Buketov University

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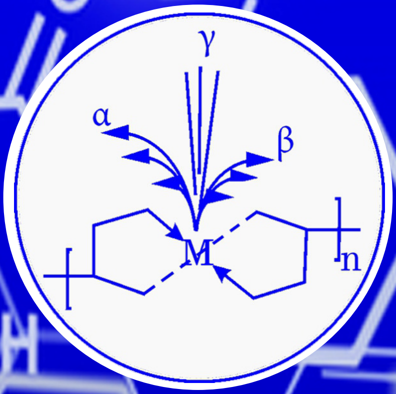
BUKETOV KARAGANDA STATE UNIVERSITY
INSTITUTE OF POLYMER MATERIALS AND TECHNOLOGY
INTERNATIONAL SCIENCE AND TECHNOLOGY CENTER

PROCEEDINGS

of the
VIII INTERNATIONAL SYMPOSIUM ON SPECIALTY POLYMERS



August 23-25

Karaganda, 2019

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INTERNATIONAL SCIENCE AND TECHNOLOGY CENTER
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PROCEEDINGS

OF THE VIII INTERNATIONAL SYMPOSIUM ON SPECIALTY POLYMERS

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2019

UDC 661
LBC 35.50
V 10

V 10 **«VIII International Symposium on Specialty Polymers (Specialty Polymers for Environment Protection, Oil Industry, Bio-, Nanotechnology and Medicine)»:** / Book of Abstracts of VIII International Symposium on Specialty Polymers (Specialty Polymers for Environment Protection, Oil Industry, Bio-, Nanotechnology and Medicine) / Buketov Karaganda State University. — Karaganda, 2019. — 122 p.

ISBN 978-9965-39-756-1

The abstract book includes the plenary lectures, oral contributions and poster sessions devoted to modern problems of polymer science, in particular it considers natural and synthetic polymers for recovery, treatment and transportation of oil; nanocatalysts for processing of oil products; biotechnological and medicinal aspects of specialty polymers; specialty polymers for environment protection; specialty polymers in solar energy and nanophotonics.

The Kazakh-Uzbek Symposium on «Modern problems of polymer science» organized in the frame of ISTC special session was devoted to development of technology of production natural polymers for oil industry, biotechnology and medicine.

The Symposium materials can be helpful for researchers, university professors, PhD, M.Sc. and undergraduate students who are interested in problems of environment protection, oil industry, biotechnology, nanotechnology and medicine.

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DEAR PARTICIPANTS!

You are cordially welcomed to E.A. Buketov Karaganda State University to take part at the 8th International Symposium on Specialty Polymers. Its history was started in 2002 in the framework of INTAS Conference to draw the attention of governmental, national and international agencies, scientific society and local administration to the ecological problems of the Semipalatinsk Nuclear Test Sites. The next International Workshop with extended topics on biotechnology and supported by INTAS was held in 2003. The following meeting in 2006 was held at Shakarim Semipalatinsk State University and dedicated to academician Esen Bekturov's 75th Birthday. In 2008 the third workshop was organized at A.B. Bekturov Institute of Chemical Sciences and taking into account the fast and worldwide development of advanced technologies its topic was enlarged by biotechnological, nanotechnological and medicinal aspects of specialty polymers. In 2011 and 2017 the 4th and 7th International Workshops on Specialty Polymers was organized at K.I. Satbayev Kazakh National Research Technical University. The 5th International Workshop on Specialty Polymers was held on the shores of Lake Issyk-Kul – the Pearl of Kyrgyzstan in 2013. The main topics considered were new materials for industry, environment protection and human health. The 6th International Workshop was organized in 2015 at Shakarim State University to discuss the topical issues of «smart» polymeric nano- and biomaterials as well as «green» technologies and «green» energy that were one of the main topics of EXPO-2017 in Kazakhstan. The program of the present 8th International Symposium was considerably expanded by ISTC special session devoted to Kazakh-Uzbek Symposium on «Modern Problems of Polymer Science». We would like to thank all participants for their agreement to take part and give the plenary lectures, oral contributions and poster presentations as well as for submitting of valuable and interesting abstracts that raise the scientific value of this event.

Rector of Karaganda State University,
Professor Azamat Yedrissov, Chairman

Director of Institute of Polymer Materials and Technology, Professor Sarkyt Kudaibergenov
Co-Chairman

PROGRAMME AND ABSTRACT BOOK
OF THE VIII INTERNATIONAL SYMPOSIUM ON SPECIALTY POLYMERS
23-25 August 2019, Karaganda, Kazakhstan

August 23, 2019

Conference Hall of Buketov KSU, 28, Universitetskaya Str.

09.00 – 09.20	Registration of participants
09.20 – 09.30	Welcome Address
09.30 – 10.30	Plenary Lectures
10.30 – 11.00	*Coffee Break*
11.00 – 12.30	Plenary Lectures
12.30 – 14.00	*Lunch*
14.00	Trip to the Resort Area «Tasbulak» (Karkaralinsk, Karaganda region)
18.00 – 19.00	Plenary Lectures (Conference Hall of Resort Area «Tasbulak»)
19.00 – 20.00	*Dinner*
20.00 – 21.30	Welcome Party

August 24, 2019

Conference Hall of Resort Area «Tasbulak»

07.00 – 09.00	*Breakfast*
09.00 – 10.30	Plenary Lectures
10.30 – 11.00	*Coffee break*
11.00 – 12.30	Plenary Lectures
12.30 – 13.30	*Lunch*
13.30 – 14.45	Oral contributions
14.45 – 15.15	*Coffee break*
15.15 – 16.15	Oral contributions
16.15 – 18.00	Poster session
18.00 – 19.00	*Dinner*

August 25, 2019

Conference Hall of Resort Area «Tasbulak»

07.00 – 09.00	*Breakfast*
09.00 – 13.00	**ISTC special session devoted to Kazakh-Uzbek Symposium on «Modern Problems of Polymer Science»**
13.00 – 13.15	Closing Ceremony
13.15 – 14.15	*Lunch*
14.30	Trip to Karaganda city
19.00	Departure

August 23, 2019

Conference Hall of Buketov KSU, 28, Universitetskaya Str.

09.00 – 09.20 Registration of Participants

WELCOME ADDRESS

09.20 – 09.25 **Azamat Yedrissov** – Rector of Buketov Karaganda State University, Kazakhstan

09.25 – 09.30 **Aidyn Turebayev** – Deputy Executive Director of ISTC

PLENARY LECTURES

09.30 – 10.00 **K.Oka, B.Winther-Jensen, H.Nishide** – Waseda University, Japan

SOLAR-DRIVEN WATER SPLITTING WITH A SPECIALTY POLYMER

10.00 – 10.30 **J.Siirilä, V.Baddam, H.Tenhu** – University of Helsinki, Finland

PHASE SEPARATION AND REMIXING OF AQUEOUS RESPONSIVE POLYMERS

10.30 – 11.00 ***Coffee Break***

11.00 – 11.30 **V.I.Lozinsky, L.G.Damshkaln, O.Yu.Kolosova, E.A.Podorozhko, A.N.Ryabev** - A.N. Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Russian Federation

POLY (VINYL ALCOHOL) CRYOGELS – MODERN ADVANCED POLYMERIC MATERIALS FOR THE IMPLEMENTATION IN VARIOUS AREAS THAT INCLUDE BIOTECHNOLOGY, MEDICINE, CHEMICAL PROCESSES, ENVIRONMENT PROTECTION, CONSTRUCTION AND OTHERS

11.30 – 12.00 **V.Khutoryanskiy** – Reading School of Pharmacy, University of Reading, United Kingdom

NEW TRENDS IN THE DEVELOPMENT OF POLYMERIC MATERIALS FOR TRANSMUCOSAL DRUG DELIVERY

12.00 – 12.30 **A.Mentbayeva[1,2], S.Kalybekkyzy[1,3], Al-F. Kopzhasar[1,4], M.V.Kahraman[3], Zh.Bakenov[1,2]** – [1]National Laboratory, Astana, School of Engineering, Nazarbayev University, Kazakhstan, [2]Institute of Batteries, Kazakhstan, [3]Department of Chemistry, Marmara University, Turkey, [4]Department of Chemistry and Chemical Technology, S.Toraighyrov Pavlodar State University, Kazakhstan.

FLEXIBLE SOLID POLYMER ELECTROLYTE FOR LITHIUM-ION BATTERIES

12.30 – 14.00 ***Lunch***

14.00 **Trip to the Resort Area «Tasbulak» (Karkaralinsk, Karaganda region)**

18.00 – 18.30 **S.Filippov[1], L.Kaberov[2], R.Hoogenboom[3]** – [1]School of Engineering and Science, Harvard University, Cambridge, MA, USA, [2]Institute of Macromolecular Chemistry, Prague, Czech Republic, [3]Ghent University, Ghent, Belgium

BEYOND CLASSICAL HYDROPHILIC-HYDROPHOBIC AMPHIPHILES: TRIBLOCK POLY(2-OXAZOLINE)S WITH A FLUORINATED BLOCK AS A NEW PLATFORM FOR ADVANCED SELF-ASSEMBLY

18.30 – 19.00 **P.Chytil, T.Etrych** – Institute of Macromolecular Chemistry, Czech Academy of Sciences, Czech Republic

POLYMER-DRUG CONJUGATES FOR ONCOTHERAPY AND IMMUNOONCOTHERAPY

19.00 – 20.00 ***Dinner***

20.00 – 21.30 ***Welcome Party***

August 24, 2019

PLENARY LECTURES (Resort Area «Tasbulak»)

Moderator:	**Sarkyt Kudaibergenov** – Director of the Institute of Polymer Materials and Technology, Head of the Laboratory of Engineering Profile, Satbayev University, Kazakhstan
09.00 – 09.30	**O.Okay** – Istanbul Technical University, Turkey **SELF-HEALABLE HYDROGELS AND RUBBERS WITH SHAPE-MEMORY FUNCTIONS VIA HYDROPHOBIC INTERACTIONS**
09.30 – 10.00	**G.Dzhardimalieva** – Institute of Problems of Chemical Physics, Russian Academy of Sciences, Russia **CLUSTER-CONTAINING AND COORDINATION POLYMERS: FROM DESIGN TO PROPERTIES**
10.00 – 10.30	**A.Z.Dzhumanazarova**[1], **B.K.Sadybakasov**[2] – [1]Institute of Chemistry and Phytotechnologies of the NAS, [2]Kyrgyz-Russian Slavic University, Kyrgyz Republic **NATURAL POLYMERS FOR IMPROVING THE PROPERTIES OF SYNTHETIC AND PLANT PESTICIDES**
10.30 – 11.00	***Coffee break***
11.00 – 11.30	**B.Sadybakasov** – Kyrgyz-Russian Slavic University, Kyrgyzstan **CONCERNING THE ACCURACY OF GEOLOGICAL AGE OF ROCKS DEFINITION BY THE METHOD OF NUCLEAR GEOCHRONOLOGY**
11.30 – 12.00	**G.Mun** – al-Farabi Kazakh National University, Kazakhstan **DEVELOPMENT OF POLYMER HYDROGEL MATERIALS RADIATON TECHNOLOGY FOR BIOMEDICAL APPLICATION**
12.00 – 12.30	**R.Pola**[1], **E.Böhmová**[1], **M.Filipová**[1], **M.Pechar**[1], **D.Větvička**[2], **J.Pankrác**[3], **O.Janoušková**[1], **L.Šefc**[3], **T.Etrych**[1] – [1]Institute of Macromolecular Chemistry, Czech Academy of Sciences, Czech Republic, [2]Institute of Biophysics and Informatics, First Faculty of Medicine, Charles University, Czech Republic, [3]Center for Advanced Preclinical Imaging (CAPI), First Faculty of Medicine, Charles University, Czech Republic **POLYMER PROBES TARGETED BY PEPTIDE USED FOR FLUORESCENCE-GUIDED ENDOSCOPIC SURGERY OF EGFR-POSITIVE TUMORS**
12.30 – 13.30	***Lunch***

ORAL CONTRIBUTIONS (Resort Area «Tasbulak»)

13.30 – 13.45 **M.Abutalip, R.K.Rakhmetullayeva** – al-Farabi Kazakh National University, Kazakhstan

SELF-ASSEMBLY PROPERTIES OF POLYCARBOXYBETAINES PREPARED BY RAFT POLYMERIZATION

13.45 – 14.00 **M.Sagyndikov[1], B.Imanbayev[1], A.Tarbanov[1], Y.Ogay[2]** - [1]LLP «KMG Engineering» «KazNIPImunaigas», Kazakhstan, [2]LLP «KMG Engineering», Kazakhstan

STUDY OF HYDROLYZED POLYACRYLAMIDE (HPAM) DEGRADATION IN THE PRESENCE OF IRON IONS AND DISSOLVED OXYGEN AT KALAMKAS OIL FIELD DEVELOPMENT CONDITIONS

14.00 – 14.15 **B.Baltabayeva, Zh.Kassymova, A.Klivenko** – Shakarim State University Semey, Kazakhstan

DEVELOPMENT OF SOIL STRUCTURING AGENTS BASED ON INTERPOLYMER COMPLEXES

14.15 – 14.30 **L.E.Agibayeva, R.A.Mangazbayeva, G.A.Mun** – al-Farabi Kazakh National University, Kazakhstan

PREPARATION AND CHARACTERIZATION OF THERMOTROPIC GELS BASED ON POLYSACCHARIDES

14.30 – 14.45 **T.K.Jumadilov, R.G.Kondaurov, A.M.Imangazy** - JSC «A.B. Bekturov Institute of Chemical Sciences», Kazakhstan

FEATURES OF DEVELOPMENT OF HIGHLY SELECTIVE INTERGEL SYSTEMS IN RELATION TO RARE-EARTH ELEMENTS IONS

14.45 – 15.15 ***Coffee Break***

15.15 – 15.30 **N.Bakranov[1], S.Kudaibergenov[1,2]** – [1]K.I. Satpayev Kazakh National Research Technical University, Kazakhstan, [2]Institute of Polymer Materials and Technology, Kazakhstan

1D NANOCOMPOSITES FOR PEC WATER SPLITTING REACTION

15.30 – 15.45 **E.T.Talgatov, N.Z.Tumabayev, K.S.Seitkalieva** – D.V.Sokolskiy Institute of Fuel, Catalysis and Electrochemistry, Kazakhstan

PALLADIUM CATALYSTS ON POLYMER-MODIFIED MAGNETIC SUPPORT FOR PHENYLACETYLENE HYDROGENATION

15.45 – 16.00 **N.Ibrayev, E.Seliverstova** – Buketov Karaganda State University, Kazakhstan

SPECTRAL-LUMINESCENT PROPERTIES OF POLYMETHINE DYES OF DIFFERENT IONICITY, DOPED IN THE PHOTOCONDUCTIVE POLYMER MATRIX

16.00 – 16.15 **G.K.Kudaibergen, E.M.Tazhbaev, G.K.Burkeeva, A.T.Kazhmuratova, S.K.Topaeva, A.A. Muratbekova** – Buketov Karaganda State University, Kazakhstan

SYNTHESIS OF TERPOLYMERS BASED ON POLYPROPYLENE FUMARATE, ACRYLIC ACID AND DIMETHYLAMINOETHYLMETHACRYLATE

16.15 – 18.00 **POSTER SESSION**

18.00 – 19.00 ***Dinner***

August 25, 2019

Resort Area «Tasbulak»

ISTC special session devoted to Kazakh-Uzbek Symposium on «Modern Problems of Polymer Science»

Moderator: **Erkeblan Tazhbayev** – Vice-Rector for Innovation in Science and Technology, Buketov Karaganda State University, Kazakhstan

PLENARY LECTURES

9.00 – 09.30 **S.Rashidova** – Institute of Polymer Chemistry and Physics of Uzbek Academy of Sciences, Uzbekistan

STATE AND MODERN PERSPECTIVES FOR DEVELOPMENT OF POLYMER SCIENCE IN UZBEKISTAN

ORAL CONTRIBUTIONS

09.30 – 09.45 **E.Bekturov** – Abay Kazakh National Pedagogical University, Kazakhstan

POLYMERS IN NANOTECHNOLOGY

09.45 – 10.00 **N.R.Ashurov, S.E.Maksimov, B.L.Oksengendler** – Institute of Polymer Chemistry and Physics of Uzbek Academy of Sciences, Uzbekistan

STATE AND PROSPECTS OF DEVELOPMENT OF ALTERNATIVE ENERGY SOURCES ON THE BASIS OF PEROVSKITE AND POLYCONJUGATED POLYMERS

10.00 – 10.15 **A.Sarymsakov** – Institute of Polymer Chemistry and Physics of Uzbek Academy of Sciences, Uzbekistan

POLYMERIC FORMS OF DRUGS

10.15 – 10.30 **M.M.Usmanova[1], V.V.Dolgov[1], N.R.Ashurov[1], A.T.Dadahodzhaev[2], S.Sh.Rashidova[1]** – [1]Institute of Polymer Chemistry and Physics, Academy of Sciences of the Republic of Uzbekistan, Uzbekistan, [2]Innovation Center of JSC «Uzkimyosanoat» and JSC «Maksam-Chirchik», Uzbekistan

OBTAINING OF NANOCATALIZERS BY LOW-TEMPERATURE CONVERSION OF OXIDE CARBON CuO / ZnO / Al2O3 WITH REDUCED COPPER CONTENT

10.30 – 11.00 ***Coffee break***

11.00 – 11.15 **A.A.Atakhanov, I.H.Turdikulov, B.N.Mamadiyorov** – Institute of Polymer Chemistry and Physics, Uzbekistan

BIODEGRADABLE COMPOSITE MATERIALS BASED ON POLYETHYLENE AND STARCH

11.15 – 11.30 **N.R.Vokhidova, S.Sh.Rashidova** – Institute of Polymer Chemistry and Physics of Academy of Sciences of the Republic of Uzbekistan, Uzbekistan

OBTAINING COMPLEXES OF CHITOSAN BOMBYX MORI WITH BIOLOGICAL ACTIVE PROPERTIES

11.30 – 11.45 **I.N.Nurgaliev, B.L.Oksengendler, S.Sh.Rashidova** – Institute of Polymer Chemistry and Physics, Tashkent, Uzbekistan

ON THE CONCEPT OF A QUANTUM CHEMICAL THEORY OF THE REACTIVITY OF FUNCTIONAL GROUPS OF POLYMERS

11.45 – 12.00 **V.O.Kudyshkin, Z.M.Abrarova, S.Sh.Rashidova** – Institute of Polymer Chemistry and Physics Academy of Sciences of Uzbekistan, Uzbekistan

REGULATION OF FORMATION THREE-DIMENSIONAL STRUCTURES OF POLYACRYLIC ACID IN RADICAL POLYMERIZATION

12.00 – 12.15 **M.G.Mukhamediev, D.J.Bekchanov, M.M.Juraev, S.Hushvaqtov** – Mirzo Ulugbek National University of Uzbekistan, Uzbekistan

NEW CATION EXCHANGE RESINES BASED ON POLYVINYLCHLORIDE

12.15 – 12.30 **D.Afanasyev[1,2], N.Ibrayev[1], E.Alikhaidarova[1]** – [1]Buketov Karaganda State University, Kazakhstan, [2]Institute of Applied Mathematics, Kazakhstan

OPTICAL AND ELECTRICAL PROPERTIES OF COMPOSITIONAL FILMS BASED ON SEMICONDUCTOR POLYMERS DOPED BY Ag - TiO2 AND Ag-SiO2 NANOSTRUCTURES

12.30 – 12.45 **B.S.Selenova[1], S.K.Kabdrakhmanova[1,2], R.T.Tursunova[1]** – [1]K.I.Satbayev Kazakh National Research Technical University, Kazakhstan, [2]Institute of Polymer Materials and Technology, Kazakhstan

SYNTHESIS AND CHARACTERIZATION OF CATALYSTS BASED ON POLYMER PROTECTED BIMETALLIC NANOPARTICLES

12.45 – 13.00 **B. Totkhuskyzy[1] T. Dzhumadilov[2] Gražulevicius Juozas Vidas** – [1]RGP on PVC «Kazakh National Women's Teacher Training University», Almaty, Kazakhstan, [2]JSC «A.B. Bekturov Institute of Chemical Sciences», Almaty, Kazakhstan

SOME PECULIARITIES OF THE INTERACTION OF SCANDIUM AND YTTRIUM IONS WITH ACTIVATED HYDROGELS

13.00 – 13.15 **Closing Ceremony**

13.15 – 14.15 ***Lunch***

14.30 **Trip to Karaganda city**

19.00 **Departure**

LIST OF POSTERS

1. **A.Zharmagambetova** - D.Sokolskiy Institute of Fuel, Catalysis & Electrochemistry, Kazakhstan

   EFFECT OF POLYMERS ON THE SUPPORTED CATALYSTS FOR HYDROGENATION

2. **M.K.Akhmetova[1], A.Z.Bekeshev[1], V.V.Khutoryanskiy[2]** - [1]K.Zhubanov Aktobe Regional State University, Kazakhstan, [2]University of Reading, Reading School of Pharmacy, Reading, United Kingdom

   PREPARATION OF PHARMACEUTICAL MATERIALS FROM WATER-SOLUBLE POLYMERS USING HOT MELT EXTRUSION

3. **D.Khrustalev[1], A.Yedrissov[2], A.Khrustaleva[1], O.Tyagunova[1]** - [1]Medical University of Karaganda, Kazakhstan, [2]Karaganda State University, Kazakhstan

   THE PREPARATION OF PHENOL-FORMALDEHYDE FOAMUNDER MICROWAVE IRRADIATION

4. **N.Ibrayev[1], A.Yedrissov[1], D.Afanasyev[1,2]** - [1]Buketov Karaganda State University, Kazakhstan, [2]Institute of Applied Mathematics, Kazakhstan

   SPIN-SELECTIVE CHARGE RECOMBINATION IN HALOGEN-CONTAINING DERIVATIVES OF POLY–N–EPOXYPROPYL CARBAZOLE DOPED WITH POLYMETHINE DYE

