5 and № 6 in a day after the intake. Determination of hematological values in peripheral blood of the experimental animals showed the following unidirectional changes in 6 days after the substances intake: decrease of erythrocyte and hemoglobin concentrations and of hematocrit level in all the studied samples. During researching biochemical values in blood serum, the most changes were marked in animals than had received sample № 5. The mentioned sample caused statistically significant reduction in alanine and asparagine aminotransferases (AST and ALT) activity, decrease in albumin content in 1, 3 and 6 days, increase in total protein content and decreasing in uric acid content in 1 and 3 days, increasing in cholesterol content in 3 days and also decreasing in triglyceride content in 1 and 6 days. Significant increase in absolute liver weight was observed (for samples № 5 and № 6), authentic increase of absolute liver weight was registered.
Conclusions. It is found that all studied active ingredients belong to the 4th class of hazard regarding their acute per-oral toxicity. It has been also observed that product 5 has more drastic toxicological impact on animals. In particular, its administration disturbs significantly and much earlier blood biochemical parameters then other investigated compounds.
References
«Conducting screening researches of technical products of pesticide active substances» Moscow, 2012 (in Russian).

P25

COMPARATIVE TOXICOLOGICAL STUDY OF EIGHT ACTIVE SUBSTANCES OF PHENOXICARBONIC ACIDS DERIVATIVES

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Introduction. At present there are more than 50% of the pesticides authorized in Russia are generic pesticides, which are analogs of original pesticides with the expiring registration. For the registration of new generic pesticides that are produced in different countries (China, India, etc.) and differ in their purity, contaminants amount and nature their comparative toxicological investigation is mandatory.
Objectives: Evaluation of toxicological bioequivalence for active ingredients of eight samples of generic pesticides phenoxicarbonic acids derivatives from different manufactures.
Materials and method: LD50s of these compounds were estimated according to the approved Standard operational procedures [1]. Toxicological effects of the investigated samples were evaluated in male rats after single oral administration of 1/10 LD_{50} dose.

The studies results. It was found that LD_{50} of the investigated ingredients at after oral administration was in the range of 883,8-1326,5 mg/kg of body weight. Administration of 1/10 LD_{50} dose showed unidirectional pattern of changes in summation-threshold value: samples 4, 6 on the 1st day, samples 1, 2 - 3d day, sample 7 - 6th day. Determination of hematological values in peripheral blood of the experimental animals showed leucocytes content decrease in sample 4 on the 1st day, sample 5 - 1st and 3d day and sample 1 - 6th day. Sample 1 showed mean cell hemoglobin increase, sample 2 – hematocrit value increase. Thrombocytes content decrease was marked in samples 5, 6 and 8. During researching biochemical values in blood serum, the most changes were marked in animals that had received sample 1: increase in alanine and aspartaminotransferases activity on the 3d day, total protein and albumin content decrease on the 1st day and their increase on the 6th day, cholesterol decrease on the 1st day, glucose decrease and triglyceride increase on the 6th day. Samples 1,2,3,4,5 showed absolute and relative heart weight increase. Sample 1 caused relative kidneys weight increase and sample 2 caused absolute and relative lungs weight increase. Regarding samples 4, 5, 6 and 7 decrease of absolute and relative liver weight was noticed. Sample 1 showed multi-directional action manifested in increase of relative liver weight.

Conclusions. It is found that the studied samples 1,2,3,6 belong to the 3d class of hazard regarding their acute peroral toxicity, samples 4,5,7,8 belong to the 4th class of hazard. Product 1 has more drastic toxicological impact on animals. In particular its administrations disturbs significantly internals weight fraction and blood biochemical parameters then other investigated compounds.

References

«Conducting screening researches of technical products of pesticide active substances» Moscow, 2012 (in Russian).

P26

TOXICODYNAMICS OF TRIAZINE DERIVATIVE IN NANO- AND MACRODISPERSE FORMS

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Introduction. Toxicological study of herbicide which is triazine derivative was conducted in nano- and macro-disperse forms including establishment of toxicodynamics parameters.

The work target: to conduct comparative toxicological exploration of preparations on triazine basis in nano- and macro-disperse forms.

Materials and methods. Long-term toxicodynamics study was performed in white male rats divided into the following groups: three groups that received the studied substance at doses of 0.75, 5.0 and 16.7 mg/kg of body weight in nanoform, three groups (the same doses of the substance) in macro-disperse form and control group. The experiment duration was 12 months.

Results. It was found out that the animals' death in all the groups was about 10-15% and it didn't significantly differ from the death in the control group; changes of body weight of the experimental animals in comparison with the control wasn't marked during 12 months.

The following changes of biochemical values were the most significant: decrease in lactatdehydrogenase activity (dose was 16.7 mg/kg, nanoform, 1 month), decrease in triglyceride content (5 mg/kg, nanoform, 9 months; 5 and 16.7 mg/kg, nanoform, 12 months), increase in cholesterol content (5 and 16.7 mg/kg, nanoform, 3 months). There were no such changes in case of macro-form intake.

Decrease of triiodthyronine (T3) content was noticed when studying hormonal status, the decrease was marked in macro-dispersed preparation during 1, 3 and 6 months; in nanoform preparation - during 1, 3, 6 and 9 months; increase of thyroxin (T4) content was noticed for 0.5, 1, 3, 6 and 12 months in macro-dispersed preparation form and - for 0.5, 1, 3 and 6 months in nanoform preparation.

Assessment of functional state of the central nervous system showed no changes.

At the end of the experiment (12 months) there were no authentic changes of absolute and relative masses of the internals.

Conclusions. At multiple peroral effect of triazine derivative in nano- and macro-disperse form, the substance was characterized by polytropic action at the two highest doses (impact on blood system, liver, endocrine system and water-salt balance). At the low dose there were no changes. It was determined that NOEL was the same for both forms. The tendency to somewhat more expressive nanoform effect on the explored values as compared to macrodisperse form of the studied substance in case of high and intermediate doses was marked.

P27

ESTIMATION OF HEXAMETHYLENEDIAMINE MIGRATION FROM POLYAMIDE FOOD CONTACTING MATERIALS TO FOODS USING GC-MS AND GC-ECD.

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Hexamethylenediamine (HMDA) is used as a monomer for the manufacture of polyamide plastic materials utilized in food industry as packing materials, in particular as boil-in bag packaging. The residuals of HMDA in these food contact materials can have toxic effects and its presence should be monitored for the protection of consumers' health. In the present study we developed, validated and compared new GC-SIM-MS and GC-ECD methods for the determination of HMDA migration from food contacting polyamides to water used as a food stimulant.
The first approach comprise the direct derivatization of HMDA with ethyl chloroformate, isolation of the derivative from the derivatization mixture and analysis by GC-EI-MS in Selective Ion Monitoring mode. The LLOD of this method is 100 ng/mL water and instrument response was linear ($r > 0,996$) in the investigated range HMDA concentrations 0.25 -2.5 μg/ml. The second approach comprises initial HMDA extraction, derivatization with trifluoroacetic anhydride and analysis by GC-ECD. The LLOD of the second approach is 2 ng/mL water and instrument response was linear ($r > 0,999$) in the investigated range HMDA concentrations 5 – 500 ng/ml. The developed methods were applied to 10 different plastic food packings acquired from the local market. The HMDA migration to water was found to be below method LOD=100 ng/mL by GC-MS approach. By the second developed GC-ECD HMDA migration was found to be from below of method LOD=2 ng/mL up to 7.3 ng/mL. which are substantially lower than specific migration limits for HMDA indicated by EU and Russian Federation.