5. **S.N.Akhmetova, A.S.Auyezkhanova, E.T.Talgatov** - D.Sokolskiy Institute of Fuel, Catalysis & Electrochemistry, Kazakhstan

   PREPARATION OF HEC-CONTAINING PALLADIUM NANOCATALYSTS FOR HYDROGENATION

6. **S.N.Akhmetova, A.S.Auyezkhanova, N.Zh.Tumabayev** - D.Sokolskiy Institute of Fuel, Catalysis & Electrochemistry, Kazakhstan

   POLYSACCHARIDE-STABILIZED CHROMIUM CATALYSTS FOR OXIDATION

7. **M.Dauletbekova[1,2], G.Toleutay[1,2]** - [1]Institute of Polymer Materials and Technology, Kazakhstan, [2]Laboratory of Engineering Profile, K.I. Satbayev Kazakh National Research Technical University, Kazakhstan

   HYDROGENATION OF NITROCOMPOUNDS BY SILVER AND GOLD NANOPARTICLES IMMOBILIZED WITHIN POLYAMPHOLYTE CRYOGELS

8. **El-S.Negim[1,2], L.Bekbayeva[3], G.Yeligbayeva[3], G.A.Mun[4], E.Ganjian[5]** - [1]KBTU, Kazakhstan, [2]National Research Centre, Polymer & Pigment Department, Egypt, [3]Satbayev University, Kazakhstan, [4]Al-Faraby Kazakh National University, Kazakhstan, [5]Coventry University, UK

   MODIFICATION OF CHITOSAN AND ITS APPLICATION IN CEMENT AS CHEMICAL ADMIXTURE

9. **A.S.Dzhalmukhanova, S.V.Karpov, V.P.Lodygina, V.V.Komratova, E.R.Badamshina** - Institute of Problems of Chemical Physics, Russian Academy of Sciences, Russia

   KINETICS OF THE REACTIONS ISOPHORONE DIISOCYANATE WITH POLY(1,4-BUTYLENE ADIPATE) AND WATER-DISPERSIBLE POLYURETHANES BASED ON THEM

10. **D.S.Kazybayeva, R.A.Shulen, G.S.Irmukhametova** - Al-Farabi Kazakh National University, Kazakhstan

    SYNTHESIS OF PETA-PEMP BASED GELS AS BIODEGRADABLE DOSAGE FORMS

11. **N.Mukhametgazy[1], I.Gussenov[2], A.Shakhvorostov[1,2]** - [1]Laboratory of Engineering Profile, K.I.Satpayev Kazakh National Research University, Kazakhstan, [2]Institute of Polymer Materials and Technology, Kazakhstan

    SALT TOLERANT ACRYLAMIDE BASED QUENCHED POLYAMPHOLYTES FOR POLYMER FLOODING

12. **M.S.Malyshev[1], N.V.Reznikova[2], K.A.Mirzakhidov[2], A.Sh. Abdurazzakov[3]** - [1]Specialized Scientific and Practical Center of Oncology and Radiology, Uzbekistan, [2]Mirzo Ulugbek National University of Uzbekistan, Uzbekistan, [3]Institute of Chemistry of Plant Substances named after S. Yunusov, Uzbekistan

    THE INTERACTION OF SOME DERIVATIVES OF BENZIMIDAZOLE WITH POLYELECTROLYTES IN AQUEOUS AND WATER-ALCOHOL MEDIUM

13. **D.T.Abduletip, P.I.Urkimbayeva, G.A.Mun, Z.A.Kenessova, B.Khavilhairat** - al-Farabi Kazakh National University, Kazakhstan

    APPLICATION OF COMPOSITE MATERIALS BASED ON POLYVINYL ALCOHOL DURING SOIL PHYTOREMEDIATION

14. **G.S.Aitkaliyeva, G.I.Boyko, N.P.Lyubchenko, R.G.Sarmurzina, U.S.Karabalin, D.S.Tiyessov -** Satbayev University, Kazakhstan

    FUNCTIONALIZED ATACTIC POLYPROPYLENE: PROPERTIES, APPLICATION

15. **E.O.Batyrbekov[1], M.B.Umerzakova[1], Z.T.Utelbaeva[2]** - [1]Institute of Chemical Sciences, Kazakhstan, [2]Kazakh State Medical Institute, Kazakhstan

    EVALUATION OF NATURAL POLYSACCHARIDES FOR CONTROLLED RELEASE OF MEXIDOLE

16. **E.O.Batyrbekov, M.B.Umerzakova** - Institute of Chemical Sciences, Kazakhstan

    SUSTAINED RELEASE OF TILOZINE FROM CALCIUM ALGINATE MICROPARTICLES

17. **T.R.Ziyayeva, G.I.Boyko, N.P.Lyubchenko, R.G.Sarmurzina, V.N.Ayukayeva, U.S.Karabalin, D.S.Tiyessov** - Satbayev University, Kazakstan

    NEW CORROSION AND SCALING INHIBITORS BASED ON MODIFIED MALEIC ANHYDRIDE COPOLYMERS

18. **N.S.Kobilov., K.S.Negmatova., Kh.Y.Rakhimov., E.B.Dusmurodov** - State Unitary Enterprise «Fan va Tarakkiyot» TSTU, Uzbekistan

    DEVELOPMENT OF COMPOSITE POLYMER REAGENTS AND WEGHTED DRILLING MUD FOR DRILLING OIL AND GAS WELLS

19. **V.E.Kurmanova[1,2], A.N.Ryabev[2], V.I.Lozinsky[2]** - [1]Higher Chemical College of the Russian Academy of Sciences, Russia, [2]A.N.Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Russia

    ON THE POSSIBILITY OF QUANTITATIVE DETERMINATION OF THE CROSS-LINKING DEGREE WITHIN THE SPATIAL NETWORK OF COVALENTLY-LINKED POLYMERIC CRYOGELS

20. **M.Rakhimova[1], A.Mametova[2], A.Dzhumanazarova[3], R.Askalieva[4], G.Dzhakypova[2]** - [1]Tajik National University, Tajik Republic, [2]Osh State University, Kyrgyzstan, [3]Institute of Chemistry and Phytotechnologies, Kyrgyzstan, [4]Kyrgyz State Medical Academy, Kyrgyzstan

    PROCESS OF COMPLEX FORMATION IN THE SYSTEM Fe (II) – Fe (III) – ACRYLAMIDE – WATER AND THEIR CHEMICAL MODELS

21. **O.Yu.Kolosova, P.A.Karelina, V.I.Lozinsky** - A.N.Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Russia

    POLY (VINYL ALCOHOL) CRYOGELS FORMED IN THE PRESENCE OF LOW-MOLECULAR-WEIGHT AMINO ACIDS

22. **Ye.M.Suleimen[1], B.Suleimenova[1], R.I.Jalmakhanbetova[1], R.V.Riguera[2]** - [1]Institute of Applied Chemistry, L.N. Gumilyov Eurasian National University, Kazakstan, [2]Santiago De Compostela University, Spain

    APPROACHES TO THE SYNTHESIS HELICAL POLYMER ON THE BASIS OF BETULIN

23. **E.K.Ozhmukhametova[1], A.Zh.Saimova[1], D.B.Kaldybekov[2,3], G.K.Abilova[2], D.S.Kazybayeva[1], G.S.Irmukhametova[1], V.V.Khutoryanskiy[2]** - [1]Semey State Medical University, Kazakhstan, [2]School of Pharmacy, University of Reading, UK, [3]Department of Chemistry and Chemical Technology, Al-Farabi Kazakh National University, Kazakhstan

    IN VIVO STUDIES OF CHITOSAN/POLY (2-ETHYL-2-OXAZOLINE) FILMS FOR OCULAR DRUG DELIVERY

24. **E.A.Podorozhko[1], T.M.Razheva[1], N.A.Stepanov[2], E.N.Efremenko[2], V.I.Lozinsky[1]** - [1]A.N.Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Russia, [2]M.V.Lomonosov Moscow State University, Russia

    POLY (VINYL ALCOHOL) COMPOSITE CRYOGELS CONTAINING DIFFERENT CELLULOSE-BASED FILLERS

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64. **Zh.B.Satpaeva[1], A.V.Omasheva[1], S.O.Kenzhetaeva[1], D.Havlicek[2]** - [1]E.A. Buketov Karaganda State University, Kazakhstan, [2]Charles University in Prague, Czech Republic

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66. **A.Kh.Zhakina, O.V.Arnt, E.P.Vassilets** - Institute of Organic Synthesis and Coal Chemistry, Republic of Kazakhstan, Kazakhstan

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SOLAR-DRIVEN WATER SPLITTING WITH A SPECIALTY POLYMER

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Hydrogen producing via water-splitting directly from sunlight is a very appealing process, which would have significant environmental, economic, and geopolitical consequences if realized in a simple and cost-efficient manner. Most research in this area has focused on inorganic materials as light-absorbers and catalysts for photochemical water-splitting.

We recently found that polythiophenes act as both a sun light-harvester and catalyst for the hydrogen evolution reaction at high pH (where a conventional MnOx works as a counter anode of the water splitting). The polythiophenes were prepared by our procedure of iodine-vapour-assisted polymerization, which achieved the highest gravimetric photo-electrocatalytic conversion rate of ca.1 mol(H2) h−1 g−1at 0 V vs the reversible hydrogen electrode. Molecular designing allowed the polythiophenes to produce the very high photovoltage of 1.4 Vabove the theoretical potential for the complete water-splitting (1.23 V), and a one-photon-per-electron solar-driven water splitting setup with MnOxwas demonstrated. We also report a solar-driven ultra-high-rate oxygen reduction to hydrogen peroxide with high selectivity by utilizing the polythiophenes as a photocatalyst.

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PHASE SEPARATION AND REMIXING OF AQUEOUS RESPONSIVE POLYMERS

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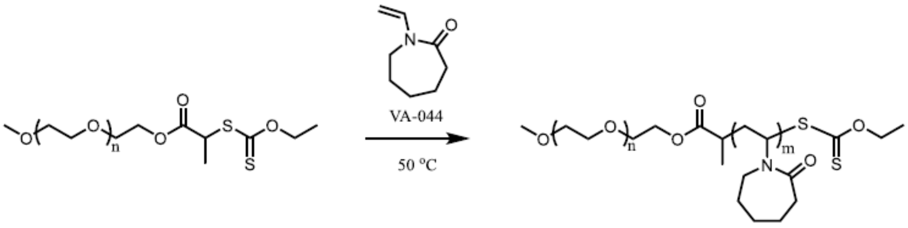
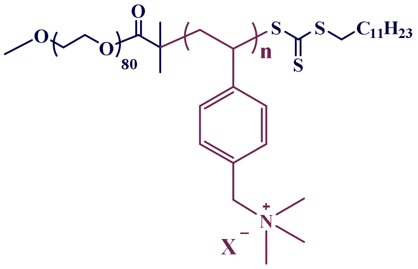
Several aqueous polymers undergo a sudden phase separation upon changing temperature. Phenomena behind the phase separation will be discussed using a few examples. Firstly, It will be shown how a LCST polymer poly(N-vinylcaprolactam) can be synthesized into interesting nanostructures through polymerization induced self assembly (PISA) reactions.



Secondly, mechanisms behind complex phase behavior of a PEG-polycationdiblock copolymer will be considered. Well defined block copolymers synthesized with RAFT reactions and having different DPs of the cationic blocks will be compared. It will be shown how the interactions between the ether units and cations may be modulated by varying the block ratio.



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POLY(VINYL ALCOHOL) CRYOGELS – MODERN ADVANCED POLYMERIC MATERIALS FOR THE IMPLEMENTATION IN VARIOUS AREAS THAT INCLUDE BIOTECHNOLOGY, MEDICINE, CHEMICAL PROCESSES, ENVIRONMENT PROTECTION, CONSTRUCTION AND OTHERS

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Poly(vinyl alcohol) cryogels (PVACGs) are formed as a result of consecutive freezing, incubating frozen and then thawing of concentrated solutions of the polymer [1-4]. The resultant cryogels are of significant practical interest in various applied fields, e.g. in biotechnology (carriers of immobilized molecules and cells, etc.), in medicine (artificial cartilages, covers on wounds and burns, gel standards for the verification of MRI and ultrasound apparatus), in chemical processes (carriers of catalysts), environment protection (reinforcing of thawed ground and soil), construction (antifiltration screens and watertight elements for dams of thawed or frozen types), etc. The key characteristic feature of PVACGs is their macroporosity, i.e. the presence of interconnected large (1-5 μm) pores in the gel bulk. Such pores are generated by the crystals of frozen solvent (ice in case of aqueous PVA solutions freezing); therefore the size and architecture of macropores in such cryogels depend on many factors capable of influencing the solvent crystallization behaviour. These factors are as follows: (i) solvent used (water or dimethylsolfoxide); (ii) properties of the gel-forming polymer (molecular weight characteristics of the PVA itself, tacticity of its chains, the amount of residual O-acyl groups) and its concentration in the initial feed solution; (iii) conditions of the cryogenic processing (freezing rate, temperature and duration of frozen storage, thawing rate, the number of freeze-thaw cycles); (iv) the presence of low- or/and high-molecular additives that possess the pore-modifying abilities. The rigidity and heat endurance of PVACGs increase as the initial polymer concentration grows. The same is also true for the influence of PVA molecular weight, whereas the increased amount of residual O-acyl groups is the unfavourable factor. The freezing rate within rather wide diapason (~0.1 – ~20 oC/min) affects weakly on the rheological properties and porous morphology of PVACGs, while frozen storage temperature biases a bell-like influence. The most principal significance has the regime of thawing: the slower the defrosting rate, the stronger the resultant cryogels and the more uniform and perfect their macroporous structure is. The increase in the number of freeze-thaw cycles results in the growth of gel’s rigidity and heat endurance with simultaneous certain widening of macropores. The additives of various low- and high-molecular weight solutes in the initial PVA solutions exert more sophisticated influence on the properties of the PVACGs. Thus, the effects of simple anions and cations correlate well with their order in the Hoffmeister’s series. The solutes with chaotropic abilities cause weakening of PVACGs and decrease in their fusion temperature, whereas kosmotropic agents strengthen PVA cryogels. Low-molecular solutes capable of dehydrating PVA chains (e.g., low-molecular alcohols) induce the microcoagulation of the polymer thus resulting in a decrease in the gel strength and in the formation of very heterogeneous macroporosity. The presence of surfactant additives causes “rounding” of the macropores due to a decrease in the surface tension at the solid-liquid interface upon the ice crystals growth. In turn, the presence of certain macromolecular additives in the initial PVA solution is able to induce the liquid-liquid phase segregation thus resulting in the formation of spongy cryogels possessing the system of interconnected gross (100-250 μm) pores in addition to smaller those usual for PVACGs.

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STATE AND MODERN PERSPECTIVES FOR DEVELOPMENT OF POLYMER SCIENCE IN UZBEKISTAN

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In the development of the economy of Uzbekistan, the creation of the polymer industry occupies a priority place. There is a tendency to use local raw materials to bring polymer products and materials to the market. At the same time, as shown by the experience of economically developed countries, the processing of industrial wastes into valuable products can significantly affect economic growth and environmental safety.

In connection with that, the main scientific objectives of the Institute of Polymer Chemistry and Physics (IPCP) of the Academy of Sciences of the Republic of Uzbekistan are development of new technologies and improvement of available ones for synthesis and processing of natural and synthetic polymers, in-depth research in the field of nanocomposite polymer materials, creation of polymer preparations and materials and their use in industries.

At the present stage of polymer science development, the nanoscale polymer systems are the subject of active research due to the possibilities of achieving a wide range of unique specific properties.

With the development of nanotechnology in the world, the direction of creating polymeric nanopreparations for medicine, pharmaceutics and agriculture in the form of medicines, medical products and plant protection chemicals with the aim of preventing and treating both people and crops is under development.

Functional polymer nanomaterials are widely used in various branches of human life. The development of new functional polymeric materials and improvement of available ones can not only significantly improve consumer qualities, but also lead to emergence of new generations of these systems that have predetermined properties.

The creation of nanocomposite materials based on natural and synthetic polymers is of great scientific and practical interest. The relevance of these studies is due to, firstly, the availability of raw materials (production of various grades of polyethylene at the Shurtan and Surguli gas-chemical complexes, huge deposits of layered aluminosilicates in the Republic of Uzbekistan), secondly, the need of many domestic enterprises for polymeric materials with special properties, and thirdly, the production of materials of the same quality as those imported from abroad. Fundamental research in this direction will help solve the problem of improving the operational properties of polyolefins - polyethylene, polypropylene and polyvinylchloride by selecting the conditions for functionalizing polyolefins, modifying the filler and producing nanocomposites.

The creation of efficient third-generation nanopolymer solar cells should be considered as a new direction having a breakthrough character and combining both theoretical and experimental studies.

The development of research in the field of nanopolymers with special properties will contribute to creating a new generation of nanostructured polymer preparations and materials with new unique properties.

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NEW TRENDS IN THE DEVELOPMENT OF POLYMERIC MATERIALS FOR TRANSMUCOSAL DRUG DELIVERY

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Mucosal membranes are wet surfaces lining human eye, airways, gastrointestinal and urogenital tracts. Drug delivery via mucosal surfaces offers a number of advantages including improved drug bioavailability and possibility of targeting particular organs [1]. Dosage forms for transmucosal drug delivery should either be able to stick to mucosal surfaces and retain on them (mucoadhesion) or be able to penetrate through mucus layer to reach epithelial cells (mucopenetration). This lecture will describe the design and characterisation of polymeric materials with enhanced ability to adhere to mucosal surfaces or enhanced ability to penetrate through mucosal barriers. A range of novel mucoadhesive polymeric materials were synthesised to have special functional groups such as thiol- [2], acrylate- [3], methacrylate- [4] and maleimide-[5, 6] capable of forming covalent linkages with thiol groups present in mucins on mucosal surfaces. Mucopenetrating materials should have inert and stealth surface chemistry [7]. We have developed mucopenetrating nanoparticles using thiolated silica decorated with poly(2-oxazoline) short chains [8, 9] and demonstrated that the nature of pendant groups strongly affects the ability of nanomaterials to penetrate. The application of these mucoadhesive and mucopenetrating polymeric systems for ocular, nasal, gastrointestinal and intravesical drug delivery will be discussed.

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BEYOND CLASSICAL HYDROPHILIC-HYDROPHOBIC AMPHIPHILES: TRIBLOCK POLY(2-OXAZOLINE)S WITH A FLUORINATED BLOCK AS A NEW PLATFORM FOR ADVANCED SELF-ASSEMBLY

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I want to make an overview of recent achievements in the field of the synthesis and self-assembly of triphilic poly(2-oxazoline) triblock copolymers. A variety of novel fluorine-containing copolymers was synthesized combining hydrophilic, hydrophobic and fluorophilic moieties into one segmented polymer [1-4] (Figure1). The presence of the blocks with the different nature in one copolymer structure facilitated self-assembly of the copolymers in water and some organic solvents as observed by dynamic light scattering, cryo-TEM, and small-angle neutron scattering. The nanoparticle morphology is strongly influenced by the order and length of each block and the nature of solvent, leading to nanoparticles with core-shell structure as confirmed by small angle neutron scattering. The supramolecular structures described represent a potential platform for 19F magnetic resonance imaging contrast agents.

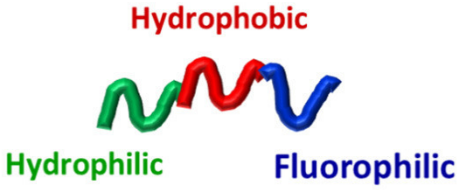

Figure 1. Chemical structure of triphilic poly(2-oxazoline) triblock copolymers.

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SELF-HEALABLE HYDROGELS AND RUBBERS WITH SHAPE-MEMORY FUNCTIONS VIA HYDROPHOBIC INTERACTIONS

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Significant progress has been achieved in the past years in the preparation of mechanically strong supramolecular polymers and hydrogels with several smart functions.1 Inspired by natural healing processes, reversible molecular interactions including hydrophobic interactions have been used recently to generate self-healing materials. In this talk I will present recent developments in this field by highlighting our ongoing research on self-healing and shape-memory materials prepared via hydrophobic interactions and crystalline domains.2-7 Several synthetic strategies for the preparation of mechanically strong supramolecular hydrogels, and rubbers containing alkyl crystals exhibiting self-healing and shape-memory functions will be discussed and their potential application areas will be presented.

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CLUSTER-CONTAINING AND COORDINATION POLYMERS: FROM DESIGN TO PROPERTIES

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Macromolecular complexes comprising cluster-containing and coordination polymers have recently attracted wide scientific attention due to their unique structural and functional properties [1,2]. Such high interest is caused by their interesting molecular topology and their excellent properties with promising applications such as catalysis, the storage and separation of gases, sensors etc. Metal-containing polymers under study are constructed frommetal ions ormetal ion clusters and bridging organic linkers (coordination polymers) or consist of macromolecular chain containing chemical bonded and structurally similar cluster repeating units (cluster-containing polymers). Depending on the coordination geometry of metal and bond directivity of donor atoms the polymer structures of 1D-, 2D- или 3D types are formed. We have obtained and characterized coordination polymers on the base of fumaric, maleic, muconic, acetylenedicarboxylic, trimesic acids. Bi-andpolynuclearstructureofmetalcarboxylateswithstablespatialfragmentssuch as lanterns and three nuclearicoxocenteredmetalclusterscanbeserveas secondary building blocks at the formation of three dimensional metal organic framework. Special attention is devoted to the analysis of catalytic properties of cluster-immobilized polymers and functional properties of coordination polymers including those as precursors of nanocomposite materials.

This work has been performed in accordance with the state tasks, state registration No 0089-2019-0008 and 0089-2019-0012.

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NATURAL POLYMERS IMPROVING THE PROPERTIES OF SYNTHETIC AND PLANT PESTICIDES

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Pesticides play an important role in maintaining the growing demand for food needed for the constantly increased population of the Earth. If pesticidesare not used, the loss of crop is from 30 to 80%.

Pesticides can be divided into two large groups – synthetic and natural origin. Thanks to synthetic pesticides, in the 60-s of the last century there is happened so-called "green revolution". However, they have become one of the largest organic pollutants of water and soil, causing concerns related to their impact on the environment and human life [1].

In order to reduce the harmful effects of pesticides on the environment, the following methods are developed:

- encapsulation of pesticides in various synthetic and natural polymers with controlled release of pesticides;
- application of nanotechnologies;
- synthesis of low molecular weight hydrogels for controlled release of pesticide active substance;
- synthesis of supramolecular complexes of pesticides with various substances that increase their solubility, and thus contribute to the bioavailability of the active substance;
- synthetic pesticides are replaced by bio-pesticides, including the ones from the plant materials.

In almost all the approaches listed above, to solve the problem of reducing the harmful effects of pesticides, polymers of both synthetic and natural origin play a key role.Natural polymers are gaining considerable acceptance over synthetic polymers as controlled-release devices because of their eco-friendly nature, cost effectiveness, easy availability, and biodegradability. Polysaccharidesareof particular interest since macromolecules consisting of monosaccharide units linked by glycosidic bonds [2].These compounds are found widely in nature, including in algae (alginate), plants (cellulose, pectin, cyclodextrin, and starch), microorganisms (dextran), and animals (chitosan). The molecules can be linear (for example, chitosan) or cyclic (such as cyclodextrin), and differ in terms of their charge, which can be neutral, positive, or negative. Advantages of these substances include their low cost and ready availability, which facilitates the large-scale production of products derived from them [2].

The most promising, but not yet widely used direction is the development of bio-pesticides to replace synthetic pesticides;the share of bio-pesticides in the world turnover is about 5%.Bio-pesticides, in contrast to synthetic pesticides, practically do not harm the environment;it is assumed that in the future they should completely replace synthetic ones [3].To increase the effectiveness of their impact, preserve their sustainability, especially for pesticides of plant origin, all of the above technologies are used.It is also forecasted that over the next twodecades, the ‘‘green revolution’’ would be accelerated by means of nanotechnology [4].

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CONCERNING THE ACCURACY OF GEOLOGICAL AGE OF ROCKS DEFINITION BY THE METHOD OF NUCLEAR GEOCHRONOLOGY

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The task of geochronology (and paleontology, in particular), as a complex of scientific methods, is to determine the age of terrestrial rocks [1]. The physical basis of the method is the phenomenon of radioactive decay of nuclei and the so-called decay constant λ or half-life $T_{1/2}$, the value of which are assumed to be constant. Radioactive decay is experienced by all isotopes in nature without exception, and their half-life periods vary within a very wide range – from nanosecond fractions (10^{-10} seconds) to a time comparable with the age of the Universe (10^{10} years) [2]. It is assumed that the decay constant does not change over time within an error of not more than 0.5% [3], and, for example, the age of the Earth ($4.54 \cdot 10^9$ years) was determined using the lead-lead method with an accuracy of ±1% [4]. However, in some rare cases, atoms can be completely ionized, so that the electrons are unable to escape from the nucleus of an atom and even to occupy the low-lying atomic orbitals. This phenomenon was first observed for ${}^{163}_{66}\mathrm{Dy}^{+}$ in 1992 by M. Young et all [5] in the Darmstadt heavy ion research group. Although the neutral ${}^{163}\mathrm{Dy}$ is considered as a stable isotope, the fully ionized ${}^{163}_{66}\mathrm{Dy}^{+}$ undergoes to β-decay in the K and L shells with a half-life period of 47 days.

Another possibility is that fully ionized atoms certainly undergo greatly accelerated β-decay, as it was observed by F. Bosch and others for ${}^{187}\mathrm{Re}$ [6]. Neutral ${}^{187}\mathrm{Re}$ undergoes β-decay with a half-life period of 42×10^9 years, but for fully ionized ${}^{187}_{75}\mathrm{Re}+$ this time is reduced by 10^9 times to 32.9 years. For comparison, the rate of decay of other nuclear processes due to the chemical environment is less than 1%. The nature of the periodic change of the decay constant of nuclei ${}^{32}_{14}\mathrm{Si}$ and ${}^{226}_{88}\mathrm{Ra}$ discovered by J. H. Jenkins and his colleagues [7] remains unclear. In particular, they found that the experimentally observed temporal fluctuations strongly correlated in time not only with each other (the results obtained for ${}^{32}_{14}\mathrm{Si}$ and ${}^{152}_{63}\mathrm{Eu}$, for which isotopes ${}^{36}_{17}\mathrm{Cl}$ and ${}^{226}_{88}\mathrm{Ra}$ were used as a long-lived standards), but also with the distance between the Earth and the Sun (parameter $\frac{1}{R^2}$). During the discussion of this phenomenon, it was suggested that the differences in the published half-life period definitions for these and other nuclides may be partly due to differences in solar activity during different experiments or even variations in fundamental constants.

Finally, publications [8,9] stated that significant reduction in the constants of decay of nuclei of some elements under the influence of some substance (of hyperplasia, in the terminology of the author [8]), produced in chemically active low temperature fluorocarbon plasmas. In particular, it describes the decrease in the activity of isotopes ${}^{85}_{38}\mathrm{Sr}$ and ${}^{106}_{44}\mathrm{Ru}$ at 20% with a mistake of experiment of 1%. Thus, the number of external factors affecting the constant of radioactive decay, in addition to the above (the distance to the nearest stars, primarily to the Sun, and their activity), include the amount of radioactive material, the degree of ionization of its atoms, as well as, perhaps, the impact of external fields, the nature of which is not fully understood. These external factors in some cases can have a significant impact on the results of determining the age of rocks (more than 20%) by nuclear geochronology.

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POLYMERS IN NANOTECHNOLOGY

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Polymers possess a great potential for development of nanomaterials and nanodevices. For systematization of basic objects, terms and formulation of common approaches to investigation of polymeric nanosystems, it is required a comprehensive analysis of fundamental and applied aspects of polymeric nanomaterails accumulated last years. Due to their composite structure and unique properties, such as improved mechanical, thermal, electrical, and optical characteristics, polymeric nanoscale objects have found a wide application in medicine, membrane technology, optical engineering, and catalysis. Hybrid nanostructures composed of organic, inorganic, and polymer materials considerably expand our fundamental representations on nanocomposites that are “smart”, fast-developing and emerging fields of advanced materials and technology.

Recently published book of authors (E.A. Bekturov, S.E. Kudaibergenov, Zh.E. Ibrayeva. Polymers in Nanotechnology, Almaty, 2019, 388p.) is devoted to polymeric nanoscale objects, hybrid polymeric nanocomposites and metal nanoparticles (and their oxides) stabilized by polymers.

The first chapter of the book considers the polymeric nanostructures existing in 1D, 2D and 3D nanomaterails. Starting from nanoparticles of single macromolecules and ending by nanosized gels it includes star polymers, fibrils, nanotubes, micelles, polymeric brushes and dendrimers.

The second chapter of the book describes the hybrid polymeric nanocomposites, such as constructional nanocomposites, functional nanocomposites, nanosized polymeric films, membranes, multilayered nanocomposites, and nanocomposites based on liquid crystalline polymers.

Polymer stabilized metal nanoparticles and metal oxides are considered in the third chapter. It contains preparation methodology of polymer-protected metal nanoparticles and metal oxides, immobilization of polymer-metal complexes and polymer-protected metal nanoparticles into the matrix of organic and inorganic polymers, catalytic properties of polymer-protected metal nanoparticles deposited onto various supporters in oxidation, hydrogenation, decomposition of various substrates.

Each chapter is provided by references. In author’s opinion this book would be useful for postgraduate, master and PhD students, and teachers who are specialized in the fields of chemistry and physics of polymers, nanomaterials, nanotechnology, oil engineering and catalysis.

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EFFECT OF POLYMERS ON THE SUPPORTED CATALYSTS FOR HYDROGENATION

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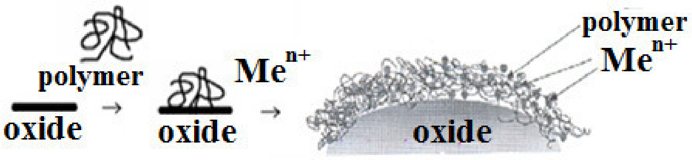
The effectiveness of supported catalysts depends on the composition, structure, size and uniform distribution of the active phase on the surface of the support. In recent years, much attention has been paid to the development of new methods of catalyst preparation based on transition metals nanoparticles stabilized with macromolecules.

The presentation is discussed the results of a study of a method for preparation of heterogeneous catalysts with even distribution of nanosized metal particles on supports based on strong and irreversible adsorption of soluble polymer on inorganic oxides and interaction of supported macromolecules with metal ions. The procedure includes: a) adsorption of polymer on a support; and b) fixation of transition metal ions on polymer coated oxides:



The proposed method makes it possible to prepare catalysts with uniformed metal active phase located both on the surface and inside the macromolecular matrix. The catalysts have shown high activity, selectivity and stability in the liquid phase hydrogenation of a wide range of unsaturated compounds under mild conditions [1, 2]. With proper selection of the solvent, the swollen surface layer of polymer-metal compound is formed during the process and can be considered as a flexible and mobile three-dimensional catalytic microreactor. Different physical and chemical methods have been used to characterize the developed catalysts and their changes after hydrogenation. The washing off active phase was insignificant due to the cooperative interactions of the functional groups of macromolecules with solid inorganic oxides used as supports. With a large number of inorganic carriers, as well as natural and synthetic polymers, the proposed method for producing catalysts seems to be promising for further application in various organic syntheses.

The promise of this direction is due to the intensive development of nanotechnology, methods for producing and stabilizing nanoparticles, as well as the presence of highly developed technologies for producing polymers with different functional groups with acidic, basic, donor or acceptor properties, which opens up broad possibilities for the synthesis of catalysts with desired properties.

The properties of the proposed catalysts have been compared in with the similar catalysts prepared by polyol method and frontal polymerization of metal-containing monomer in the presence of highly dispersed mineral support. Adventures and limitations of these three types of catalysts in the reaction of hydrogenation of acetylene compound at identical process conditions have been shown and discussed.

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SYNTHESIS AND CHARACTERIZATION OF CATALYSTS BASED ON POLYMER PROTECTED BIMETALLIC NANOPARTICLES

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The most common catalytic systems used for the reductive dehydrochlorination of organohalogen substances are palladium-containing catalysts on inert supports. The content of palladium in such catalysts reaches up to 10%. Therefore, studies to reduce the cost of palladium catalysts due to the "dilution" of the noble metal with other metals with low cost characteristics have been the trend of recent years. The development of nanomaterials and nanotechnology allows the creation and use of new types of bimetallic catalysts with a reduced Pd content. The presence of nano-sized palladium particles undoubtedly improves the course of the hydrodechlorination process of organohalogen substances, in particular chlorobenzene and polychlorinated biphenyls, which makes it possible to reduce the content of noble metal in the catalyst.

We have carried out work on the development of bimetallic catalysts based on noble nanoparticles (palladium) and transition metals (nickel) deposited on the natural montmorillonite clay from the deposit (Almaty region, Kazakhstan). Previously, the work was carried out to study and modify the physicochemical properties of the natural clay from the Kolzhat deposit. The phase and elemental composition of the Kolzhat clay was studied using X-ray diffraction and atomic emission spectrometry with inductively coupled plasma. It is established that the basis of the Kolzhat clay is oxides of aluminum, silicon and iron. Modification of montmorillonite clay was performed using concentrated nitric and hydrochloric acids. The optimal conditions for calcination of the Kolzhatmontmorillonite clay were determined.

The method of preparing Pd-Ni/Cly catalysts (Kolzhat clay) is based on stabilization with a 10% solution of poly-nVinylpyrrolidone and metal salts in volume ratios with 1:1 polymer, with further titration with 0.01 M sodium borohydride solution and applied to modified and calcined clay. The separation of the catalysts was carried out by filtration on a Buchner funnel. The obtained precipitate was repeatedly washed with distilled water and dried at a temperature of 100°C for 2-5 hours. The catalytic activity of the catalysts was tested by decomposition of hydrogen peroxide by the volumetric method according to the rate of oxygen evolution at temperatures of 65-85°C.

DEVELOPMENT OF POLYMER HYDROGEL MATERIALS RADIATON TECHNOLOGY FOR BIOMEDICAL APPLICATION

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This report presents the data obtained by our research group in the field of synthesis and characterization polymer hydrogel materials as well their biomedical application. In the work we have used various monomers, including hydroxyl containing vinyl ethers - vinyl ether of ethyleneglycol (VEEG), vinyl ether of diethyleneglycol (VEDEG). These monomers were produced in Kazakhstan in industrial scale earlier.

It is known that vinyl alkyl ethers are readily polymerized by cationic mechanism. Unlike vinyl alkyl ethers the functional vinyl ethers of glycols do not polymerized by cationic mechanism. The use of radical polymerization initiators results in the obtaining of oligomers only. Thus, in the radical polymerization the vinyl ethers show very low activity. The further research indicated that the method of radiation polymerization could be successfully used for preparation of polymer hydrogels based on these low active monomers.

The great fundamental information content has been obtained about these monomers and polymers including direct quantitative data of their structure formation mechanism and physicochemical properties. These data served as a basis for design of novel polymer hydrogels of different type including smart materials, which are able to respond on small changes of environmental parameters (temperature, pH, electric field). The radiation technology such hydrogel production has been developed.

As the result of many years collaboration with a number of leading medical centers of Kazakhstan and Russia the possibility of wide and effective application of these hydrogel materials in different areas of medicine has been found (contact hydrogel for ultrasonic diagnostics; hydrogel basis for medicinal and cosmetic ointments; hydrogel implant material).

The inject implant material (IIM) technology based on poly-VEEG hydrogel has been developed for endoscopic correction of vesicoureteral reflux (VUR). VUR is the most frequent form of urodynamic disorders, and this disease affects mostly children, in which case it progresses much faster and leads to serious irreversible morphofunctional changes in the kidneys and the superior urinary tracts.

Unlike the hydrogel implant material used today in soft tissue, the rheological properties of the IIM allow to transport it into the corrected areas of the body with an endoscope or with a regular syringe and a needle in quantities sufficient for the achievement of a stable functional and cosmetic effects.

The IIM has undergone a full complex of preclinical testing. It is established that IIM is completely conforms to the medical and biologic requirements for the implantation materials. Clinical tests estimating safety, tolerability and efficiency of IPIM for the treatment of VUR have begun and are in the process. The results of the clinical research for a period up to 6 months testify for high efficiency of IIM application in infantile urology at endoscopic correction of VUR.

The formulations of polymeric hydrogel dressings containing herbal remedies based on Kazakhstan herbal drugs or silver nanoparticles were designed and optimized also. As the gel-forming polymer for obtaining dressings poly-vinylpyrrolidone (PVP) was used. Biomedical tests of the obtained development samples of the hydrogel ointments and the dressings have been performed. The received preliminary results testify to high efficiency of use of hydrogel wound and ointments in treatment of extensive wounds and burns.

MODIFICATION OF CHITOSAN AND ITS APPLICATION IN CEMENT AS CHEMICAL ADMIXTURE

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ABSTRACT: Three different composition ratios of acrylic acid-g-chitosan P[AA-g-Ch] were prepared in the presence of potassium persulphate as an initiator using free radical technique. The grafted copolymers were characterized through FT-IR, TGA, DSC, and SEM. The results showed that these grafted copolymers have a single glass transition indicating that these copolymers are able to form a miscible phase. The P[AA-g-Ch] exhibit thermal stability. SEM of the grafted copolymers showed no phase separation, when compared with the pure Ch. The effect of grafted copolymers on the physico-mechanical properties of cement pastes was investigated. The addition of water mixed with grafted copolymer to the cement, improves characteristics of cement pastes. As the ratios of AA in the grafted copolymer increases, the water-to-cement (WC) ratio, setting time as well as water absorption decreases. While The compressive strength was sharply increased at nearly all hydration ages.

Keywords: Chitosan, Acrylic acid, Grafting polymerization, Portland Cement

RESEARCH HEATING AGING OF ADHESIVE COMPOUNDS

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The current stage of development of chemistry and technology of composite polymeric materials is largely determined by the search for ways to create materials with improved sets of properties, among which composite materials for producing adhesives take a special place.

Glue is mainly used for sticking paper decals, stickies and other identification warning signs on metal, glass plastic, cardboard and other containers, and can also be used in the food industry.

Phenol-formaldehyde resin is obtained on the basis of phenol and formaldehyde, which are toxic substances. Therefore, phenol-formaldehyde resin is also poisonous.

In this regard, there was a problem to develop composite polymer adhesives - a substitute for phenol-formaldehyde resin based on local raw materials and waste production of organic and inorganic origin.

In this regard, the development of an effective composition of a phenol-formaldehyde resin substitute based on local raw materials and industrial wastes for use in the manufacture of heat-insulating materials having high adhesion properties, ensuring good durability and heat resistance is an important issue.

With the prolonged effect of increased temperature on the adhesive joints, the strength changes due to thermal or thermal-oxidative degradation or due to the effect of thermal stresses due to the difference in linear expansion coefficients of the materials to be glued and adhesive. The latter circumstance is mostly decisive in the operation of adhesive joints in conditions of low temperatures or a sharp temperature difference. If the materials being glued under the action of temperature dry up and at the same time deform, then there are also stresses (humidity), which can be more destructive than thermal ones. Therefore, it is very important to find out the predominant mechanism of aging.

With prolonged exposure to high (and sometimes low) temperatures, the nature of the surface of the adhered materials may change.

The table shows the thermal aging of adhesive joints based on urea formaldehyde resin.

Table

Thermal aging of adhesive joints in adhesives with operating temperatures up to 8000C

Glue brand	Aging conditions		Breaking stress at shear, MPa					
	Tem-ra, 0C	Prod-st, h	In the initial state			After aging		
			- 600C	200C	600C	- 600C	200C	600C
K-153	60	500	9,1	9,7	9,0	9,5	10,5	8,9
Modified composite polymer adhesive	60	500	5,0	6,0	0,8	7,0	11,0	7,0

Thus, a formulation of modified glue based on synthetic fibers, caustic soda and with targeted additives has been developed. It has been established that the addition of target additives to the adhesive composition contributes to the improvement of their physical and mechanical characteristics.

PS

CONSTRUCTIONAL POLYAMIDE COMPOSITION MATERIALS OF FUNCTIONAL PURPOSE

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When developing polymer composite materials, the most important is the choice of material and fillers. This choice is based on the intended purpose of the material: for antifriction material, this is a low coefficient of friction with raw cotton in various operating conditions; for wear-resistant - minimum wear, and for antifriction and wear-resistant composite material - low friction coefficient and low wear of the material during friction with raw cotton are needed.

Based on the above, we have developed shock-resistant and anti-friction and wear-resistant composite materials based on polyamide (PA), in their established optimal ratios, providing functionally important physicomechanical, tribological and operational properties of composite polymeric materials raw Moreover, they have high anti-friction properties and wear resistance compared to steel.

Table

Properties of shock-resistant (ShPPAC) and antifriction and wear-resistant polyamide compositions (AWRPAC)

Indicators	ShPPAC-1	ShPPAC - 2	AWRPAC -1	AWRPAC - 2	AWRPAC -3
Destructive stress at bending σи, MPa	108,0	110,3	100,3	103,5	105,1
Impact strength, a, J/m2	137,5	139,0	135,1	138,2	141,0
Brinell Hb hardness Hb, MPa	84,0	85,7	85,0	87,3	89,4
Flexural modulus, Eb, GPa	2,1	1,95	2,0	2,2	2,3
The friction coefficient f (8 when P=0,01 MPa, V=1,5 m/s, W=8,2%)	0,35	0,33	0,35	0,34	0,32

As can be seen from the table, the properties of composite polyamide materials fully meet the functional requirements, meet the requirements imposed on the material of the parts of the rubbing pairs of the working parts of machines and mechanisms of the cotton complex, the main ones being the technology and efficiency of the material used, effective reduction of the damage of cotton fiber and seeds , elimination of static electricity accumulation, formation of fiber windings on the surface of spikes and sparks when colliding with solid bodies mi, located in raw cotton.

The use of developed composite polymeric materials as materials for parts of rubbing pairs of working parts of cotton machines and mechanisms operating under conditions of frictional interaction with raw cotton leads to an increase in the productivity of machines by 10–14% and a decrease in power consumption by 7-16%, damage to cotton fibers and fragmentation of seeds, as well as the elimination of the possible ignition of cotton cotton and the formation of coils of fiber on the surface of the pegs.

MODIFICATION OF EPOXY RESIN CUBE REMAINING FURFURYL ALCOHOL

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For corrosion protection of equipment in the chemical industry, as well as in engineering, various corrosion-resistant polymer coatings are widely used.

The properties of lacquer coatings are determined by the structure and structure of film-forming substances, pigments and fillers, i.e. the main components that make up the paintwork material, as well as various modifying additives (hardeners, surfactants, solvents), which determine the structure of the paintwork system and the properties of the coating.

Furan compounds are used in the manufacture of polymeric materials. Polymer materials modified with furan compounds acquire new operational characteristics, better processability, lower toxicity, high mechanical and chemical resistance, including in aggressive media.

The bottom residue of the production of furfuryl alcohol (tab.) Is a liquid with a specific smell of furfuryl alcohol, the density at 20 ° C is 1.120 ... 1.135 g / cm3, the hydroxyl number is within 11.0 ... 12.5 and pH = 6.5 ..On the basis of bottoms of pentosan-containing compounds, paint-and-lacquer compositions were obtained, coatings on the basis of which were used to effectively protect metal surfaces of pipelines and vehicle assemblies from corrosion instead of deficient bitumen insulation;

- the possibility of partial replacement of the film former ED-20 by the VAT residue of pentosan-containing compounds (COPS) was revealed. It is established that the best film former is a combined mixture of ED-20 with KOFS 1: 1;
- by mechanical activation of solid fillers (bentonite, kaolin, talc) increased the number of free radicals on the surface of the particles. This has significantly reduced the time of preparation of the compositions, ensuring a high homogeneity of the system and improving the complex of physical, mechanical and performance properties;
- studied the rheological and technological properties of the coatings obtained.