P28

NOVEL SYSTEMS FOR DELIVERY OF HYPNOTIC DRUGS TO BRAIN BY INTRANASAL ADMINISTRATION

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Intranasal administration of drugs for delivery into the brain has several advantages such as non-invasiveness, high bioavailability of the drug and rapid development of therapeutic effects. The use of containers based on porous microparticles for intranasal administration can provide delivery of the drug due to the retention of the system on the epithelium of the mucous membrane and also can protect the drug compound from enzymatic degradation in nasal cavity. Polyelectrolyte shell of the containers can increase their residence time within the nasal cavity due to mucoadhesive properties and also can provide sustained release of the active substance. Earlier the effectiveness of the use of porous microparticles of calcium carbonate and titanium dioxide as a delivery system of the central anesthetic loperamide into the central nervous system by intranasal administration was shown [1].
In this work the loading of different microcontainers such as calcium and manganese carbonate and titanium dioxide microparticles with hypnotic drug zolpidem in various forms (tartrate, acid and potassium salt) was determined and optimized. Two methods of incorporation of the drug were proposed: adsorption on previously synthesized particles and coprecipitation of the drug with the particles.The amount of incorporated zolpidem was determined spectrophotometrically. The dynamics of release of zolpidem from the particles was studied. Particle surface was modified with polyelectrolyte shell composed of polysaccharides. Influence of the shell composition on the release of zolpidem was shown. It was observed that the enzyme dextranase has effect on release of zolpidem from containers with the shell formed of diethylaminoethyl-dextran.
[1] T.V. Bukreeva, I.V. Marchenko, T.N. Borodina, I.V. Degtev, S L. Sitnikov, Yu.V. Moiseeva, N.V. Gulyaeva, and M.V. Kovalchuk // Doklady Physical Chemistry, 2011, Vol. 440, Part 1, pp. 165–167.
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P29

MULTIFUNCTIONAL DRUG DELIVERY SYSTEM BASED ON POLYSACCHARIDES' CONTAINERS AND INORGANIC NANOPARTICLES

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Development of hydrophobic drugs' delivery carriers is an important task of nanoengineering due to inability to these substances transport independently by bloodstream. Polysaccharide containers obtained by using low frequency ultrasound have been proposed as such systems [1]. Modification of the containers by inorganic nanoparticles can be used to add additional functionalities to the proposed systems. In this work, containers' shells formed by xanthan gum and chitosan were modified by gold nanoparticles to improve surface enhanced Raman spectrum (SERS) properties. The gold nanoparticles were prepared by two different methods. The first one is reduction of nanoparticles from chloroauric acid by ascorbic acid on containers shells. The second comprises particles adsorption from a sol on the containers' surface. SERS properties of the obtained systems were confirmed by preliminary experiments.
In addition, magnetic nanoparticles were embedded into containers' shells to enable delivery of encapsulated substances to be driven by external magnetic field. Magnetite particles were synthesized by chemical condensation of di- and trivalent iron followed by stabilization of the particle surface by citrate ions. The nanoparticles were adsorbed on the containers' surface by layer-by-layer technique. The high sensitivity of the containers to constant magnetic field has been successfully demonstrated.
The described approaches allow creating the containers consisting both the gold and magnetic nanoparticles. We demonstrated the formation of polysaccharide containers, which may comprise diagnostic elements and act as the multifunctional delivery systems of hydrophobic drugs.
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P30

A CHIMERIC LYSK-LYSOSTAPHIN FUSION ENZYME LYSING STAPHYLOCOCCUS AUREUS CELLS: KINETIC PECULARITIES OF INACTIVATION AND SPECIFICS OF INTERACTIN WITH BLOCK-COPOLYMERS OF POLY-L-CLUTAMIC ACID AND POLYETHYLENE GLYCOL