It is shown that the coverage, viability of the filled paintwork materials depend on their viscosity;

- a technology has been developed to produce and apply a wear-and-shock-corrosion-resistant polymer coating based on the bottom residue of pentosan-containing resins with epoxy resin;
- the method of mathematical modeling carried out the selection of the optimal composition of the paint composition;
- it is shown that the impact resistance of the obtained coatings is higher on average by 20%, which is equal to 50 kgf / cm, wear of the coating is 7%, bending is 1 mm;
- it was established that for prototypes the standard potentials are about 0.545 volts, and for water 0.422 volts. Corrosive current for water is ic = 0.467 MA, and for samples based on KOFS with ED-20 ic = 2.585 MA. It is shown that the filled samples have the maximum thermal stability and the thermal stability is improved by 50-70 ° C.

Thus, the theoretical background of the possibility of using some organic synthesis wastes to obtain anti-corrosion coatings that protect the surfaces of equipment from the corrosive effects of operating environments has been identified and analyzed. As can be seen from the above data, polymers are the main representatives of thermoplastic and thermosetting polymeric materials, which are widely used in many industries, and in particular for the anticorrosive protection of metals.

PS

INVESTIGATION OF PHYSICOCHEMICAL PROPERTIES OF POWDERED WATER-SOLUBLE MODIFIED GOCCIOLAVA RESINS AND THE POSSIBILITY OF THEIR APPLICATION AS SURFACTANTS FOR THE PREPARATION OF DRILLING FLUIDS WHEN DRILLING OIL AND GAS WELLS

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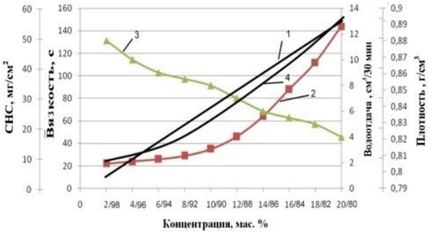
When creating a technology for producing effective composite polymer materials used for the preparation of drilling fluids that can be operated under various geological and technical conditions of drilling of the desired quality, it is important to use a powdered water-soluble modified gossypol resin (PVM-GS). The initial raw material for its production was viscous-flowing gossypol resin – waste oil and fat production after modification with caustic and calcined soda and aluminum.

Figure 1 shows the dependence of the physical, chemical and technological properties of 10% drilling fluids obtained using the composite polymer materials of the brand PVM-GS and CMC prepared on the mineralized water of the North Berdakh Deposit developed by us.



In the numerator – the content of CMC, in the denominator the content of PWM-HS

Fig 1. Dependence of density (1), viscosity (2), yield (3) and SNS10 (4) on the ratio of PWM-KS and CMC

From the course of curves Fig. 1 it can be seen that 10% drilling fluids, depending on the ratio of PWM-HS and CMC and their content, have different physical, chemical and technological properties. It is easy to notice that with the increase in the amount of PWM-HS in the drilling fluid, there is a decrease in all physical, chemical and technological parameters, except for the water yield index. Thus, when changing the ratio of PWM-HS and CMC from 2/98 to 20/80, the density of drilling fluids lies within 0.8 – 0.89 g/cm3, viscosity – from 22 to 144 s, water yield decreases from 11.5 to 4.0 cm3/30 min and SNA – from 10 to 56 mg/cm2.

The most acceptable of these formulations are those containing PWM-HS from 86 to 92% and CMC from 8 to 14%. At the CMC content in the composition from 2 to 6% viscosity and SNA of 10% drilling mud are relatively low and are unable to provide a complete release of drilling cuttings. At the above concentrations, the water yield is quite high, which sufficiently increases the permeability of the drilling fluid into the reservoir, of course, its consumption will be significant.

The developed technology makes it possible to produce surfactants consisting of organo-mineral ingredients based on local raw materials and industrial waste, and is used to improve the efficiency of the drilling process of oil and gas wells and increase the yield of products in complicated geological conditions of oil and gas areas of JSC "Uzbekneftegaz".

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PS

COMPOSITION OF CORROSION INHIBITORS BASED ON POLYAMINO-CROTONOL (PKI-3) AND COPPER-ZINC COMPLEX HYDROXYETHYLIDENE DIPHOSPHONIC ACID

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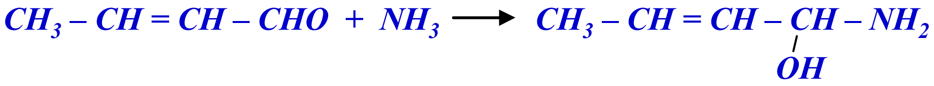
In the world, in order to obtain inhibitors of mineral salt deposits and corrosion, a number of priority areas are being studied [1], including: to obtain hydroxy, carboxy, and sulfooxy derivatives, as well as amino alcohols, by the condensation of amines and amides with ammonia and aldehydes, as well as the preparation of zinc salts complexation by the interaction of sodium zincate with an aqueous solution of organophosphonates.

Investigated corrosion inhibitors based on 1-amino-1-crotonol, the condensation product of crotonaldehyde and ammonia:



$$CH_3-CH=CH-CHO + NH_3 \longrightarrow CH_3-CH=CH-\underset{\displaystyle OH}{\underset{|}{CH}}-NH_2$$

In order to obtain corrosion inhibitors with higher efficiency, we continued research on the development of a composition based on the crotonic condensation product (PKI-3) in the presence of a solvent with the addition of organophosphonates and their zinc complexes of HEDP.

Conducting an electrode of low carbon steel St. 3 in 3.10-3 mol / l solution and NaCl and Na2S without the additive (l) and with the addition of inhibitors ESC-1 (2) and ESC-2 (3) are presented in Fig. 1 and Fig. 2.

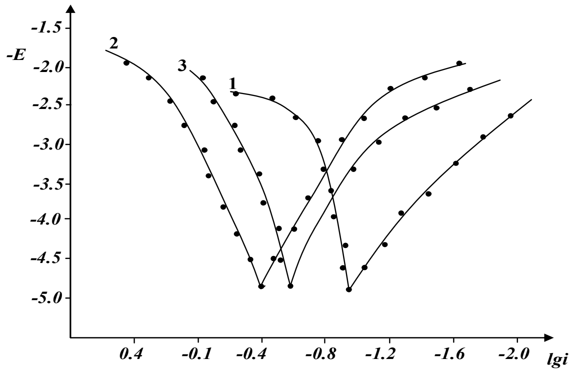


Fig.1. Polarization curves of a steel electrode in a background solution of 3.10–3 mol / l NaCl (1) in the presence of 1.10–3 ESC-1 (curves 2) and ESC-2 (curves 3)

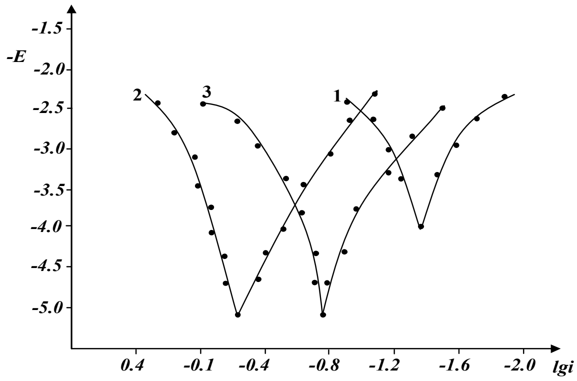


Fig.2. Polarization curves of a steel electrode in a background solution of 3.10–3 mol / l Na_2S (1) in the presence of 1.10–3 ESC-1 (curves 2) and ESC-2 (curves 3)

Increasing the concentration of inhibitors ESC-1 and ESC-2 three times in the first solution of Na2S lowers the maximum value of the corrosion rate. In the first hours of the test, small fluctuations in the corrosion rate also occur, after which the values of corrosion losses are equalized and reach 5.8 g / (m2.h). Inhibitor ESC-1 in a solution of Na2S is the most effective inhibitor of hydrogen sulfide corrosion of steel St. 3.

Thus, to protect St. 3 steel from corrosion in acidic and neutral media, inhibitors ESC-1 and ESC-1 can be recommended, for hydrosulphuric environments ESC-1.

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COMPOSITE POLYMERIC MATERIALS, ADDITIVES AND DRILLING FLUIDS BASED ON THEM, PREVENTING THE BIT BALLING WHILE DRILLING WELLS

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When drilling wells, especially with clay drilling fluids on the bit and the elements of the layout below the drill strings (BHA), in most cases, seals (oil seal destroyer) are formed, leading to a decrease in the mechanical speed of drilling, increased wear of the drilling tool and the appearance of tacks. All this together makes the quality of drilling fluids certain requirements that affect the prevention of certain accidents and complications.

The main task now before drillers of the oil and gas industry of our Republic is creation of technology of receiving the reliable and available additives to a drilling mud which are composite polymeric materials, heat-resistant and steady against aggressive influence of the drilling fluids interfering formation of oil seals (oil seal destroyer) [1].

The additive reagent should also reduce the friction of the drill string against the well wall, prevent or reduce the level of sticking and tightening during the str. At the same time, it should not change the parameters of the drilling fluid, to increase the mechanical speed of drilling on aqueous solutions. Finally, the additive reagent should prevent or minimize the formation of oil seals on the bit and BHA elements, wear of the drilling tool and thereby save the time of the str.

Thus, the creation of effective compositions of composite chemical reagents-additives and their introduction to the drilling mud, which prevents the formation of seals on the bit and BHA elements, is an extremely urgent problem.

This problem will be solved in two stages. In the first stage, effective compositions will be created and a technology for obtaining import-substituting and export-oriented, non-deficit, affordable and relatively cheap composite polymer materials-additives using food waste and other ingredients, their testing in drilling mud, which allows to prevent the formation of seals on the bit and BHA elements will be developed.

In the second stage, mini-production of drilling fluids on fresh and formation waters will be organized using the created composite polymer materials-additives; their production tests will be carried out at one of the wells under drilling conditions in the system of JSC "Uzbekneftegaz". Regulatory and technical documents for the production of composite polymer materials-additives to drilling mud that prevents the formation of oil seals (oil seal destroyer) will be developed and approved.

Thus, during the first and second stages of this work, optimal compositions will be developed, production technologies will be mastered and composite polymer materials will be introduced to the drilling fluid, which will prevent the formation of oil seals in the process of drilling oil and gas wells.

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PS

METHOD OF DEFINITION OF THE COEFFICIENT OF FRICTION OF ANTI-STATIC-HEAT CONDUCTING COMPOSITION POLYMER MATERIALS WITH INTERACTION WITH COTTON-CHEESE

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It is known that one of the most important operational characteristics of the material for the working bodies of the machines, ensuring maximum preservation of the natural properties of raw cotton, is its antifriction properties. It should be noted that, at present, there is no uniform methodology for studying the tribotechnical characteristics of structural composite polymeric materials and coatings based on them when interacting with raw cotton, which makes it difficult to choose composite polymeric materials with specified properties for the manufacture of parts of working bodies. machines and mechanisms and correctly assess the effectiveness of available research results.

The method of determining the coefficient of friction lies in the fact that raw cotton is laid inside the cylindrical box, and a piston with weights is laid on top. When the disc is rotated, the polymer coating carries along a cylindrical box with a sample of raw cotton and thereby tightens the cable, which, in turn, bends the beam with strain gauges. Mechanical deformation of the beam with the help of strain gauges is converted into electrical oscillations, and transmitted to the microprocessor (microcontroller). The micropressor is equipped with the Arduino UNO program, which connects the information with a special Chart Grafic program installed in the computer using a USB cable. The program Chart Grafic captures the signals received from the microprocessor, then the signals are recorded on the computer screen in the form of graphs. The tests were carried out under conditions of ambient air temperature (23 ± 3 ° C) and relative air humidity (52 ± 3%), as well as with a moisture content of raw cotton from 7.0 to 50.0% and a weediness of raw cotton, from 1.0 to 25.0%.

The table shows the obtained values of the friction coefficients of polyethylene (PE), polypropylene (PP), epoxy (E) and pentaplastic (PNP) composites.

Table The friction coefficients of polyethylene (PE), polypropylene (PP), epoxy (E) and pentaplastic (PNP) composites

Material	Coefficient friction, f	Material	Coefficient friction, f	Material	Coefficient friction, f
AACPEC-1	0,36	AACPPC-1	0,29	AWRACPPC -1	0,28
AACPEC-1	0,34	AACPPC -3	0,27	AWRACPPC -2	0,26
WRACEC-1	0,34	WRACPNPC-1	0,31	AWRACEC-1	0,28
WRACEC -2	0,36	WRACPNPC -2	0,32	AWRACEC -2	0,26
AACEC-1	0,24	AACPNPC-1	0,24	AWRACPNPC-1	0,26
AACEC -2	0,24	AACPNPC -2	0,24	AWRACPNPC -2	0,27

As can be seen from the table, the friction coefficient of antistatic-heat-conducting polyolefin and epoxy composite polymeric materials fully meets the functional requirements imposed on the material of parts of rubbing pairs of working parts of machines and mechanisms of the cotton complex, the most important of which are technology and cost-effectiveness of the material used, effective reduction of damage cotton fiber and seeds, the exception accumulation of static electricity, the formation of windings of fiber on the surface and spikes and sparks when colliding with solids in raw cotton.

THE STUDY OF THE PROBLEM OF BIT BALLING AT THE OPENING OF CLAY ROCKS

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When drilling wells, especially with clay drilling fluids on the bit and the elements of the layout below the drill strings (BHA), in most cases, seals (oil seal destroyer) are formed, leading to a decrease in the mechanical speed of drilling, increased wear of the drilling tool and the appearance of tacks. All this together makes the quality of drilling fluids certain requirements that affect the prevention of certain accidents and complications.

Research on the effective control of the process of salinity remains open. The formation of a gland on the elements of the BHA is a complication that prevents the penetration of wells. The oil seal prevents the deepening of the face, creates a piston effect during the descent of lifting operations, a high probability of sticking the drilling tool and a number of other negative consequences.

To prevent the formation of oil seals, it is necessary to know the causes and conditions of the gland and to have in the Arsenal of technological means to eliminate this complication. It should be noted that the momentum is divided into two types of complications:

1. Formation of clay crust in the drilled intervals of the wellbore, the so-called "clay rings»;
2. The formation of the gland directly on the drilling tool and the elements of the BHA clay rings occur when drilling rocks containing a large percentage of swelling clays, with a high mechanical speed. The drilled clay particles circulate in the annular space and join into clay lumps, as a result of which the drilled clay particles adhere to the clay crust.

The mechanism of the glands is expanded: to the purely adhesive effect of the gland, an auto-adhesive effect is added, which consists in additional sticking of clay on the already formed initial layer of the gland. At the same time, after drilling, the clay intensely absorbs moisture from the drilling mud, and the strength of its adhesion contact with the metal surface increases sharply. In the same work, the process of wetting the clay rock particles with water from the solution and further adhesion to other clay particles, the metal of cutters and BHA, based on the graph proposed by Eric van Oort [1], is described in sufficient detail.

On the basis of the above, it can be concluded that the existing chemical reagents in the Republic of Uzbekistan are not sufficiently effective and relatively expensive, especially in the conditions of the formation of seals on the bit and elements of the BHA in the process of drilling oil and gas wells.

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TECHNOLOGY OF OBTAINING ANTIFRICTION COMPOSITE POLYMER MATERIAL BASED ON WOOD-TOPOL AND TALA

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The developed technology for producing modified wood differs from the known ones in that it allows the compaction of the wood substance under conditions ensuring its thermofriction interaction with the modifier, due to the joint short-term effect on the modifier and wood. This technology allows to obtain antifriction self-lubricating composite material based on wood-poplar and tala, polymers and other high-quality components [1], which makes it possible to successfully replace non-ferrous and ferrous metals and rolling bearings operating in dusty conditions.

In accordance with the developed technology, the technological process of manufacturing a composite material based on wood and polymer is carried out according to a continuous scheme. In the continuous process, the binder and fillers flow from the tanks to the dosing units (weighing units), where the initial components of the mixture are dosed in a certain ratio, then the components from the dosing units enter the drum mixer. In the process of mixing the dispersion of the components of the mixture. The mixing time of the components of the mixture is 30-120 minutes, depending on the composition of the mixture. In many cases, when mixing, it is desirable to avoid the ingress of various particles and air into the mixture, the presence of which leads to a decrease in the strength of the composition.

After preparation of the mixture of components of the composition, simultaneous drying and impregnation of wood with warm engine oil coming from the container through the dispenser into the chamber and heated to t = 40-60 ° C is carried out. Exposure in this furnace is 24-48 hours. Then the oil temperature is brought to t = 110-120 0C, at the same time there is a partial provarka wood within 1-2 hours. After that, the furnace is cooled for 12-15 hours.

From the mixer, the resulting mixture of the composition enters the preheating bath, where the mixture of the composition dissolves to t = 140-160 ° C and where the oil-soaked wood is loaded with aging at this temperature for 1.5-2.0 hours. In addition, the loaded wood is impregnated with a molten solution of the polymer composition mixture at a pressure of P = 1.2–1.5 MPa and a temperature of 393–413K, followed by cooling. Impregnated wood with a modified polymer is fed into the chamber for drying products at a temperature of 333-363K. Then, hot blanks are loaded into cold molds and pressed at a specific load of 1.5-2.0 MPa. Compressed blanks are kept in molds under a universal press for 5-10 minutes to cool them to a temperature of t = 40-50 ° C.

After this, the process of normalization (drying out) of compressed wood in the surrounding air or in a bath with cold dehydrated oil occurs within 24-48 hours.

The wood thus obtained, impregnated with modified polymer and engine oil, after drying, is packed in plastic or paper bags.

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COMPOSITE MATERIALS WITH SURFACE-ACTIVE ADDITIVES OF CONSTRUCTION PURPOSE

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One of the main tasks of ensuring further industrialization of building production and turning it into a mechanized process of assembling and installing buildings and structures made of reinforced concrete panels, blocks, parts is to reduce the material intensity of products, economical consumption of raw materials, fuel, energy, metal, cement and other materials.

In this aspect, the development of effective composite materials for construction purposes based on cement systems, in particular, concrete and polyquaternized salts, which are surface-active additives, is relevant. As effective additives were used aqueous solutions of polymeric quaternary salts - dimethylaminoethyl methacrylate with benzyl chloride (PDMAEMA • HB), benzyl bromide (PDMAEMA • BB), benzyl iodide (PDMAEMA • IB), and also polydimethyldilylmethylamine, and iodide with benzyl iodide, as well as polydimethyldiylmethylamine, iodide benzyl

The mercury porosimetry adsorption method establishes the mechanism for the formation of the microstructure of cement stone modified with polyquaternized salts and shows that as a result of the modification an optimal pore structure is formed with a predominance of uniformly distributed conditions of closed micropores. The structure of concrete is formed in the process of the formation of a capillary-porous system before the concrete mixture sets, but mainly in the process of hardening and is an interesting object of study. Introduction of PDMAEMA • HB was also reflected in the presence of microcracks in the cement stone. Photocolorimetric studies carried out using a solution of an organic dye - Congo Red showed that the introduction of PDMAEMA • HB, thanks to the plasticizing effect of the latter, allows us to obtain a more dense structure of cement stone in concrete, which has an even distribution of micropores, and this greatly reduces the area of microcracks. Photocolorimetric studies carried out using a solution of an organic dye - Congo Red showed that the introduction of PDMAEMA • HB, thanks to the plasticizing effect of the latter, allows us to obtain a more dense structure of cement stone in concrete, which has an even distribution of micropores, and this greatly reduces the area of microcracks. This can be judged by the data presented in the table.

Table. The effect of modification of concrete on the degree of clarification of the dye during sorption by its samples

Sample Name	Amount of absorption, s / m •102	Degree of clarification, α	Lg/a
Control	1,51	83	1,09
+ 0.01% PDMAEMA • HB	1,55	90	1,29
+ 0.02% GRP-1	1,88	80	0,91

Thus, the addition of PDMAEMA • HB significantly modifies the structure of the cement stone, contributing to the formation of fine-porous structure. And this in turn makes it possible to save energy during cement operation.

PS

RESEARCH DEMINERALIZATION OF WATER-OIL EMULSION OF DEPOSIT OF " SOVLIGAR " BY THE WORKED OUT COMPOSITION DEMULSIFIES FROM LOCAL RAW MATERIAL

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A demineralization of oil is a technological process the aim of that is moving away from the crude oil of mineral salts got on a deposit. In most cases the question is about chlorous salts. Mineral salts can be contained as in water entering in the complement of the got water-oil emulsion, in a cut-in kind, so directly in oil as crystals. The last variant much is less widespread, however also meets in practice [1].

Depending on the index of maintenance of salts, in the so-called commodity oil in accordance with norms GOST, three groups of quality are distinguished: for the first group the index of maintenance of salt must not exceed 100 mgs/of l, for the second are 300 mgs/of л, for the third are 1 800 mgs/of l. In addition, there is a separate requirement for the product sent to the export is maintenance of salt in it, as well as in the first group of quality, 100 mgs/of l must not exceed.

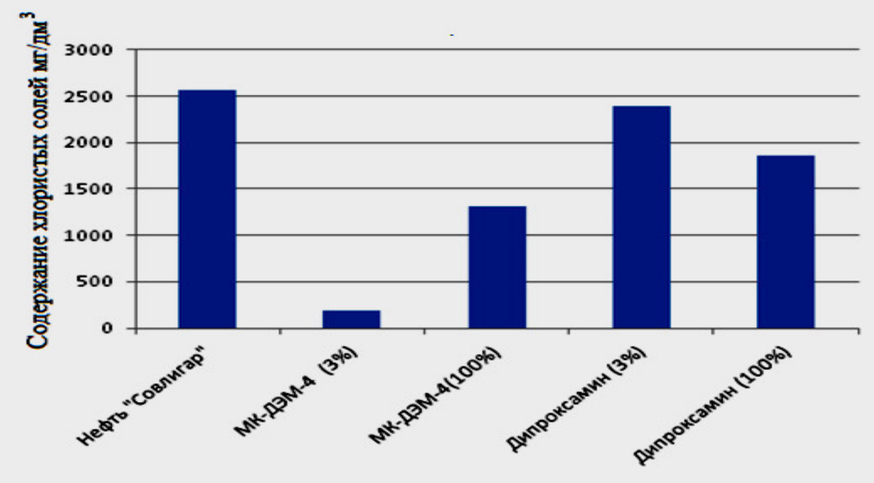
We conducted the alpha tests of the modified composition demulsifier of brand of "MK-DEM-4" for comparing to used presently in practice by the demulsifier of " Diproksamin-157M" with the purpose of study of process of demineralization of petroleum emulsions.