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A staphylolytic LysK-lysostaphin triple fusion enzyme possesses three lytic activities comprised of the LysK CHAP endopeptidase, and amidase domains, and the lysostaphin glycyl-glycine endopeptidase domain. To appreciate the power of possible therapeutic applications the kinetic properties (activity, stability) of the chimeric enzyme were investigated. To reduce the immunogenicity of the enzyme the biophysical effect of inclusion of LysK-lysostaphin triple fusion enzyme in anionic polymer matrices was tested.
Triple fusion enzyme reveals a maximal lytic activity under the following conditions: pH 6.0-10.0, t 20-30°C, NaCl 400-800 mM. At 37°C (temperature of functioning) the chimeric enzyme is inactivated by a monomolecular mechanism and possesses a high half-inactivation time of 12.7±3.0 hrs. At storage conditions (22°C, 4°C, pH 6.0-9.0, the enzyme concentration of 0.2-0.8 mg/mL) triple fusion enzyme is inactivated by a complex mechanism (combination of monomolecular and bimolecular mechanisms). The optimal storage conditions (enzyme retains 100% activity during 140 days) were appointed (4°C, the enzyme concentration of 0.8 mg/mL, pH 6.0/7.5). It can be concluded that no additional stabilization of the enzyme is needed at 4°C.
Triple fusion enzyme was included in complexes with block-copolymers of poly-L-glutamic acid and polyethylene glycol (PGLU-PEG). Both activity and stability of the enzyme are retained. The inclusion of triple fusion enzyme in a polymer matrix may result in a reduced immunogenicity of biocatalyst which is a prerequisite for commercialization of a proteinaceous antimicrobial agent.
The work was supported by RFBR 15-04-07995 A and SkolTech N 182-MRA grants.

P31

BACTERIOPHAGE PHI11 LYSIN: STRUCTURE AND INACTIVATION KINETIC

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Bacteriophage lytic enzymes are promising agents for the treatment of diseases caused by antibiotic-resistant strains of *Staphylococcus aureus*. The staphylococcal phage phi11 endolysin (LysPhi11) can effectively lyse *S. aureus* cells, including strains resistant to methicillin and vancomycin. Enzyme structure and kinetic behavior have not previously been characterized. It is shown that at 37°C LysPhi11 loses activity due to thermal denaturation and aggregation of its molecules. Under optimal storage conditions (4°C, pH 6.0-8.0, 10 mM NaCl) LysPhi11 half-inactivation time is equal to 3-4 months. In the storage conditions the enzyme is inactivated by monomolecular mechanism; conformational changes in the molecule may be accompanied by disruption of the structure of Me^{++}-binding site and transition of cysteine residues to the deprotonated form.
The work was supported by RFBR 15-04-07995 A and SkolTech N 182-MRA grants.

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CALCIUM PHOSPHATE-BASED MICROCARRIERS FOR TISSUE ENGINEERING

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Microcarriers based on hydroxyapatite (HA) have been widely proposed as scaffolds for bone tissue engineering due to their ability to stimulate osteogenic differentiation of stem cells. Since the microcarriers from pure HA have rather poor mechanical properties and low resorption rate, various chemical modifications of HA were proposed. It was also shown that modification of HA structure with SiO_4 or CO_3 or fabrication of its composites with tricalcium phosphate (TCP) could influence on bioactivity of the scaffolds in terms of cell growth and differentiation.
The aim of this work was to study physicochemical properties of microcarriers based on various modified calcium phosphates as well as to evaluate their cytotoxicity and ability to support adhesion, spreading and growth of various cell lines on its surface. In this study we evaluated microcarriers based on calcium phosphate of different composition, namely silicon-substituted HA (SiHA, substitution degree (SD) of PO_4 groups for SiO_4 was 10 mol.%), carbonate-substituted HA (CHA, SD of PO_4 groups for CO_3 was 6 mol.%) as well as on composite HA/TCP material (HA/TCP ratio was 80/20 w/w). Physicochemical properties (mean size, surface morphology, specific surface area and protein sorption) of the microcarriers were studied. All parameters were found to depend upon the microcarrier type. Thus, the mean particle size was 156, 136 and 170 mm for SiHA, CHA and HA/TCP, respectively. The protein adsorption was revealed only at the outer surface of the microcarriers. The highest protein adsorption was found for the CHA-based microcarriers. Human osteoblast-like cells (HOS) and mesenchymal stem cells (MSC) isolated from the human adipose tissue were cultivated on the microcarriers for 7 days. Cell growth was controlled by optical and confocal microscopy, while the number of viable cells was determined by MTT assay after 4 and 7 days of cultivation. All types of the microcarriers were found to support rather good cell adhesion and spreading. It was also demonstrated that the properties of the SiHA-based microcarriers were optimal to provide cell growth and proliferation.
The study was supported by Russian Foundation of Basic Research (grant № 14-04-01861-a).

P33

MULTIFUNCTIONAL POLYESTER-BASED MICROCARRIERS LOADED WITH BIOACTIVE COMPAUNDS FOR TISSUE ENGINEERING

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Microcarriers are promising scaffolds for tissue engineering due to their injectability and large specific surface for cell attachment. Moreover, biodegradable microcarriers can serve both as bioactive factor delivery systems and as scaffolds for cell attachment and growth.
The aim of the study was to develop multifunctional biodegradable poly(lactide) microparticles with improved surface chemistry to promote cell adhesion and loaded with bioactive peptide to stimulate cell growth and proliferation.
In this study, thrombin agonist peptide (TRAP-6, Ser-Phe-Leu-Leu-Arg-Asn) was encapsulated in PLA microparticles, during their preparation by an oil-in-water emulsion solvent evaporation technique. The effect of the peptide on L929 mouse fibroblasts growth was evaluated using trypan blue exclusion method. It was found that TRAP-6 significantly promoted cell growth and proliferation.
However, the surface of the microparticles prepared by this technique could provide rather poor cell affinity because of polyvinyl alcohol, which was used as an emulsifier in water phase and could contaminate the surface. In order to enhance cell attachment, the microcarrier surface could be modified with positively charged polymers. In this study, the surface of the microparticles was coated with chitosan by physical sorption. The modification of microcarrier surface was shown to enhance L929 cell growth. However, this modification can not be used for preparation of TRAP-6-loaded microparticles, since the peptide has rather low molecular weight (Mw 980 Da), and therefore it can be completely released from the microparticles during their incubation in the chitosan solution.
Therefore, another one-step technique has been proposed, in order to obtain the surface-modified microcarriers using chitosan-g-oligo/poly(lactide) copolymers synthetized by solid-state reactive blending (SSRB) technique [1, 2]. Surface modification was carried out by introducing chitosan-based copolymers either in water or oil phase during the microcarrier preparation. Scanning electron and confocal laser scanning microscopy techniques have been used to study the effect of these modifications on surface morphology. The impact of the modification on cell growth was evaluated using the MTT assay on day 4 and 7 of cell cultivation on microcarriers. The confocal, scanning and optical microscopy were used for cell growth monitoring. The surface modification was shown to promote better cell adhesion and spreading on the microcarrier surface as well as to enhance cell growth, compared to that on the non-modified microparticles.
Thus, this one-step approach allows to improve microcarrier surface properties (topography, charge etc.) and to load microcarriers with various bioactive molecules, stimulating cell growth and proliferation, and as a result to accelerate tissue repair.
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The study was supported by Russian Foundation of Basic Research (grant 14-04-01861-a).

P34

SYNTHESIS AND APPLICATION OF MODIFIED POLY(VINYL ALCOHOL) WITH EPICHLOROHYDRIN

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The approach to a controlled chain branching of poly(vinyl alcohol) under the action of epichlorohydrin in an alkaline medium was developed. The dependence of the viscosity of the reaction system on synthesis time was investigated. It was shown that there was a limit concentration of alkali, and above that one, a non-linear increase in viscosity was observed.
It was found that the proportion of branched structures is considerably increased with the increase of reactant concentration in the reaction system. Formation of branched PVA under these conditions confirmed the possibility

of dissolving it in hot distilled water, and these gel permeation chromatography. It was found that a molecular weight of branched poly(vinyl alcohol) can exceed 4,000,000 (gel permeation chromatography).
The kinetics of the epichlorohydrin hydrolysis under alkaline conditions and kinetics of interaction of polyvinyl alcohol and epichlorohydrin was investigated, and it revealed a number of side reactions.
It was found that the branched polyvinyl alcohol forms strong films by evaporation of water. These films can be used as a dialysis membrane, as well as materials for manufacturing anti-adhesive materials.
The study was financially supported by the Ministry of Education and Science of the Russian Federation within the framework of fulfillment of the base part of the state task.