Researches were conducted on next methodology (GOST- 21534):

Essence of method consists in extracting of salts from oil by hot water and titration of water extraction of chlorides by solution of nitric acid Mercury on a reaction:

$Hg(NO3)2 + 2NaCl \longrightarrow HgCl2 + 2NaNO3$

The got results are indicated in stated below picture.



Ffigure - Amount of salt in composition petroemulsions after influence worked out "MK-DEM-4" and diproksamina

The results of the got analyses showed that the demulsifier of "MK-DEM-4" during a 3% concentration at a test in laboratory terms had shown the best result as compared to a demulsifier to applied presently at the plant of LTD. "Bukharan NPZ" diproksamina.

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RESEARCH OF PHYSICOMECHANICAL PROPERTIES OF WASTES OF PRODUCTIONS AS A SUSPENSOID, FOR THE RECEIPT OF THE BORING SOLUTIONS MADE HEAVIER

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The boring drilling in the searching-reconnaissance mining holes of Uzbekistan is conducted both in normal and in complicated geological terms. Geological structure of разбуриваемых areas, depth of bedding of productive horizons, and also distinction of stratal pressures and presence of zones of complications require the quality boring drilling. For this purpose effective washings liquids are required in turn, well clearing a coalface mining holes from a выбуренной mountain breed, formative a thin crust with a smooth surface on the walls of mining holes. Quality of boring solutions pure [1].

All of it requires development of unscarce, accessible and comparatively cheap composition polymeric materials with the use of organic and inorganic ingredients on the basis of local raw material and wastes of production for treatment of boring solutions with the use of the mineralized stratal waters as washings liquids for the boring drilling on the different deposits of Uzbekistan, that is the issue of the day.

As suspensoids of boring solutions apply minerals, and also wastes of chemical and metallurgical production. Suspensoids from natural minerals distinguish on the method of their production. Depending on basis of mineral suspensoids from natural ores are divided by a few kinds: баритовые, ferrous, carbonate and galenic [2].

For the study of физико-механических properties of wastes of metallurgical productions, exactly wastes of copper-concentrating factory (МОФ- 2, a tail is general test №216) of Almalyk MMC and Angren TPP, it was investigational specific all and grain-size distribution of wastes.

Specific all the departure of МОФ- 2 and ТЭС determined by means of volumeter of Le Chatelier. For this purpose preliminary portion of wastes was dried out to permanent mass at the temperature of 105 0C in a drying closet, cooled in эксикаторе and weighed out a 100 g within 0,01 and expected specific all the wastes: departure of MOF- 2has specific all ɤat=a 2,75 g/of sm3, departure of Angren TPP has ɤat=a 2,044 g/cm3.

A sieve analysis method was used to determine particle sizes.

Table 1. Waste size distribution

Sample name	1,2 мм (1200 мкм)		1 мм (1000 мкм)		0,8 мм (800 мкм)		Less than 0.8 mm (800 microns)	
	г	%	г	%	г	%	г	%
Total tail test number 216	66,2	6,62	9,8	0,98	15,2	1,52	908,8	90,88
Angren Thermal Power Plant	9,92	0,992	14,8	1,48	19,88	1,988	955,4	95,54

The results of the obtained analyzes showed that, unlike the AGMK waste, the waste of the Angren thermal power plant can be used as a weighting agent for drilling fluids.

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PS

PHYSICO-CHEMICAL PROPERTIES VISCOUS HOIPOLLOI RESIN OF VARIOUS OIL AND FAT, FOR THE DEVELOPMENT OF A COMPOSITE POLYMERIC SURFACE-ACTIVE SUBSTANCES

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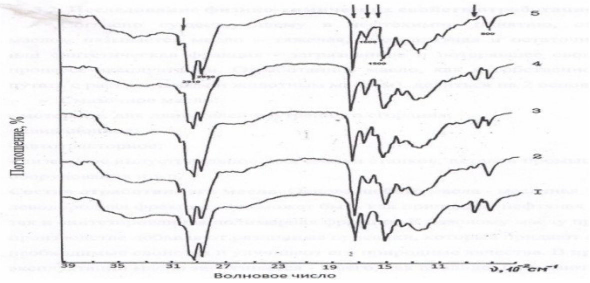
In the production of composite chemical reagents used in the drilling of oil and gas wells, various surfactants (surfactants) are used to stabilize drilling fluids in the process of drilling oil and gas wells. However, these surfactants are very expensive, difficult to access and, mainly, in the country are imported from abroad for foreign currencies, and sometimes they do not meet the requirements of the oil and gas industry [1].

In this regard, the development of effective compositions and technologies for the production of polymer surfactants based on local raw materials and available production, their use in the production of composite chemical reagents and drilling fluids based on them is very relevant and in demand.

The purpose of this work is to study the physico-chemical properties of gossypol resin of various oil and fat plants for the development of composite polymer surfactants.

To accomplish this purpose it was studied the modern state and the possibility of using hoipolloi resin in various branches of industrial production conducted by the IR spectromicroscope research.

The results of IR spectroscopic studies are shown in figure 1.



1-Andijan; 2-Kokand; 3-Kattakurgan; 4-Urgench; 5-Yangiyul.

Fig.1 - IR spectra of gossypol resins of various oil and fat plants

In the IR spectrum absorption hoipolloi resin – 1,1; 6,6; 7,7 – hexaoxa of 3,3 – dimethyl – 5,5 –di-ISO-propyl – 2,2 - dinaphthyl – 8,8 1-dialdehyde (SSS) detected frequency while 3751, 3725, 3711, 3670, 3648, 3628, 3608, 3357, 2923, 2853, 1712, 1645, 1557, 1464, 1456, 1377, 1280, 1110, 967, 842 and 723 cm-1. In the IR spectra of gossypol resins of various oil and fat plants, the degree of absorption in the regions of 1580, 1350, 1000-1490 cm-1 is observed due to the presence of –C=O, -soon and –C-OH groups.

As can be seen from the results of IR spectroscopic studies of gossypol resins, all samples of gossypol resin obtained from all the above mentioned oil and fat plants have active functional groups, which allow to improve the relationship with all components of the developed composite polymer surfactants.

Study of physico-chemical and technological characteristics hoipolloi resin and products of its modification it was found that through physical and chemical modification of the resin gocciolava relevant ingredients in the environment of the alkaline solution can translate it into solid, powdery state, which improves its use, transportability and extends the field of application.

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PS

METHODS FOR ENHANCING THE STRENGTH OF THE TOOTHED WHEELS.

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Large-dimensional gear wheels in production conditions are used in a large lubricant environment. That's why these teeth are eaten fast and the wheels are broken. The researchers of the Department of "Theoretical Technologies" of the Tashkent State Technical University carried out researches on the development of the technique of increasing the strength of gear wheels. Thermal treatment modalities were optimized based on the study of the impact of the surface of the workpiece on the dimensions and solids resistance, and the processing modes were examined in the test laboratory equipment. Table 1 shows the degree of dependence on the cooling intensity of the environment used for thermal treatment.

1-table. Cooling intensity of compaction media

Heating environments and their beginning temperature	Steam suspension output temperature (boiling)	Cooling relative intensity
Water, 200S Water, 400S Water, 800C 10% NCI solution in water, 20 ° C The solution of 10% NaOH in the agar solution is 20 ° C 50% NaOH in water 20 ° C Mineral oils, 20 ... 200'S	400. ..100 350 ..100 280 ..100 650 ..100 650 ..100 650 ..100 500 ..250	1,0 0,7 0,2 3,0 2,0 2,0 0,3

The quality of the product depends on the proper use of equipment and equipment for thermal processing. The equipment of the thermal warehouse consists of different furnaces; and in many plants, these ovens are part of special aggregates. Processes are mechanized and automated.

The results of the research were used with a scanning electron microscope (SEM) and intellectual diffractometer (Empyrean Malvern Panalytical), to find the chemical properties of the metal samples, one or more clear images and surface properties to increase the validity of the val shesterna teeth.

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ADVANCED MANUFACTURING TECHNIQUES FOR CAST MACHINE PARTS WITH WEAR-RESISTANT CARBIDE COATING BY CASTING ON FOAM POLYSTYRENE GASIFIED MODELS

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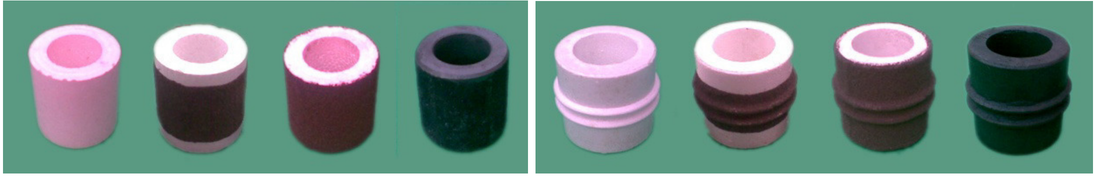
The most important achievement in recent years in the field of materials science and the technology of heat treatment of metals should be attributed to the manufacture of cast machine parts with wear-resistant carbide coating as a new composition of the hard alloy of metal composite materials.

Metal composite materials based on carbide coatings are characterized by high hardness, wear resistance and durability, due to which they become the object of systematic research. The object of research was the details of rolling mill rollers (Fig. 1), obtained by molding on polystyrene foam gasified models [1] and experiencing intense abrasive wear during sliding on metal [2].

According to the developed technologies, a foam model is first obtained (Fig. 1, a.a1) and is coated with a wear-resistant carbide coating (Fig. 1, B.v, B1, B1), then it is formed into a casting box-container and poured with 35GL steel metal (Fig. 1, g, g1). During pouring, the foam model burns down, and its place is filled with melt. In this way, the foam model is produced and cast parts with a hard-alloy wear-resistant coating are obtained. Improving the wear resistance and durability of the surface layers of cast steel machine parts is a very urgent task.



а) б) в) г) а1 б1 в1 г1

Fig.1. Cast steel rollers of a rolling mill with wear-resistant carbide coating and subsequent heat treatment.

In this regard, the production of environmentally friendly technology for producing cast steel parts for structural purposes is of great interest and allows you to solve actual problems aimed at developing export-oriented technology that meets the existing and world standard. In accordance with the above, we were the first to develop and propose a new composition of carbide coatings for structural purposes and the technology for their preparation according to the PGM.

The proposed carbide compositions differ from the known compositions of carbide materials by the following features: 1-coating must meet the requirement of a 3-4-fold increase in wear resistance compared with the wear resistance of the steel base; 2-coating should include affordable and inexpensive components and be distinguished by the simplicity of its application technology; 3-availability and low cost. These features fully ensures the strength and durability of cast parts. All samples and molded parts were subjected to optimal heat treatment with double phase recrystallization [3] (hardening 900-11500C and tempering 200-6000C), which increases the wear resistance of parts 2-3 times higher than serial products.

The results of the development have been successfully implemented at JSC "Uzbek Metallurgical Plant".

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OC

STATE AND PROSPECTS OF DEVELOPMENT OF ALTERNATIVE ENERGY SOURCES ON THE BASIS OF PEROVSKITE AND POLYCONJUGATED POLYMERS

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Among the most important problems of the development of modern alternative energetics, the particularly relevant is the search and study of materials that are promising from the point of view of their use in developed efficient solar energy converters. Of particular interest in recent years is the creation of photovoltaic cells based on the organic-inorganic perovskites [1-4], which have a high absorption coefficient and are promising from the point of view of their manufacturability. Perovskites with an ABX3 structure, where A is the organic part, B are metals (Pb, Sn, Cd, etc.), X are halogens (iodine, chlorine, bromine) in view of their excellent optoelectronic properties are the best representatives of the active layer in the third-generation of solar cells. Among the solar irradiation absorbers used in these cells, the iodide CH3NH3PbI3 and the mixed CH3NH3PbI3-xClx perovskites are most widely used. Record arise of rates of the conversion of solar radiation into electrical energy from 3% from 2009 to 22% attract more and more attention from researchers of alternative energy sources [3,4]. According to the type of design features, two types of perovskite solar cells are distinguished: mesoporous and planar [2–4]. The mesoporous structure is effective from the point of view of the maximum degree of coating of the layers, whereas the structure of planar cells is simpler and more technological. In turn, in terms of the sequence of working layers (with respect to incident solar irradiation), cells with n-i-p and p-i-n architectures are distinguished, respectively. The most important problems of perovskite solar cells are increasing of their conversion rates and increasing of the service times. One of the very promising approaches for their solution is the introduction of solvents (antisolvent treatment), which reduce the solubility of precursors, during the synthesis of the perovskite absorber. It is shown that this leads to a significant improvement of the morphology of the perovskite absorber in cells with both n-i-p [5] and p-i-n [6] architectures. Recent developments by scientists from the Moscow State University [7, 8], based on liquid polyiodide and processing layers of lead iodine and methylammonium (processes without the use of solvents), have shown very encouraging results in terms of the manufacturability and the solving of the problems of scaling.

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REGULATION OF FORMATION THREE-DIMENSIONAL STRUCTURES OF POLYACRYLIC ACID IN RADICAL POLYMERIZATION

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The problem of radical polymerization regulation has been traditionally a priority in the field of polymer science. In recent years, a number of approaches have been developed to synthesize macromolecules of a given structure and molecular weight under radical polymerization.

Synthesis of polymers of three-dimensional structure under conditions of radical polymerization is usually achieved by introducing additional crosslinking agents that provide interaction between polymer chains due to reactions with functional groups of macromolecules.However, the process of structurization macromolecules can occur without the introduction of crosslinking agents.The macromolecules which are present in the reaction mixture where polymerization is taking place are not inert compounds.At least the following processes take place with their participation:

The chain Transfer to the polymer, consisting in the interaction of the macroradical with the macromolecule and the formation of an new active radical on the macromolecule.This process often leads to the production of macromolecules of three-dimensional structure.

Interaction of redox initiators with mobile hydrogen atoms of macromolecular chain with formation of active radicals capable of initiating polymerization by interaction with double bond of monomers. As well as the chain transfer to the polymer, this process helps to obtain macromolecules of three-dimensional structure.

- The formation of grafted copolymers with the introduction of the reaction mixture of macromolecules of the other polymer.
- A occurrence of the gel effect, which is expressed in the diffusion limitation (restriction of the translational and segmental diffusion of macroradicals).

Use of these interactions is possible to regulate the process of radical polymerization that occurs with the formation of macromolecules of a three-dimensional structure, for example such as cross-linked hydrogels based on polyacrylic acid (Poly-AA).

In this work the regularities of radical polymerization of AA to high yield are shown. It is established that the nature of the initiator plays a decisive role in the formation of the Poly-AA structure.The use of potassium persulfate makes it possible to obtain three-dimensional polymers– superabsorbents – without introducing additional crosslinking agents into the reaction mixture. The formation of the three-dimensional structure is obviously due to the formation of additional active centers on macromolecules due to interaction with the initiator and also due to the chain transfer to polymer.It is found that by varying the synthesis conditions, such as the concentration of the initiator, monomer and reaction temperature, it is possible to effectively influence the rate of structure formation of the reaction mixture.It is also shown that the introduction into the reaction mixture of small (up to 1%) amounts of chitosan significantly accelerates the process of structure formation and can serve as a tool for the formation of crosslinked structures.

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POLYMERIC FORMS OF DRUGS

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Analysis of state of development of chemistry and physical chemistry, including nanochemistry and nanotechnology, in the direction of creating pharmaceutical, original drugs shows that polymeric, nanostructured biologically active compounds, as opposed to traditional low-molecular drugs, have a number of features.

The polymeric form of drugs consists of the active medicine and the dosage form, which ensures intake of the medicine in the body. The effectiveness of the preparation is determined not only by the content, structure and properties of the drug, but also to a large extent from its medicinal form.

Polymeric forms of drugs can be divided into two groups, distinguished by principles that determine their biological activity. The first group of polymeric forms of drugs includes compounds whose biological activity is due to their polymeric structure, that is, their molecular weight structure, molecular weight distribution, nature and content of functional groups and the physicochemical properties of the macromolecule as a whole.

Low-molecular analogs of these polymers in most cases do not have the biological activity characteristic of these types of polymers.

The mechanism of action of this type of polymers is not related to their decomposition into low molecular weight biologically active fragments, but depends on the properties of macromolecules, in particular with cooperative polymer-polymer reactions between body biopolymers and polymer forms of a biologically active compound. This mechanism of action is not typical for low molecular drugs. This type of polymer drug with its “proper” biological activity is diverse, as are low-molecular drugs.

The second group of polymeric forms of drugs includes compounds whose structure includes relatively inert polymers in relation to the organism otherwise “carrier polymers” and low molecular or high molecular drugs.

Those polymers can be conventionally attributed to the group of "graft" type polymers, as in the overwhelming cases, low and high molecular drug compounds are chemically attached to carrier polymers with various types of chemical bonds. The second polymers group in most cases the biological activity is manifested due to the grafted fragment. The biological activity of this group of drugs varies due to the basic principles of molecular design of the polymer carrier and low molecular or high molecular drugs.

The positive effect achieved when the medicinal substance is included in the structure of an inert polymer is the long-term circulation of the medicinal substance in the organism or in the bloodstream due to its gradual release in time from the structure of the carrier polymer. When this is achieved, the therapeutic concentration of the drug in the organism is preserved, which reduces the frequency and the amount of its introduction into the organism.

Based on the above data can be conclude that the obtaining of new polymer drugs belong to the developing field of chemistry, biology and pharmacology of high-molecular compounds. The basic principles for obtaining new polymer drugs considered in this report should be taken into account in the molecular design of polymeric forms of biologically active compounds.

Successes in the field of polymer drugs synthesis will probably be connected with an experimental elucidation of the mechanisms of polymer drugs action and the choice of targeted ways and approaches for their synthesis.

OC

BIODEGRADABLE COMPOSITE MATERIALS BASED ON POLYETHYLENE AND STARCH

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At present, due to such properties as flexibility, durability, resistance to moisture, convenience, safety and etc. polyolefins (polyethylene, polypropylene, etc.) are commodity plastics found in applications varying from house hold items such as grocery bags, containers, carpets, toys and appliances, to high tech products such as engineering plastic. At the same time, there are problemsconnected with environmental pollution with polymeric waste, as these synthetic polymers have not been decomposed under natural conditions for several years. Recycling and incineration of plastic materials are not effective enough. When recycling process is usedproduct quality deteriorates. Incineration leads to an increase in emissions of harmful substances into the atmosphere. The solution to this problem can be the creation of polymeric materials that can undergo biodegradation under the influence of various factors in natural conditions.

The most technologically and economically beneficial way to create biodegradable polymers is the development of composite materials based on traditional synthetic polymers and various natural additives that initiate the process of biodegradation. The addition of natural fillers allows to ensure biodegradability and partially replace non-renewable petrochemical raw materials with renewable ones, but also to reduce the cost of production

To improve the thermodynamic and technological compatibility of synthetic polymers and natural fillers, a third component (compatibilizer)is introduced. Compatibilizers consisting of polar and non-polar parts, are located in the interfacial region, increasing the interaction between the non-polar polymer and the polar filler and promoting uniform distribution of the filler.

In this paper, we studied to obtain a composition based on polyethylene and starch, using various compatibilizers. As a compatibilizerwas usedLDPE-g-MAH (maleic anhydride was grafted onto low-density polyethylene), LMWPE-g-MAH (maleic anhydride was grafted onto low-molecular-weight polyethylene) and Starch-g-MAH (maleic anhydride was grafted onto starch).

Theeffects of various experimental conditions on the grafting degree, such as initiator concentration,MAHconcentration, reaction time, reaction temperature and the time for initiator addition were investigated. The results demonstrated that the initiator concentration had the greatest influenceon the grafting degree, while the reaction temperature had a minimal influence on the grafting degree. It was found the optimal conditions of the synthesis of compatibilizers with a high grafting degree.

Compositions with different content of constituent components (polyethylene: filler: compatibilizer) were obtained. Optical studies of the films to determine the particle size of the fillers and their distribution in the polymer matrix were carried out, the rheological properties (melt flow index) of the samples were determined, and the physic-mechanical properties (tensile strength, relative elongation) were studied. It was found that the addition of compatibilizer to the composition improves the distribution of the filler in the polyethylene matrix and the physic-mechanical properties.

The biodegradability of the compositions was investigated by the standard techniques and it was showed that they are subject to biodegradation over time. The deterioration of the structure and physic-mechanical properties of composite films after a certain time of composting under special conditions was revealed.

The technology of production biodegradable composition and a biodegradable film based on it has been developed, which have been positively tested under production conditions.

OBTAINING OF NANOCATALIZERS BY LOW-TEMPERATURE CONVERSION OF OXIDE CARBON CuO / ZnO / Al2O3 WITH REDUCED COPPER CONTENT

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In recent years, the need for catalysts used in the production of hydrogen and hydrogen-containing gases by the method of hydrocarbon conversion has increased. Existing methods of the preparation of copper-containing low-temperature catalysts are characterized by a complex, multi-stage and expensive main production scheme, which necessitates the improvement of existing technologies of catalysts' producing using nanotechnology approaches to reduce the cost of low-temperature catalysts.

In this regard, the main goal of the work is to reduce the copper content (in terms of copper (II) oxide) in the composition of the conversion catalyst, and to preserve high catalytic and physico-mechanical characteristics.

During this work, it was revealed that oxide catalysts obtained from precursors (metal hydroxocarbonates) have a high dispersity and activity. As an alternative to the current technology for producing of the catalyst, a method has been chosen, the precursor of which is copper/zinc hydroxocarbonate with aurichalcite structure, which was obtained by precipitation from copper (II) and zinc nitrates, and sodium bicarbonate. It was shown that copper/zinc hydroxocarbonate with the aurichalcite structure is formed both at a Cu: Zn ratio of 70:30 mol.%, and at a ratio of 30:70 mol%. The presence of an insignificant amount of a solid solution based on the copper (II) oxide lattice was also detected.