P35

DOPAMINE-CONTAINING COPOLYMERS OF N-VINYLPYRROLIDONE AND ALLYLGLYCIDYL ETHER

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By the radical polymerization of N-vinylpyrrolidone and allylglycidyl ether and with the subsequent modification by dopamine we prepared macromers which are capable of crosslinking by the mechanism of oxidative polymerization when processing by the number of oxidizing agents and also iron salts.
The structure of the obtained macromers is identified by nuclear magnetic resonance, ultraviolet and infrared spectroscopy. It is shown that the introduction of dopamine is carried out as a result of disclosure of epoxy cycle by primary amino group. The kinetics of this process was also studied. Kinetic regularities of oxidizing polymerization of the dopamine and dopamine-containing N-vinylpyrrolidone copolymer with allylglycidyl ether was also investigated.
It was established that the products of oxidative cross-linking of dopamine-containing macromeres have high adhesion to a number of surfaces, including the soft tissues of living organisms. Thus, the considered system can be used as an adhesive for bonding soft tissues.
The study was financially supported by the Ministry of Education and Science of the Russian Federation within the framework of fulfillment of the base part of the state task.

P36

SUPEROXIDE DISMUTASE 1-CONTAINING NANOZYME FOR TREATMENT OF EYE INFLAMMATION

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Inflammatory diseases, including ocular ones, are accompanied by excessive production of reactive oxygen species (ROS) and by depletion of endogenous antioxidants. Even a minor damage caused by the ROS activation in the eye can affect its functions resulting in a loss of optical transparency of cornea and lens as well as disorders of hydrodynamics and the functioning of photoreceptor apparatus. The free radical processes enhancement was shown to occur in the course of development of almost all types of ophthalmic pathology (inflammations, eye burns, glaucoma, cataract, intraocular hemorrhage, diabetic retinopathy, and others). So, one of the perspective approaches for the treatment of eye inflammations accompanying such diseases is the use of antioxidants, and enzymes such as superoxide dismutase (SOD), in particular.
Unlike corticosteroids, non-specific anti-inflammatory drugs, antibiotics, immunomodulators used in the combined medical therapy against eye inflammations, possessing numerous side effects, the application of based on SOD preparations is the most harmless. SOD removes the superoxide radicals and prevents the formation of others, more dangerous: hydroxyl radicals and singlet oxygen. It is very important that SOD is practically nontoxic. However, only 5-10 % SOD containing medicine in the form of eye drops penetrates through the cornea to the intraocular tissues because of the technical and clinical problems, such as solubility of the components and instability of drug solutions, limited efficacy and limited corneal/sclera permeability, elimination of the major part of drug solution via the nasolacrimal drainage system after instillation.
Drug loaded polymeric nanoparticles can improve the efficacy of drug delivery into the eye by overcoming corneal/sclera diffusion barrier, enhancing bioavailability and biocompatibility. The use of drug-containing nanoparticles can also decrease the dose of the drug and diminish side effects. In this study we demonstrate the advantages of topical instillations of superoxide dismutase 1 (SOD1) in the form of complexes and conjugates with differently

charged poly-electrolytes (so called "nanozymes") in the treatment of ocular inflammation. The ability of SOD1 nanozyme as well as the native SOD1 to reduce inflammatory processes in the eye was examined *in vivo* in rabbits with immunogenic uveitis. Results suggested that topical instillations of both enzyme forms demonstrated anti-inflammatory activity; however, nanozyme was much more effective compared to the free enzyme in decreasing uveitis manifestations (corneal and iris edema, hyperemia of conjunctiva, lens opacity, fibrin clots, and the protein content in aqueous humor). Clinical findings were confirmed by histological data. Thus, SOD1-containing nanozyme is potentially useful therapeutic agent for the treatment of ocular inflammatory disorders.

P37

NANOMECHANICAL APPROACH FOR CHANGING COENZYME SPECIFITY OF NAD-DEPENDENT FORMATE DEHYDROGENASE, IMMOBILIZED ON MAGNETITE@GOLD NANOPARTICLES, UNDER LOW-FREQUENCY MAGNETIC FIELD

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Application of magnetic nanoparticles for therapy, drug delivery, cells separation and as a contrast agent for MRI has undergone explosive development recently. Nanomechanical approach for biochemical reaction management is one of the promising techniques for using magnetic nanoparticles for biomedical application. In this technique, rotation of magnetic nanoparticles with immobilized on them enzyme under expose of alternative magnetic field is applied for changing an enzyme structure-activity. In the case of chymotrypsin immobilized between two magnetic nanoparticles (MNP), rotation of MNP under low-frequency magnetic field can significantly change the enzyme structure leading to the decrease of the enzyme-catalyzed reaction rate. Contact forces applied to the enzyme molecule in such nanomechanical device amounts to hundreds of pNs. In case of enzyme molecules immobilized on single magnetic nanoparticle, the hydrodynamic forces changing the enzyme structure more mild. Our aim in this work was to investigate coenzyme specificity using as an example NAD-dependent formate dehydrogenase (FDH), immobilized on magnetite@gold nanoparticles, under exposure of low-frequency magnetic field to find out, if there is a possibility of changing it to NADP.
Magnetite nanoparticles were prepared by co-precipitation of Fe(II) and Fe(III) salts followed by gold shell covering. The surface was modified with carboxylate mercapto-PEG_{5000}. Immobilization of NAD-dependent FDH was made by carbodiimide method. Sizes of uncovered and enzyme modified nanoparticles were determined by TEM and NTA. Enzymatic activity of MNP-FDH conjugates was investigated by measuring the increase of NADH or NADPH in the catalyzed by FDH reaction. The activity of MNP-FDH didn't change under expose of 50 Hz magnetic field, when NAD^+ was used as a coenzyme. Though, when $NADP^+$ was used in the same conditions, the activity of MNP-FDH noticeably increased. It might be possible that in this case forces applied to FDH under LF MF action were leading to an opening the coenzyme binding site. Thus, we showed the possibility of changing coenzyme specificity using LF MF action as a "tool" tuning an enzyme active-site structure.
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P38

BUILDING MATERIALS MADE OF INDUSTRIAL WASTE

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The problem of creation of building materials and construction with the specified properties is the one of the major problems in today's construction materials science. The problem has two main aspects such as: material science and technology. The first aspect provides an establishment of the quantitative relationship of composition and structure of materials and their properties and also the establishment of regularities of changes the properties of materials in use. The second aspect relates to the technological maintenance of specified quality indicators. The solution of these problems is a methodological approach in which building composites are considered as complexly organized material systems. Qualitatively new stage in the development of a unified theory of structure formation and properties of the highly organized material systems is fundamental tenets of scientific disciplines such as: construction materials science, synergy, physical and colloid chemistry, mechanics of heterogeneous structures that deepen understanding of the processes of multi-level structural organization of materials at all stages of the

process.Environmental issues resource saving energy efficiency comes to the fore in the building materials industry. Demand for different binders and fillers for concrete and mortar increases continuously, which increase the relevance of these issues many times. We need a more complete and comprehensive use of reserves and mineral resources, which include a variety of industrial wastes.Guidelines on using of various industry wastes as binders, mineral fillers, active modifying additives have an experimental - theoretical foundation. Having been developed compositions of mixed binding agents, such as gypsum cement, pozzolanic, slag-alkaline, filled with cement compositions, sodium silicates, furan and other binders with the use of solid mineral waste are finely dispersed fillers obtained by grinding the concrete scrap, various glass dihydrate phosphor gypsum, pickling sludge, slag-ferrous metallurgy. Also a composite-technology approach, which provides a fairly wide range of building materials for various purposes in industrial and civil engineering and road construction has been developed. However, the problematic subject is a matter under consideration and requires further solutions.