It was shown that among the many salts obtained from the metal hydroxocarbonates precursors, the most effective is the double copper / zinc hydroxocarbonate with the aurichalcite structure. The decomposition of such a precursor allows to obtain copper and zinc oxides, the crystal lattices of which are maximally distorted, while after the reduction of such a solid solution with hydrogen, nanoscale clusters of metallic copper are formed, which have a high specific surface and high activity in the redox conversion of carbon monoxide with water vapor in order to produce the hydrogen.

This approach allows us to obtain, first, a catalyst with high activity (up to 92%), high specific surface area; secondly, to obtain a catalyst that does not contain chromium oxide (the second after copper component is an expensive component imported from abroad); thirdly, to obtain a catalyst with a copper content lowered by 10 - 15 wt.% (in terms of copper oxide), which will significantly reduce its cost.

We have proposed a technology for producing of the nanocatalysts of low-temperature carbon monoxide conversion with reduced (up to 20% from 54 to 34 wt.%) copper content in them, the optimization of the conditions for producing a precursor and catalyst of a selected composition with a reduced content of an expensive copper component with a complex of improved characteristics has been performed which is tested under production conditions.

This technology may be of considerable interest under use in the production of hydrogen and hydrogen-containing gases by the method of conversion of hydrocarbons, in the production of ammonia, methyl alcohol, etc.

OBTAINING COMPLEXES OF CHITOSAN BOMBYX MORI WITH BIOLOGICAL ACTIVE PROPERTIES

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In recent years, studies on the production of interpolyelectrolyte complexes of chitosan (CS) with polyanions and polyampholytes of natural and synthetic origin have been of interest [1-5].

Chitosan, a natural polycation, is obtained from renewable raw materials with a number of properties wich are attractive in many fields of science, biotechnology and medicine. CS has unique physicochemical and biological properties, the environments of which can highlight its biocompatibility, biodegradability, antimicrobial action, etc. The attention of researchers is attracted by the ability of CS to form covalent and non-covalent complexes with other polyelectrolytes [6]. These complexes have specific properties that define new areas of their use.

The process of complex formation of CS is influenced by its conformational, molecular mass characteristics, as well as the pH of the production environment and other factors, which require a specific approach to the preparation of complexes based on it.

At present, the study of the fundamental principles of the production of interpolyelectrolyte complexes (IPEC) of natural polyelectrolytes and the creation of preparations based on them is of scientific and applied interest. The aim of this study is to obtain thermodynamically stable interpolyelectrolyte complexes based on chitosan Bombyx mori and to study their ability to bind with soil minerals.

For the first time, stoichiometric and non-stoichiometric chitosan Bombyx mori complexes were obtained and the possibility of their use as a soil formative agent was shown. Features of creating biodegradable and environmentally friendly products based on interpolyelectrolyte complexes of chitosan are that chitosan is a non-toxic polymer and is extracted from renewable natural sources. Due to the possibility of controlling the surface charge (Q- and Q +), interpolyelectrolyte complexes can be applied in various industries, in particular, in agriculture.

The composition and hydrodynamic dimensions of chitosan complexes are revealed. It was established that at pH = 6.3, chitosan and Na-CMC interact at a molar ratio of 1: 0.34. The hydrodynamic sizes of IPEC particles vary from 80 to 1000 nm and are capable of binding to soil minerals, forming strong crusts. It has been shown that polyelectrolyte crusts are resistant to washing and mechanical stress, these complexes can be applied in the future against soil erosion. Interpolyelectrolyte complexes obtained at pH = 3.5 have been found to have biologically active properties against phytopathogenic microorganisms.

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PURIFICATION OF TECHNICAL CARBOXYMETHYLCELLULOSE

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Purified water soluble carboxymethylcellulose (CMC) is widely used in food and pharmaceutical industry as a filler, a thickener, binder, stabilizer, protective colloid, a suspending agent and control the rheology or flowability of pharmaceuticals, and any liquid food, film former resistant to oils, greases and organic solvents. CMC dissolved rapidly in cold or hot water, physiologically inert and biodegradable in the body is exposed.

Currently, preparation of purified CMC is carried out according to a known technology, by treating the technical CMC with an alcohol-aqueous solution. At the same time, the content of the basic substance increases from 49-51% to 75-98%. Purified CMC samples obtained from technical grades by known technology, can be used in various industries, in addition to the pharmaceutical, medical and food industries, as they always contain impurities of polyvalent and heavy metals, which is a feature of the production technology of technical brands of CMC.

To obtain purified CMC grades, it is necessary to create a technological line from special steel grades to ensure the purity of the final product and exclude the possibility of the presence of metal compounds in the CMC content.

The purpose of this work was to study the conditions for obtaining low molecular weight, highly purified sodium salt of (Na-CMC) for the pharmaceutical, medical and food industries.

To obtain Na-CMC that meets the requirements of the pharmaceutical and food industries, we have developed a new method of purification of technical CMC with various degrees of substitution (DS) and degree of polymerization (DP) providing the required level of purity by treating it with an aqueous solution of mineral acids. Obtained insoluble acid form of CMC (H-CMC) washed by water and treated with alkaline solution in alcohol which converted to water-soluble form of Na-CMC.

The influence of the duration of acid treatment of technical Na-CMC on the properties and composition of purified H-CMC was investigated.

The conditions for the transfer of H-CMC to a water-soluble sodium form by treatment with an alkaline solution in alcohol were also investigated.

The effects of various parameters on the quality parameters of the obtained CMC were studied and the optimal method for obtaining low viscosity, water soluble purified CMC responding the requirements of the State Pharmacopoeia was established.

The possibilities of obtaining highly purified CMC which can use for practical medical and pharmaceutical industry are shown.

It has been established that the application of the developed purification method is more efficient and less laborious, since the cleaning process is much faster compared with the known methods. According to the developed method, high purified samples of Na-CMC with the lower cost were obtained.

ON THE CONCEPT OF A QUANTUM CHEMICAL THEORY OF THE REACTIVITY OF FUNCTIONAL GROUPS OF POLYMERS

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Biopolymers, including polysaccharides for example chitosan broadly defined as biosynthesized materials, play a central role in medicine and pharmacy with applications in tissue engineering, regenerative medicine, and drug-carrier systems. Such materials are advantageous in biomedical and pharmaceutical applications because of their inherent properties of biocompatibility and biodegradation. Detailed knowledge of the complete molar mass distribution and hydrodynamic properties of chitosan is of increasing importance. Polysaccharides are typically heterogeneous materials, exhibiting a wide range of molecular weight, sequence, and structure. Information as to size, structure and conformation is very useful in order to understand better solution behavior, intra- and intermolecular interactions and function.

Each molecule of a polymer substrate actually represents a whole spectrum of substrates (reaction centers) with different reactivity. The reactivity of polymers, which depends on many factors, including the presence of functional groups, is a collective concept, currently needs to be interpreted within the framework of the fundamental concepts of polymer physics and chemistry. This concept is a band gap in the electronic spectrum, representing the difference in the energies of the lowest free and highest occupied molecular orbitals of the polymer. Such approaches are described in the research approaches and the results of the thesis.

In our research on the reactivity of polymers from the standpoint of electronic properties used two fundamental points:

1. As the results of the quantum theory of the reactivity of the ability of two small molecules (Besrucker's theory, etc.)[1-3] can be used (as much as possible without loss of simplicity) on an object such as a small molecule + polymer.

2. Since the polymer has an individual property - its own electron gap ($\Delta 0$), at the time of the reaction a gap Δ is used for the total spectrum of the reacting system (small molecule + polymer), how can Δ be associated with the individual characteristic of the polymer $\Delta 0$, this was done in the second order perturbation theory in calculating the vibronic constant, in this case, it is perturbed.

For the first time, an analysis of electronic characteristics (HOMO and LUMO orbitals) was carried out, for chitosan chains of various lengths and degrees of deacetylation, calculated using a semi-empirical method. The change in the energy difference from the number of links in the chitosan chain is shown to be non-monotonic, which indicates the effect on the electronic structure of an increase in the number of monomeric links in the chain, and, accordingly, a change in reactivity due to the ease of the electronic transition.

It was shown that the rate of formation, the shape and size of the aggregated particles formed by the chains of chitin, chitosan and carboxymethylchitosan depend on the structural characteristics of the polysaccharides. Such as the degree of deacetylation, the number of protonated amino groups of chitosan, the degree of substitution and the length of the chains of carboxymethylchitosan, however, the aggregates of the latter have a more compact structure compared to the aggregates of chitosan due to the greater number of hydrogen bonds between the chains.

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SYNTHESIS OF CHITOSAN BOMBYX MORI FOR MEDICINE

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Achievements of modern biomedical technologies have led to the emergence of new medical products based on polysaccharides, proteins, nucleic acids with therapeutic qualities. A promising line of research is devoted to the development of carriers of large molecules through tissue barriers. One of the first on the role of the drug delivery was proposed chitosan. Nanoparticles based on chitosan and its derivatives are able to protect macromolecules from acid denaturation and enzymatic degradation.

In this regard, the development of methods for modifying chitin and chitosan, as well as nanostructured systems based on them, which provide for obtaining new bioactive compounds, identifying the connection of the chemical structure with the effectiveness of the protective action and enhancing the body's resistance to various infections, is of particular importance.

The polysaccharide chitosan obtained by general methods is characterized by structural and chemical heterogeneity, since even after treatment in hard chemical conditions it contains a small amount of mineral and protein impurities, and also is characterized by a broad molecular weight distribution. Thelattercausestheformationofinsolublegelparticlesupondissolutionofchitosan

Like chitin, chitosan is an amorphous-crystalline polymer, which is characterized by the phenomenon of polymorphism, and the conformation of macromolecules does not change significantly from chitin to chitosan. At the same time, in the process of chitin deacetylation, the overall structure order is noticeably reduced (the degree of crystallinity decreases to 40-50%). To obtain chitosan from silkworm pupae, it is necessary to sequentially separate the protein and mineral components of the raw material, i.e. transfer them to a soluble state and remove [1,2].

The process of obtaining purified chitosan from silkworm pupa Bomby mori consists of successive stages of dissolution of technical chitosan in acetic acid, precipitation at pH = 8-9, coagulation, centrifugation, freeze drying at T = -50 -550C, P = 0.3-0.5 mbar. A method for obtaining purified chitosan with a yield of 62-67% has been developed. A high degree of purity of the purified samples is shown: the nitrogen content increases to almost theoretical values of -8.52%, the solubility increases significantly, 96-98%, the ash content of the samples decreases -0.5 % -1%. From samples of purified chitosan, Bombyx mori nanochitosan was synthesized, which was confirmed by AFM. The particle size is in the range -90-200 nm.

The resulting polymers chitosan and its nanostructured form of various concentrations were tested for sensitivity of various strains of microorganisms in vitro: gram-positive, gram-negative and microorganisms related to fungi. It has been shown that, depending on the concentration, chitosan has an antibacterial effect on Klebsiella microorganisms and fungicidal microorganisms: Actinomyces - 0.1%, at a concentration of 0.5% on Prot.vulgaris. It should be noted that with an increase in chitosan concentration up to 1%, an antibacterial effect is also observed on the anaerobic bacteria Ps.aerogenosa.

When conducting tests on the antibacterial activity of chitosan, it was revealed that the nanochitosan preparation had a pronounced effect on almost all groups of microorganisms: St.saprofiticus, Str.pyogens, Ent.faecalis, Esch. Coli LP, Esch. Coli LN, Prot.vulgaris, Klebsiella, Actinomyces regardless of concentration. Based on these studies, it can be concluded that chitosan and especially its nanostructured forms belong to the antistaphylococcal action drugs, which can be used in the treatment of staphylococcal infections.

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WATER-SOLUBLE CARBOXYMETHYLATED DERIVATIVES OF CHITOSAN BOMBYX MORI ON THE BASIS OF SILK INDUSTRY WASTE

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Of particular interest to natural polymers, in particular, to chitosan (CHS) Bombyx mori is associated with its ability to modify, as a result of which the structural basis of CHS does not change significantly, but at the same time new or improved properties appear. The presence of carboxyl groups (-COOH) in the side chain of the CHS polymer causes its probability of film formation and biological activity. Therefore, a number of water-soluble carboxymethylated chitosan derivatives were synthesized with different proportions of primary unsubstituted amino groups (-NH2) and carboxyl groups in the polymer side chain: N-carboxymethylchitosan (N-CMC) [1] and 6-O-carboxymethylchitosan (O-CMC) [2].

N- CMC is a polyampholyte obtained by reacting primary -NH2 groups with glyoxylic acid in an acidic medium. At the same time, in the final water-soluble derivative, the content of carboxyl groups was 80%, and primary -NH2 -20%. 6-O- CMC-obtained by introducing carboxymethyl groups into the structure of the chitosan at its interaction with monochloroacetic acid. The degree of substitution of a water-soluble product was 70%. The structure of the polymers obtained was confirmed by NMR spectroscopy and the quantitative content of -COOH groups by conductometric titration was determined. The main advantage of this direction is the availability of raw materials (silkworm Bombyx mori) and obtaining an environmentally safe water-soluble product, which has a growth-regulating and stimulating effect, the effectiveness of which is determined by pre-sowing treatment of cotton seeds and gourds.

The preparation O-carboxymethylchitosan was applied in practice and it was revealed that the total yield of breeding varieties of cotton S-6524, Bukhara-6, Namangan-77 for untreated seeds is 34.0 centners / ha, 2.6 centners / ha, 33.8 centners / ha, and treated with 2% solution CMC 38.1 c / ha, 37.3 centner / ha, 37.8 c / ha. The use of CMC allowed to determine the increase in cotton yield by 4-5% compared with untreated seeds.

The presence of a positive charge on the primary -NH2 group favors obtaining N- CMC, which was used in the formation of nanoparticles by precipitation coacervation with a size range from 88 nm to 200 nm, which opens up the possibility of expanding their practical application in biomedical practice.

Thus, obtaining a polymeric preparation of carboxymethylchitosan with its own biological activity indicates a promising future when used in various industries.

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SYNTHESIS OF COPOLYMERS OF METHYLACRYLATE WITH ACRYLIC ACID TO APPLY RESTORATION OF ARCHAEOLOGICAL OBJECTS

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The mechanism of acrylic acid and (meth)acrylic esters copolymerization of various structures in organic solvents and in the absence of solvents are well studied [1]. Copolymers of acrylic monomers are used in various industries as thickeners, emulsifiers, stabilizers for the physicochemical properties of systems, as paint films and coatings. However, despite significant practical interest in copolymers of acrylic monomers, there is little information in the literature about the properties of copolymers of methylacrylate (MA)and acrylic acid (AA). There is also information that the copolymers MA:AA successfully tested in the practice of restoration of paper objects [2]. This report shows the possibility of synthesis of statistical copolymers MA and AA of different compositions and shows the perspectives of their practical application for the restoration of archaeological objects.

Copolymers were synthesized in a flask placed in a water bath in a nitrogen atmosphere, in the presence of benzoyl peroxide (BP) as initiator at 600C. Re-precipitation of the polymers was performed with hexane. The composition of the copolymer was determined by elemental analysis by titration of carboxylic groups.The values of the copolymerization constants for the MA-AK system, calculated by two different methods, turned out to be quite close to each other. The values of $r1 \times r2$ less than one indicate that during copolymerization in solution and in block, a statistical copolymer is formed to random distribution of units along the macromolecular chain. Attention is drawn to the fact that during the polymerization in the blockr1< 1, r2>1 whereas during the polymerization in the dioxane solution r1<1, r2<1. Such a change in the relative activity of acrylic acid is due to its ability to form dimers in the block, which have a higher reactivity than the free AA molecules.In solution, dimers are destroyed, which leads to a regular decrease in the relative activity of AA.The obtained MA:AA copolymers were tested on models of archaeological objects. The experiments showed that the mechanical strength of models impregnated with solutions of copolymers MA:AA increases with growing their mass fraction.

Thus, in the conditions of radical initiation the copolymers MA and AA of different composition were synthesized. It is established that the copolymer MA: AA has all the basic criteria necessary for its application in the practice of restoration of archaeological objects. Impregnation of models with copolymer solutions leads to an increase in their mechanical strength. In this case, the copolymer retains the linear structure and can be removed from the object if necessary [3].

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PALLADIUM CATALYSTS ON POLYMER-MODIFIED MAGNETIC SUPPORT FOR PHENYLACETYLENE HYDROGENATION

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Recently, magnetic nanoparticles (MNPs) have attracted a great interest for catalysis application due to their large surface area, ordered structure of mesopores and magnetic properties [1-3].

The results of the study of catalytic properties of Pd-polymer/MNPs catalysts in phenylacetylene hydrogenation are presented in this paper. The catalysts were prepared by adsorption of palladium ions onto synthesized polymer modified magnetic material. Polymer/MNPs composites were synthesized by co-precipitation of iron chlorides with sodium hydroxide from the polyacrylamide (PAM) and polyvinylpyrrolidone (PVP) containing water solutions. The polymer concentration in magnetic composites was varied from 5 to 20%. The complete Pd adsorption of on the magnetic samples was confirmed by spectrophotometric method. The palladium concentration in all catalysts was 1.0 wt % close to calculated data.

The Pd-polymer/MNPs catalysts showed high activity (2.0-2.8×10-6 mol s-1) and selectivity to styrene (92-93%) in phenylacetylene semi-hydrogenation under mild conditions (table 1).

Table 1 – Testing of 1%Pd-polymer/MNPs catalysts in phenylacetylene hydrogenation

№	Polymer modified magnetic support	W×10-6, mol s-1		Sst, %	Conversion, %
		C≡C	C=C		
1	5%PAM/MNPs	2.0	2.7	93.4	91.3
2	5%PVP/MNPs	2.8	2.8	92.8	95.4
3	10%PVP/MNPs	2.7	3.0	92.1	97.2
4	20%PVP/MNPs	2.6	2.9	91.8	97.5
Test conditions: mcat = 0.02 g; Vsubstrate = 0.25 mL; solvent – ethanol (20 mL); T = 40°C; p(H2) = 1 atm.					

The polymer nature has affected activity of the supported Pd-polymer/MNPs catalysts, while the styrene selectivity practically was not changed. The best polymer for modification of catalysts was PVP. However, the activity of Pd-PVP/MNPs was not changed with the increase of the polymer content in the catalyst. These effects can be explained by good swelling ability of supported Pd-PVP complex in the ethanol used as solvent in the hydrogenation.

Thus, the proposed method for the synthesis of polymer modified magnetic catalysts is simple and allows to control their catalytic characteristics by varying of polymer nature and easy separation of the catalysts under magnetic field.

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STUDY OF HYDROLYZED POLYACRYLAMIDE (HPAM) DEGRADATION IN THE PRESENCE OF IRON IONS AND DISSOLVED OXYGEN AT KALAMKAS OILFIELD DEVELOPMENT CONDITIONS

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This work represents an experimental study of the hydrolyzed polyacrylamide (HPAM) stability in the presence of iron ions (Fe2+, Fe3+) and dissolved oxygen at current Kalamkas oilfield conditions (fig 1). Special experiments results show that presence of oxygen without iron ions will not significantly impact rheology of the polymer solution, presence of Fe2+ and Fe3+ without oxygen decreases the effective viscosity to 30.2 and 38.5% respectively, presence of Fe2+ and Fe3+ with oxygen decreases the effective viscosity to 52.3 and 91.2% respectively. Experimental results indicate the need to remove iron ions in the water used for the polymer solution preparation.

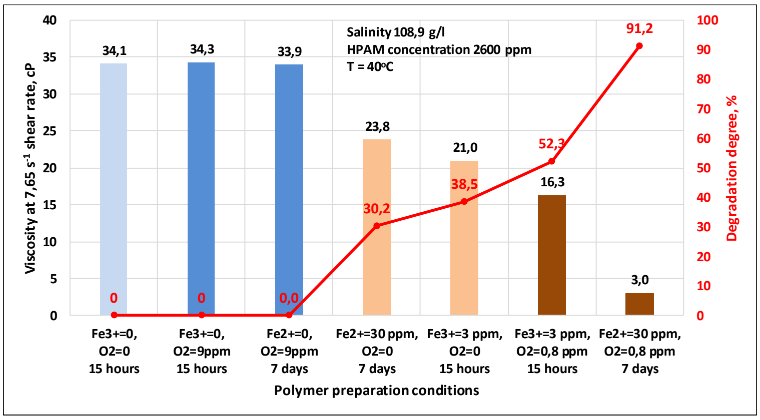

Figure 1. Effect of Fe2+, Fe3+ and O2 on HPAM stability

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OC

DEVELOPMENT OF SOIL STRUCTURING AGENTS BASED ON INTERPOLYMER COMPLEXES

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Today, biological polymers and complexes of them are used as a drug delivery system in medicine, in agriculture as composers and radionuclide sorbents in ecology. We provide new type of soil structuring agents based on polyelectrolyte complexes of chitosan (Ch) and sodium alginate (SA). There is a very promise material due to their biocompatibility and biodegradability. Soil degradation is big problem for Kazakhstan. For example in 2018 year 11.2% and 2.8% of agricultural land of Kazakhstan is subject of wind and water erosion respectively. So, the aim of our research was the combat against soil erosion using interpolymer complexes of Ch:SA.

The compositions of the complexes were established using various physicochemical methods such as turbidimetry, conductometry, DLS.

The study of the mechanical properties of soil structures showed high strength specimens treated by IPC

It should be taken into account that the values of Young modulus are not critical for plants, because the growth in plant cells develops so-called turgor pressure, which can reach up to 2 MPa [1].

The study of resistance to water erosion has shown the high efficiency of the developed soil structuring agents, in comparison with pure polymers

Influence of IPC on growth and development of radish (Raphanus sativus) were studied due vegetation experiment in lab conditions using.

Figure 3. An appearance of growth and development of radish plants for 20 days.