P39

INTEGRATED ASSESSMENT OF ANTIMICROBIAL POLYMER COMPOUND TOXICITY

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Use of novel biologically active compounds is one of the most effective ways to fight pathogens causing infectious diseases. However, apart from their high antimicrobial activity, they are not supposed to have a toxic effect on multicellular organisms. The goal of our study was an assessment of the acute toxicity of a polymeric compound, poly oxazolidine ammonia modified by hydrate-iodine ions (POAH-M), on the water fleas (*Daphnia magna* Straus) and white laboratory mice. In the pilot study, we discovered wide range of antimicrobial activity of this polymer towards standard and clinical strains of opportunistic pathogenic microorganisms. Two treatments used in our experimental work differed in hydrate-iodine ions content of the tested polymer: 100 μg/ml and 1000 μg/ml.
At the first stage of our research, the acute toxic effects of various POAH-M concentrations were assessed by water fleas mortality during 48 hours exposure. None of the tested treatment options of POAH-M caused test objects mortality or affected their physiological activity. That is why we could not establish $LC_{100\text{-}48}$ and $LC_{50\text{-}48}$ indicators for POAH-M, regardless of hydrate-iodine ions content in its composition. This finding justified classifying various treatment options of POAH-M with different hydrate-iodine ions content as non-toxic compounds.
At the second stage of our study, we assessed acute toxicity of POAH-M treatment options using male mice to estimate LD_{50}. In this experiment, POAH-M was administered orally and intraperitoneally. After the introduction of the highest possible doses, our experimental study revealed that general physiological condition of mice and their behavior remained unchanged and stable.

P40

NANOMECHANICAL STIMULATION OF BIOCHEMICAL SYSTEMS BY NON-HEATING ALTERNATING MAGNETIC FIELD

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Nanomechanical approach to biochemical systems actuation has appeared in the past decade. This method involves application of magnetic nanoparticles (MNP) controlled by non-heating low-frequency (LF) alternating magnetic field (AMF). Specificity at cellular or molecular level and spatial locality is its key advantage as compared to magnetic hyperthermia. However current experimental studies have weak theoretical basis. Models of magneto-mechanical actuation in non-heating LF AMF are presented in the article. Single core-shell, rod-like, Janus MNPs as well as dimer constructed of two MNPs with macromolecules immobilized on their surface are considered. MNPs bound with macromolecules or cellular membranes can affect their functions and properties. This could be widely used in therapy, in particular for targeted drug delivery. Aggregate constructed of two and more particles can strongly affect surrounding macromolecules; force on the order of several hundreds of piconewton is predicted. Possibilities of controlled *in vitro* and in vivo aggregate assembly are discussed.

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P41

MODELING ALTERNATIVE CURRENT MAGNETIC FIELD IMPACT ON KINETICS OF DRUG RELEASE FROM MAGNETIC NANOPARTICLE CARRIERS

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Various plausible acceleration mechanisms of drug release from nanocarriers composed of single domain magnetic nanoparticle core with attached long macromolecule chains incited by low frequency alternating magnetic field are discussed. The most important system characteristics affecting the magnetic field exposure impact are determined. Impact of several reasonable mechanisms is estimated analytically or obtained using numerical modeling. Some cases providing manifold release acceleration as a result from exposure in magnetic field are found.
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MAGNETIC NANOPARTICLES IN NON-HEATING LOW FREQUENCY MAGNETIC FIELDS AS A NEW THERANOSTIC PLATFORM

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This review highlights one of the most promising branches of new generation biomedicine, namely magnetic nanotheranostics using remote control of functionalized magnetic nanoparticles (f-MNPs) by means of alternating magnetic fields (ACMF) and is mainly focused on new approach which utilizes non-heating low frequency magnetic fields (LFMF). This approach is compared to traditional ones which utilize radio frequency heating ACMF, like magnetic resonant imaging (MRI) and radio frequency magnetic hyperthermia. Innovation principles and specific models of biostructures' non thermal magneto-mechanical actuation by MNPs' rotational oscillational motion in LFMF are described. Discussed instrumentation family allows monitoring biostructures in situ, delivering drugs to target tissues and releasing them with controlled rates, controlling biocatalytic reaction kinetics, inducing malignant cells apoptosis and more. Parameter optimization of LFMF effect on f-MNPs and subsequent f-MNPs impact on molecular targets may improve treatment efficiency, locality and selectivity on molecular or cellular levels and allow implementing both drug and drugless, i.e. pure nanomechanical, therapy, in particular anti-cancer therapy.

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