The results showed that, against the background of the introduction of IPC, the seedlings of the plants were obtained earlier, and the height of the plants was higher than in the control variant.

Analysis of experimental data shows that the formation of IPC’s upon interaction of two oppositely charged biopolymers. Soil treatment with IPC’s increased the mechanical strength of soil structures, which indicates the aggregation of soil particles and large-pore structure that increase soil resistance to water and wind erosion and creating a good supply of water in the root layer. Vegetation experiments with radish confirmed the high efficiency of the developed structurant for use in agriculture.

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PREPARATION AND CHARACTERIZATION OF THERMOTROPIC GELS BASED ON POLYSACCHARIDES

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In this work, composite hydrogel materials based on semi-interpenetrating networks (semi-IPN) of polysaccharideswere prepared.The method of obtaining hydrogels was based on the unique property of gellan to structure into a three-dimensional network with increasing temperature to the sol-gel transition point [1]. This unique property of gellan makes it possible to simplify and cheapen the process of synthesis of hydrogels due to the absence of additional components in the system (for example, a crosslinking agent) and to reduce the number of stages of synthesis.The second component for preparation of semi-IPN hydrogels were hydroxypropyl cellulose (HPC), hydroxyethyl cellulose (HEC), and starch. The reason of this choice is due to the non-toxic properties and biomedical application of cellulose derivatives and stabilizing properties of starch and its application for drug compliance.Thus, using the property of gellan mentioned above following hydrogels were obtained: gellan-HPC; gellan-HEC, gellan-starch.

Obtaining of thermotropichydrogelswas conducted by a gradual dissolution of the second component firstly, then gellan, followed by gradual heating and stirring the mixture at a temperature of 80°C - the sol-gel transition point of gellan macromolecules. Upon reaching this temperature, the mixture was kept under constant stirring for 10 minutes and then allowed to cool to room temperature. As a result, the mixture lost its fluidity, acquiring gel-like elasticity. Alsoit was shown that the color and transparency of the gels obtained directly depends on the initial solution of the second component. For example, a gellan-starch sample is a white opaque gel.For preparation the hydrogels based on semi-IPN, concentrationof gellan was varied - 1 and 2 wt. %, as well as the concentration of second component– 2; 4 and 6 wt. %.During the preparation it was determined that hydrogels with gellan concentration 1 wt. % had low elasticity, thus these samples weren't used for further investigations.The obtained hydrogels have been cut off in form of discs and freeze dried up to a constant mass.

The swelling properties of thermotropichydrogels were studied in water and isotonic solution. It was determined thatthe swelling degree of hydrogels with a concentration of second component 2 wt. % was the highest, andat 6 wt. % α was the lowest. As the concentration of additives increases, the density of the network is increasing too, so their swelling is reduced.During studying the swelling properties of hydrogels it was shown thatthe swelling degree α of hydrogels in water were 1.5-2 times higher than in isotonic solutiondue to the thermodynamic nature of solvent.Also it was noticed that gellan-HPC hydrogel has the highest swelling degree: in waterit is about 40 g/g; and gellan-starchhas the lowest α: about 3 g/g. The values of swelling degree for semi-IPN hydrogels are directly related to the construction of second component and their ability to form hydrogen bonds.In addition, the porosity of the obtained hydrogels was studiedusing optical microscopy with a magnification of 20 times and further analysis using ImageJ program, and the results correlates with the results of studying swelling properties: the more is the swelling degree, the bigger are the pores of hydrogels.

The mechanical properties of hydrogels were studied by application of a gradually increasing load till maximum 7.5 kg until their destruction. As the result, the hydrogel containing 6 wt. % of HPChas the the highest value of mechanical strength 10.7 kPa. As the concentration of second component increases, the hydrogel was stronger due to the increasing density of network.

Thus, the thermotropic hydrogels based on semi-IPN of gellan and HPC, HEC and starch were prepared and characterized.

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FEATURES OF DEVELOPMENT OF HIGHLY SELECTIVE INTERGEL SYSTEMS IN RELATION TO RARE-EARTH ELEMENTS IONS

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Intergel systems can be concerned as the real alternative to the existing methods of sorption of rare-earth elements(mainly ion-exchangers) [1]. "Long-range effect" provides significant changes of electrochemical and volume-gravimetric properties of the initial polyacids and polybases. Also, it should be noted that there is strong increase of sorption properties of the polymers in intergel systems due to transition into highly ionized state due to mutual activation of the macromolecules during remote interaction [2].Thereisa formationofoptimalconformationduringtheprocessofremote interaction of rare-crosslinked polymer hydrogels in intergel systems.

For extraction of rare-earth metals (on example of lanthanum, cerium, neodymium and samarium ions) intergel systems based on polyacrylic acid hydrogel (hPAA), polymethacrylic acid hydrogel (hPMAA), poly-4-vinylpyridine hydrogel (hP4VP), poly-2-methyl-5-vinylpyridine hydrogel (hP2M5VP) were developed. Found that maximum sorption of lanthanum ions in intergel systems hPAA-hP4VP, hPMAA-hP4VP, hPAA-hP2M5VP, hPMAA-hP2M5VP occurs at ratios 33%hPAA-67%hP4VP, 17%hPMAA-83%hP4VP, 67%hPAA-33%hP2M5VP, 50%hPMAA-50%hP2M5VP. Lanthanum ions extraction degree is 94.04%; 90.35%; 91.09%; 89.65% respectively. Polymer chain binding degree (in relation to lanthanum ions) is 78.33%; 75.33%; 75.83%; 74.67% respectively. Effective dynamic exchange capacity (in relation to lanthanum ions) is 7.06 mmol/g; 6.77 mmol/g; 6.83 mmol/g; 6.72 mmol/g.Areas of cerium ions maximum sorption are ratios 17%hPAA-83%hP4VP, 50%hPMAA-50%hP4VP, 33%hPAA-67%hP2M5VP, 67%hPMAA-33%hP2M5VP. Sorption degree of cerium ions is 92.33%; 89.33%; 90.67%; 87.67% respectively. Polymer chain binding degree (in relation to cerium ions) is 76.59%; 74.10%; 75.21%; 72.72% respectively. Effective dynamic exchange capacity (in relation to cerium ions) is 6.16 mmol/g; 5.96 mmol/g; 6.04 mmol/g; 5.84 mmol/g respectively. Themaximumamount of neodymium ions is sorbed by the intergel systems at the following ratios: 83%hPAA-17%hP4VP, 67%hPMAA-33%hP4VP, 50%hPAA-50%hP2M5VP, 33%hPMAA-67%hP2M5VP. Extractiondegreeofneodymium ions is 93.59%; 92,41%; 91,91%; 90,72% respectively. Polymerchainbinding degree (in relation to neodymium ions) is 73.24%; 71.56%; 72.36%; 69.89% respectively. Effective dynamic exchange capacity (in relation to neodymium ions) 6.03 mmol/g; 5.84 mmol/g; 5.79 mmol/g; 5.66 mmol/g. Maximum sorption of samarium occurs at ratios 67%hPAA-33%hP4VP, 50%hPMAA-50%hP4VP, 17%hPAA-83%hP2M5VP, 83%hPMAA-17%hP2M5VP. Extraction degree of samarium ions is 93.78%; 90.11%; 90,78%; 88.55% respectively. Polymerchainbindingdegree (in relation to samarium ions) is 77.89%; 74.89%; 75.66%; 73.24% respectively. Effectivedynamic exchange capacity (in relation to samarium ions) is 6.66 mmol/g; 6.13 mmol/g; 6.42 mmol/g; 5.93 mmol/g.

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DETERMINATION OF THE SELECTIVITY OF POLYAMPHOLYTES TO NONFERROUS METALS IONS

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To solve the technological problems associated with obtaining high-purity substances in separation processes, extraction and concentration of rare and non-ferrous metals should be used chelating resins having a greater affinity for the studied ions. Such sorbents include nitrogen and phosphorus polyampholytes having in its composition and amino phosphoric group [1]. Such sequestering polymers may be used in non-ferrous metallurgy, hydrometallurgy for recovery of zinc, copper, cobalt and nickel from waste water in the chemical industry, and also for producing substances of various natures.

Complexing sorbents useful for the selective adsorption of nonferrous metals can be divided into two classes: the sorbents containing amino groups and sorbents containing phosphonic groups [2].

Therefore, the present work is devoted to the analysis of sorption of Cu (II), Zn (II), Co (II) and Ni (II) from aqueous solutions of nitrogen and phosphorus containing polyampholytes PPE-1-P.

Ion exchanger material PPE-1-P synthesized by modification of granular polyvinyl chloride (PVC) with amines to further processing with phosphorous acid in the presence of formaldehyde [3], in static conditions. It have cation exchange phosphonic and anion exchange amine groups.

To determine the selectivity of PPE-1-P polyampholyte with respect to metal ions, a complex artificial solution containing copper (II), nickel (II), zinc (II) and cobalt (II) ions was used. From 1 to 0.05 mol of the salt of copper (II) nitrate, nickel (II), zinc (II) and cobalt (II) salt, 1 liter of distilled water was dissolved and a 0.05 M solution was prepared. The sorption of metal ions in this solution was carried out under dynamic conditions in the active position. To determine the concentration of metal ions before and after sorption by polyampholyte, an atomic emission sorption analysis method was used.

The test substance is determined on an Optima-2100DV device (USA). Optics of an emission spectrometer with an inductively coupled argon plasma or a similar spectrometer. In the method of determination, indicate the optimal wavelength of the element to be determined from the list of software of the device at which the element emits the maximum emission of the absorbed energy.

Table

Quantitative determination of polymer metals

The name of the substance	Metallsmg/kgppm			
	Cu	Ni	Cd	Zn
PPE-1-P+Me	6585	260	1250	1557

As can be seen from the data given in table copper (II) ions were sorbed to PPE-1-P polyampholyte 5 times more than other ions of the investigated ions, which indicates the polyampholyte PPE-1-P selectivity to copper (II) ions in degree than the rest of the ions in solution.

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OC

1D NANOCOMPOSITES FOR PEC WATER SPLITTING REACTION

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Among the existing approaches in terms of converting solar energy the photoelectrochemical (PEC) hydrogen production is very promising [1]. Direct decomposition of water in terrestrial conditions under the action of sunlight is practically not feasible, since the water is transparent to light waves longer than 190 nm [2]. Therefore, the use of PEC process using semiconductor materials and/or organic compounds is very promising [3]. Semiconductor materials with positions of valence and conduction levels suitable for PEC reactions are important components of photoelectrodes. Zinc oxide and cadmium sulfide are commercially available materials with semiconductor properties when used as active photoanode layers. The relatively low temperature of synthesis of such semiconductors allows to reduce the total cost of the PEC cell and, therefore, to obtain cheap hydrogen.

The formation of zinc oxide nanotubes was carried by selective etching of ZnO nanorods. The process of selective etching proceeded in a potentiostatic mode in a three-electrode cell. The electrolyte of the system was a solution containing 0.05M Zn(NO3)2*6H2O and 0.5M KCl. Temperature 70□, time 120 min, applied positive voltage was 1 V.composite materials ZnO/Ag were obtained by electrodeposition of silver nanoparticles on ZnO arrays [4] by applying a negative voltage of 1± 0.1 V for 90 seconds, followed by washing the samples with deionized water. The deposition ofCdS layers proceeded according to the well-known layer-by-layer (SILAR) adsorption technique described in [5]. In result ZnO/Ag/CdS nanocomposites as an active material for PEC cell was obtained (Fig. 1)

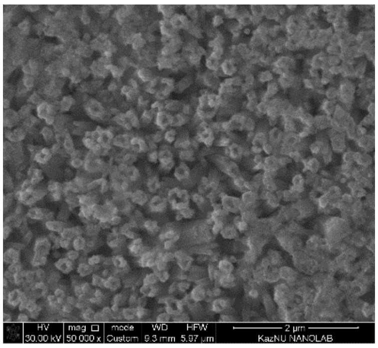

Figure 1. SEM image of ZnO/Ag/CdS nanocomposites

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NEW CATION EXCHANGE RESINES BASED ON POLYVINYLCHLORIDE

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Ion exchange materials are a critical component in advanced technologies. They are used in many market segments and applications globally. Their use is crucial for the effective and efficient operation of many technologies encompassing diverse applications from commodity chemicals to water purification technologies. Among all their application segments, they are used for separations, purifications, columns and a variety of chemical processes that produce components we use in our daily lives[1].

The global market for ion exchange materials should reach $9.5 billion by 2021 from $5.5 billion in 2016 at a compound annual growth rate (CAGR) of 11.8%, from 2016 to 2021.• The water technologies market is the largest sector of the ion exchange materials market. The market is expected to grow from $1.8 billion in 2016 to $2.5 billion in 2021 at a CAGR of 6.7% for the period 2016-2021.• The energy storage and generation sector of the ion exchange materials market is expected to grow from $1.0 billion in 2016 to $3.3 billion in 2021 at a CAGR of 26.5% for the period 2016-2021 [2].

Starting from the very beginning of our independence, in Uzbekistan all required conditions have been creating for industrial development and new no waste productions of competitive, ecological and import-substituting goods are creating. We can name some of them - «Shurtan Gas Chemical» and «Ustyurt Gas Chemical», producing polymers using local raw materials, and a new chemical plant which is creating at «Navoiyazot Ltd» and expecting to be completed in 2019 with annual production of 100000 tons of polyvinylchloride (PVC). It makes possible to diversify chemical industry by creation of production of various polymer materials having different and complex properties.

Purpose of research work is synthesizing cationites containing sulfuric groups by modifying polyvinylchloride and studying the physical and chemical properties of obtained products [3-5].

As a result of the conducted studies were found optimal conditions for synthesis of cationexchange resin using granular polyvinylchloride as a substrate have been determined for the first time.

It has been found that synthesized ionites have high sorption efficiency, thermal and mechanical resistance and are similar to those of commercial cationitKU-2 in terms of abovementioned characteristics. High sorption factors of synthesized cationites for copper, calciumand magnesium ions have been found.

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PREPARATION OF PHARMACEUTICAL MATERIALS FROM WATER-SOLUBLE POLYMERS USING HOT MELT EXTRUSION

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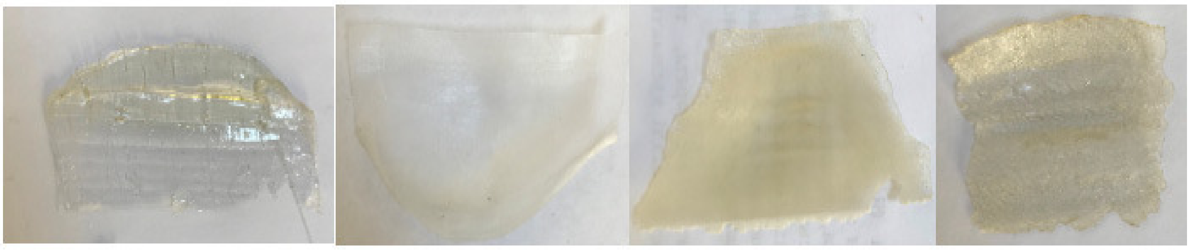
Hot melt extrusion (HME) is the method involving an application of heat and pressure to produce polymeric films or fibers. HMEhas been widely used to produce pharmaceutical materials [1-3]. In this work homogeneous polymer films were produced from several water-soluble polymers using hot melt extrusion for potential pharmaceutical applications.These films were preparedusingpoly(2-ethyl-2-oxazoline), poly(N-vinylpyrrolidone), poly(vinyl alcohol) and polyacrylamideusingextrusion of polymer powders with microcompounder DSMXplore (Netherlands). The microstructure of these films was examined using scanning electron microscopy. These studies indicate that the morphology of the resulting materials isnot fully uniform and is dependent on the nature of polymer used.



a) b) c) d)

Fig. 1. Images of the films prepared from (a) poly(2-ethyl-2-oxazoline), b) poly(vinyl alcohol), c) polyacrylamide, and d) poly(N-vinylpyrrolidone).

In the future these films will be evaluated for their mechanical properties, thermal properties, solubility in biologically relevant fluids, and transparency. Additionally we are planning to evaluate the possibility of preparing composite films from physical mixtures of different water-soluble polymers.

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PREPARATION OF HEC-CONTAINING PALLADIUM NANOCATALYSTS FOR HYDROGENATION

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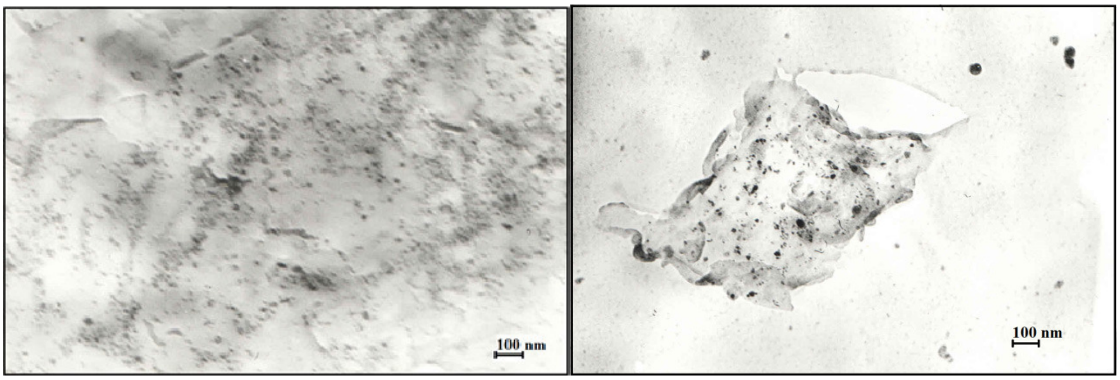
In the last decade, increasing environmental problems and the high cost of synthetic materials necessitate to search for the new renewable resources for chemical synthesis. In this regard, application of natural polymers such as polysaccharides becomes promising due to their unique properties including high ability to complexation [1, 2]. The latter feature is used in design of the new hybrid organic-inorganic materials. Combination of components with different chemical nature can lead to the formation of composites with new characteristics.

In this work we used such approach for the development of hydrogenation catalysts based on natural polysaccharide and inorganic support. A natural sorbent - bentonite (BT) was used as a support. A cellulose derivative (2-hydroxyethylcellulose -HEC), was chosen as the modifier. Palladium chloride was used to prepare the catalysts with 1 wt. % of Pd. According to photometric studies, the all introduced targeted Pd was fixed to HEC-modified bentonite. Elemental analysis data confirms the results.

The interaction of palladium ions with the polymer was detected by IR-spectroscopy. Shifting of the bands of functional groups of HEC was observed in the spectra of HEC-BT and Pd-HEC/BT composites.

TEM of Pd-HEC/BT showed the formation of small nanoparticles with sizes of 4-5 nm (Figure 1, a). In the sample of the catalyst without the polymer the larger palladium particles (from 5-7 to 20-30 nm) are randomly distributed on the BT surface (Figure 1, b).



a b

Figure 1. TEM images of Pd-HEC/BT (a) and Pd/BT (b)

The developed nanocatalysts showed high activity and selectivity in hydrogenation of phenylacetylene to styrene (90%) at 40°C and atmospheric pressure of hydrogen.

Thus, the design of the catalysts based on sequential adsorption of the polymer and then Pd on BT is encouraging. The advantage of the method was low-temperature for all stages of preparation (without processes of calcinations and reduction).

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POLYSACCHARIDE-STABILIZED CHROMIUM CATALYSTS FOR OXIDATION

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At present time nature polysaccharides are used in catalysts design[1, 2]. They are characterized by a unique combination of such properties as biocompatibility, biodegradability, bioadhesiveness and nontoxicity.In addition, polysaccharides are capable for complexing with metal ions, wide available and, as a rule, cheap making them promising components for the creation of catalysts.

We have developed the method for preparation of catalystsby adsorption of polysaccharide and then transition metal ions on the surface of inorganic supports. In thisresearch, we demonstrate catalytic properties of 7% chromium catalysts supported on bentonite modified with polysaccharide.

Pectine (PC) and hydroxyethyl cellulose (HEC) were selected as stabilizer of the active phase. The preparation of catalyst includes two main stages: The first, adsorbtion of polysaccharides-bentonite composites. The second, fixation of chromium ions on the polysaccharides-bentonite composites.

The developed chromium catalysts were studied by transmission (TEM) and scanning(SEM) electron microscopy, IR-spectroscopy. TEM of 7% Cr-PC/BT catalyst showed the formation of chromium nanoparticles with 5-8 nm sizes (Figure 1, a). In the case of the HEC-containing catalyst, aggregates of small chromium particles (3-4 nm) are formed, perhaps, due to their location inside bulky polymer matrix (Figure 1, b).

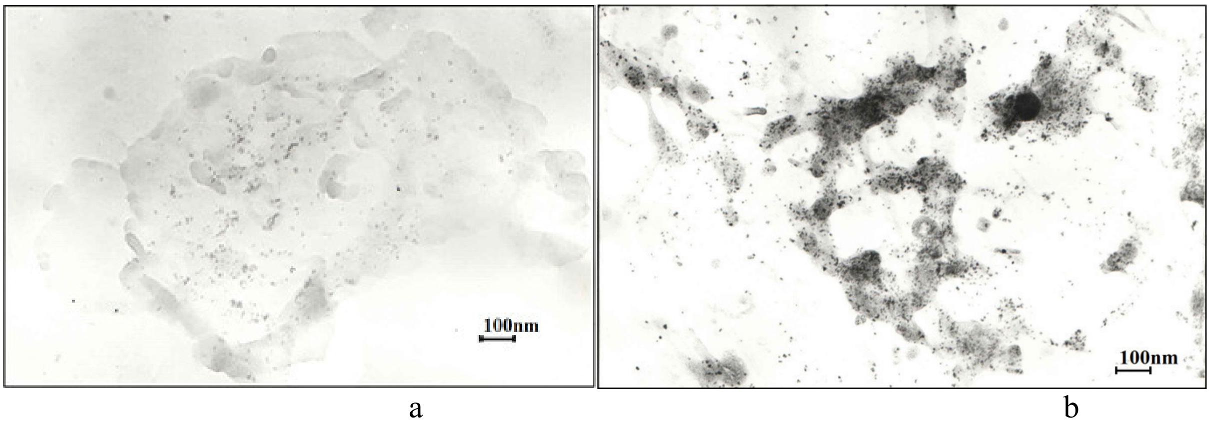

Figure 1. TEM images of 7% Cr-PC/BT (a) and 7% Cr-HEC/BT (b)

The prepared catalysts were tested in oxidation of cyclohexane by hydrogen peroxide under mild conditions. The catalysts showed high effectiveness in the reaction. In the presence of 7% Cr-PC/BT the conversion was 12.1 %and the selectivity to KA-oil (a mixture of cyclohexanone and cyclohexanol) – around 99.0%.

Thus, natural polysaccharides can be used for preparing effective supported chromium catalysts for the oxidation. The role of polysaccharide is to stabilize Cr nanoparticles, fix them on the surface of the supports and prevent agglomeration.

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HYDROGENATION OF NITROCOMPOUNDS BY SILVER AND GOLD NANOPARTICLES IMMOBILIZED WITHIN POLYAMPHOLYTE CRYOGELS

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The application of amphoteric macroporouscryogels with immobilized metal nanoparticles as effective flow-through catalytic reactor for one-step synthesis of aminoaromatic compounds has been realized for the first time. Aqueous solutions of p-nitrophenol (p-NPh) and p-nitrobenzoic acid (p-NBA) were hydrogenated in mild conditions in the presence of silver (AgNPs)and gold (AuNPs)nanoparticles immobilized within macroporous amphoteric cryogels based on N,N-dimethylaminoethylmethacrylate (DMAEM) and methacrylic acid (MAA) (Figures 1,2,3 and 4).

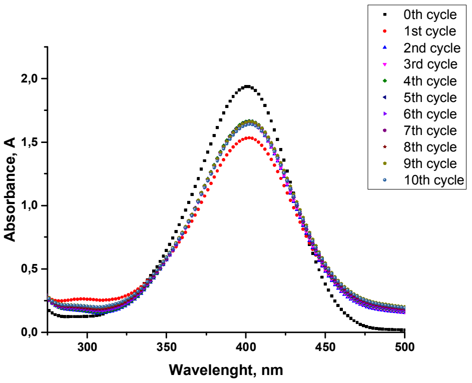

Figure 1 – Hydrogenation of p-NPh (AgNPs)

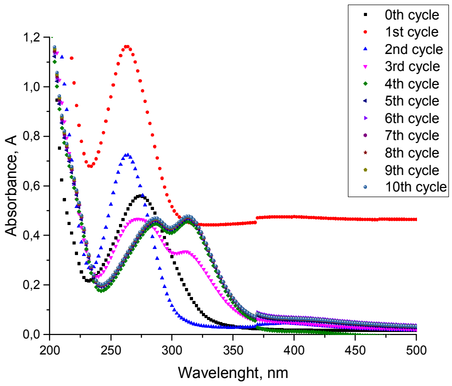

Figure 2 - Hydrogenation of p-NPh(AgNPs)

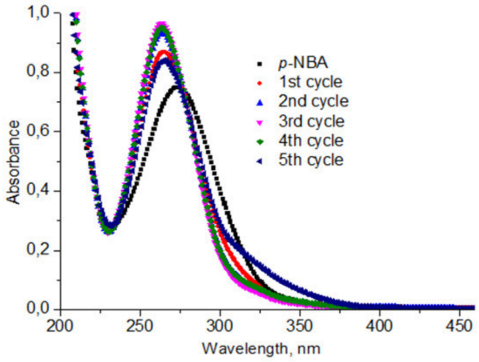

Figure 3 – Absorption spectra of p-NBA hydrogenatedfrom the 1st to 5th cycles (AuNPs)

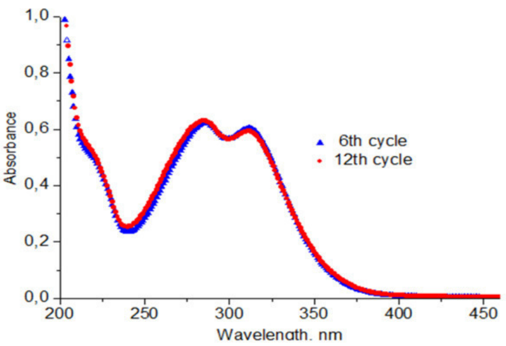

Figure 4 – Absorption spectra of p-NBA hydrogenatedfrom the 6th to 12th cycles (AuNPs)

The reduction of p-NPh to p-aminophenol (p-APh) and p-NBA to p-aminobenzoic acid (p-ABA) by NaBH4 was monitored by measurement of the absorption spectra of substrate at 400 nm and 274 nm respectively. The molar ratio of substrate to reducing agent was varied from 1:10 to 1:100 at constant concentration of substrate (1·10-10 or 5·10-5 mol·L-1). Starting from the 4th cycle of p-NBA hydrogenation, an additional two absorption peaks at 285 nm and 313 nm are observed (Figure 2). The intensity of these peaks does not change up to the 10th cycle. It is supposed that the appearance of the two peaks is connected with formation of p.p'-azodibenzoate due to catalytic coupling condensation of nitroso compound with hydroxylamine.

Acknowledgement. Financial support from the Ministry of Education and Science of the Republic of Kazakhstan (IRN AP05131003, 2018-2020) is greatly acknowledged.

KINETICS OF THE REACTIONS ISOPHORONE DIISOCYANATE WITH POLY(1,4-BUTYLENE ADIPATE) AND WATER-DISPERSIBLE POLYURETHANES BASED ON THEM

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As shown early [1,2], selectivity of the NCO-groups ofisophoronediisocyanate (IPDI) in the reactions with alcohols can be controlled by varying the nature and concentration of catalyst as well as the nature of solvents. In this work the kinetics of urethane formation with IPDI and poly(1,4-butelene adipate) (PBA) in acetone using IR spectroscopy was investigated. The rates of reactions with the aliphatic and cycloaliphatic isocyanate groups of the isophoronediisocyanate were established. Efficiencies of dibutyltindilaurate(DBSDL) and 1,4-diazabicyclo[2.2.2]octane (DABCO)–based catalysts in these reactions were estimated. Water dispersible polyurethanes (WDPU) with various contents of the hydrophilic agent 2,2-bis(hydroxymethyl)propionic acid (DMPA) were synthesized based on obtained kinetic data, and their properties were studied.It was found that in the case of DBSDL NCO-prepolymer contains of cycloaliphatic urethane units mainly whereas at using DABCO the contents of aliphatic and cycloaliphatic urethane groups are close. Thus, varying the type of catalysts prepolymers of different structures can be synthesized.

This work has been performed in accordance with the state task, state registration No 0089-2019-0008 with the use of the Analytical center for shared use of IPCP RAS.

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SYNTHESIS OF PETA-PEMP BASED GELS AS BIODEGRADABLE DOSAGE FORMS

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Nowadays, polymers are the largest and most promising class of biomaterials.Thisis confirmed by their widespread use for various medical purposes.Tissue engineering scaffolds, biosensors, drug delivery systems and wound dressings are closely connected with polymer materials.They have become very popular due to their unique properties such as non-toxicity, flexibility,biodegradability and biocompatibility [1].

In our work polymer materials of different monomer ratios were synthesized in the presence of N,N-dimethylformamide (DMF) as described in [2]. Initial monomer mixture was based on pentaerythritoltetraacrylate (PETA)and pentaerythritoltetrakis(3-mercaptopropionate) (PEMP). Synthesis was conducted at 30°C up to one hour with constant stirring. Reaction resulted in transparent brittle gels. Synthesized gels were washed in DMF and then acetone. When exposed to water obtained gels lost their transparency and turned white.

These polymer materials were characterized using different methods such as sol-gel analysis, FTIR-spectroscopy, RAMAN-spectroscopy, scanning electron microscopy and compression test.

According to sol-gel analysis it was found that the highest yield of gel fraction is observed for the 1:1 composition. At 3:1 and 1:3ratios, the yield of the gel fraction is smaller, since one of the components is deficient, all PETA or PEMP molecules are bound, and the remaining unreacted monomers simply remain in solution, thenremoved during washing.

Chemical composition of the synthesized gels was studied using FTIR-spectroscopy and RAMAN-spectroscopy. IR-spectra showed bands in the region of 1745-1725 cm-1due toC=O stretching, 1180–1140 cm–1due to C–O–C stretching. The absorption band in the region of 690–640 cm–1 indicates the presence of (–C–S)functional groups in the polymer, band at 1635 cm-1 indicates the presence of (-C=C) groups. In order to confirm thiolgroupspresenceRAMAN-spectroscopy was used, since SH-groups have weak signals on the IR-spectra. The RAMAN-spectra showed a strong band at 2590-2550 cm-1due to S-H stretching.

For a detailed study of the structure and morphology of the gels, the samples were analyzed by scanning electron microscopy. Gels with an excess of PETA havemore porous structure. As the concentration of PEMP monomers increases, more densenetwork structure is formed.

Mechanical properties of synthesized materials were investigated by mechanical test in compression mode.Compression test showed that gels based on PETA-PEMP are quite strong and elastic. The influence of the ratio of the initial monomers on the strength of the obtained gels is noticeable. The presence of a predominant amount of PEMP in the composition contributes to a slight decrease in the elasticity of the polymer network and an increase in its strength.

We suppose that PETA-PEMP based polymers could be used as biomedical materials for drug delivery. In future, we plan to test them as implantable drug carriers and study their drug loading and release properties.

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SALT TOLERANT ACRYLAMIDE BASED QUENCHED POLYAMPHOLYTES FOR POLYMER FLOODING

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Salt tolerant polyampholyte terpolymers synthesized from fully charged monomers such as 2-acrylamido-2-methyl-1-propanesulfonic acid sodium salt (AMPS) and (3-acrylamidopropyl)trimethylammonium chloride (APTAC) in combination with nonionic acrylamide (AAm) were used for polymer flooding experiments in sand pack model. The structure of terpolymerswere identified by proton NMR. Polyampholyteswith different molar compositions AMPS-APTAC-AAm = 5:5:90; 10:10:80; 15:15:70; 20:20:60 and 25:25:50 mol.%/mol.%/mol.% were tested for polymer flooding experiments.High permeable porous medium (16 Darcy) and viscous oil of East Moldabek (Kazakhstan) (140cp) were used for sand pack flooding experiments. Initially the model was saturated with brine (100g·L-1) and oil. Water flooding allowed to displace 33% of oil. Figure 1 presents the results of the polymer-flooding test.

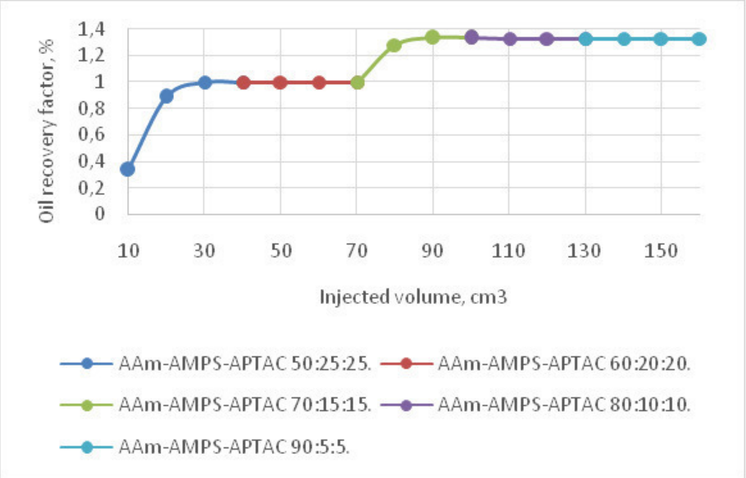

Figure 1 – Oil recovery vs polymer injected volume at room temperature. Polymer concentration is 0.5%, salinity of brine is 100 g·L-1. Flow rate is 0.1cm3/min. 1 pore volume is around 50cm3.

As seen from figure 1, the injection of AMPS-APTAC-AAm = 25:25:50and 15:15:70allowed recovering1 and 0.3% incremental oil respectively.However, taking into account the high permeability and oil viscosity, as well as homogeneity of the sand (grains size was 0.25-0.5mm)one can expect that the better results may be obtained for layered heterogeneous models with lower oil viscosity [1].

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THE INTERACTION OF SOME DERIVATIVES OF BENZIMIDAZOLE WITH POLYELECTROLYTES IN AQUEOUS AND WATER-ALCOHOL MEDIUM

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Today, all around the world, due to the expansion and increasing of use of polymers in various industries, the demand for artificial polymers is increasing. Therefore, the creation of new complexes of polymerswiththe biologically active substances allows to create the new dosage forms and macromolecular therapeutic systems, reduce the toxicity, increasethe resistance to the action of various enzymes. The extension of their application is important [1]. In the hot countries, it is particularly importantto developthelivestock breeding, aswell as to develop the effective remedies for treatmentand preventing of diseases, which can damage this industry.

This report presents the results of the study of the interaction between some anthelmintic anti-echinococcus drugs-medamin and albendazole-andsome natural and synthetic carboxyl-containing polymers.The potentiometric titration method was used to calculate the degree of the electrostatic binding between medamineandpolyacids. It shows, that there was the dynamic equilibrium between the combined and free drug at any ratios, and there was also some part of free drugs - medamine and albendazole, not combined to the polymer complex.The viscosimetry shows that the complexation of medamine and albendazole with polymers is accompanied by conformational changes of macromolecules, in some cases the complexation proceeds the release of the new phase - gel or precipitate [2].The IR and UV spectroscopy [2] supported the formation of a polymeric complex between medamineand the polyacids and albendazole and the polyacids. These complexes were realized by the electrostatic interactions and by the formation of hydrogen bonds.The thermodynamic parameters (ΔG0, ΔH0, ΔS0) of the complexation process of medamine with pectin acid and directly pectin were found by the method of differential microcalorimetry. The exothermic nature of the general binding due to the large contribution of electrostatic interactions was established. It was shown that the overall thermal effect consists of the hydrophobic component and the thermal contribution of the electrostatic interactions. The thermodynamic parameters of the interaction of medamine and albendazole with polymers were determined by the rare-crosslinked gelssorption method. It was shown that the complexation was the spontaneous process. The ordering of the system as a whole wasoccured. The recommended polymeric carriers for medamine are pectin and pectic acid, for albendazole -pectic acid and polymethacrylic acid [1].It was determined that the polymeric complex of medamine with pectin is the low-toxicdrugwith good tolerance, whichhas thestrongly pronounced anti-echinococcus action. The 2.5% aqueous solution of the polymeric complex of medamine with pectin was recommended for the treatment and prevention of alveolar nepionicechinococcosis in veterinary practice.

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APPLICATION OF COMPOSITE MATERIALS BASED ON POLYVINYL ALCOHOL DURING SOIL PHYTOREMEDIATION

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Soil is one of the most important natural resources, the state of which largely determines the ecological balance of the planet. The main characteristic of the soil is the fertility, which is formed by the activity of microorganisms. Economic activity leads to soil contamination, reduction of economic and potential fertility.Soil Contamination with oil and petroleum products is currently an urgent problem. Extraction of oil from the subsoil, purification and transportation are not only technically difficult, but also dangerous processes, since it is impossible to preserve natural environmental conditions during the development of deposits. Inevitably, each stage of production is accompanied by oil leakage, which can cause incorrigible situations. Chronic oil spills are a serious threat to the environment and human health.Microorganisms along with plantsandanimalstakeanindirectpartin thedecompositionof oil. If the soil is contaminated with oil, it is possible to inhibit the growth of plants and the activity of soil animals, which in turn can have an impact on microbial activity. Loosening the soil with plant roots, earthworms and burrowing arthropods improves soil drainage and facilitates gas exchange. In addition, burrowing animals can move organic material to biologically active surface layers of soil. Plants and especially legumes enrich the soil with nitrogen and biologically active compounds, which stimulates the growth of microorganisms and, accordingly, increases the intensity of oil decomposition.

In the proposed work, films were obtained by mechanical mixing, in the presence of a glycerin plasticizer. Polyvinyl alcohol (PVA) and chitosan (Ch) were taken as initial reagents. Solutions of polyvinyl alcohol and chitosan with a concentration of 1% were prepared to produce films. PVA solution was obtained by dissolving in distilled water at a temperature of 70-75oC in a thermomagnetic stirrer, chitosan solution was obtained by dissolving in 1 % acetic acid at room temperature. The films were obtained by mechanical mixing of two solutions in the presence of a glycerin plasticizer with a concentration of 0.5 wt.%. Then the films were poured into Petri dishes and dried. The solubility of films in organic solvents and in distilled water was investigated. It was shown that the solubility of films in distilled water is higher than in organic solvents. For the obtained films were removed IR spectra, which observed absorption bands characteristic of the structure of polysaccharides and alcohol. Also, it is shown that polyvinyl alcohol and copolymers of chitosan stabilized by hydrogen bond. The mechanical properties of these films were studied. It is found that with increasing molecular weight of PVA and the content of polysaccharide their interaction and strength properties decrease.

During the study, the obtained films based on polyvinyl alcohol and chitosan were used in the process of phytoremediation. In the laboratory, the plant was grown in oil-contaminated soil, in the presence of the resulting copolymer. Were taken 3, 6, 9% oil by soil massand 0.1 g polymer. In the course of the experiment, it was studied that soil contaminated with 6% oilby soil mass stimulates plant growth, when soil contaminated with 9% oil by soil massadversely affects plant growth. Also, to determine the effect of films based on [PVA]:[Ch] on the process of phytoremediation, soil extraction was carried out. It was found that the use of plants and copolymers [PVA]:[Ch] in the phytoremidiation of oil-contaminated soils by extraction gives a high degree of purification (86.9%).

Thus, the polymer films based on PVA can be used in the process of phytoremediation for the cleaning of oil-contaminated soils.

FUNCTIONALIZED ATACTIC POLYPROPYLENE: PROPERTIES, APPLICATION

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New complex reagents based on polyolefin production waste - atactic polypropylene (APP) have been developed. Modification of atactic polypropylene was carried out by the method of radiation-chemical grafting of allylamine (AA) and vinyl butyl ether (VBE) on its macromolecule at an irradiation dose of 200 and 1200 kGy.

The degree of grafting of the monomer onto the APP matrix was determined by a gravimetric method. It was revealed that with an increase in the dose of radiation, the degree of vaccination increases and for the APP-AA copolymer it is up to 29%, for APP-VBE -27.5%.

The composition, structure, and basic characteristics of the modified samples of DLC were investigated by means of IR, 1H, and 13C NMR spectroscopy, DSC, and X-ray phase analysis. It was established that the radiation-chemical modification of the DSC promotes an increase in the amorphous phase, which leads to a decrease in the melting point of the copolymers, an increase in their solubility in hydrocarbon solvents, which confirms the addition of grafted monomers to the DSC as lateral units.

The copolymers developed were tested as inhibitors and depressants for high paraffin oil from the Kumkol field.

According to the research results, it was revealed that the introduction of the developed copolymers based on APP to the tested oil improves the rheological properties and allows reducing the ARP deposition process by directing the phase composition of the deposits [1].

It is noted that the effectiveness of inhibition of paraffin and depressant activity of the reagent increases with increasing dose of radiation APP. The best effect of improving the rheological properties (depression –21˚C) and inhibiting ARPD (79%) of oil is observed when introducing the APP-AA reagent with a dose of 1200 kGy (APP-AA / 1200). The optimal concentration of all reagents is 300 ppm. According to the results of studying the effect of inhibitors on the phase state of ARPD oil, it was revealed that the developed reagents allow to change the phase composition of sediment directionally: after entering the APP-AA / 1200 brand reagent into oil, the degree of amorphization of ARPD increases from 44 to 78%.

It is established that copolymers based on APP and allylamine exhibit corrosion inhibiting ability: the inhibitory efficiency of the APP-AA / 1200 reagent was 92%.

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FLEXIBLE SOLID POLYMER ELECTROLYTE FOR LITHIUM-ION BATTERIES

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The development of portable electronic devices, such as roll-up displays, smart cards, wireless sensors, and wearable devices needs flexible and compact lithium ion batteries (LIBs) with a high energy density, long cycle life, and excellent rate capability.As one of the critical components ofLIB, solid polymer electrolytes (SPEs) are very important for preparing high-performance flexible LIBs.

We prepared series of UV-crosslinked solid polymer electrolytes based on polydimethylsiloxane (PDMS) with acrylate terminal groups. Lithium bis(trifluoromethane)sulfonamide (LiTFSI) was used as Li salt and trimethilolpropane ethoxylate triacrylate (ETPTA) as a crosslinking monomer. After UV-crosslinking process FTIR and NMR spectroscopies were used to confirm the structure of polymer films.Mechanical and thermal properties of obtained SPEs were studied by TGA, DSC and stress-strain analysis. The ionic conductivities were determined by electrochemical impedance spectroscopy (EIS) analysis. Obtained transparent SPEs have excellent mechanical properties and good flexibility.

Acknowledgements

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POLYMER-DRUG CONJUGATES FOR ONCOTHERAPY AND IMMUNOONCOTHERAPY

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Targeted delivery combined with controlled drug release plays a key role in the development of personalized medicine. The benefits of the use of synthetic polymers, e.g. N-(2-hydroxypropyl) methacrylamide (HPMA) copolymers, as drug carriers to tumor treatment have been widely accepted.1

Synthesis of the polymer-drug conjugates is based on conjugation of reactive copolymers – polymer precursors with drugs or other biologically active compounds.The conjugates containing anticancer drug doxorubicin, pirarubicin or docetaxel bound by a pH-sensitive hydrazone bond exhibited a significant therapeutic effect in vivo.2While the polymer-drug conjugates were stable in a buffer at pH 7.4 (mimicking blood stream environment), the drug was released in a buffer under mild acidic conditions modelling the tumor tissue or cells. Besides controlled drug release the therapeutic efficacy of polymer-drug conjugates is based on selectivity toward solid tumors driven by the Enhanced permeability and retention (EPR) effect, which results in almost 100 times higher concentration of drug in the solid tumor than in normal tissue.3Polymer carriers based on high-molecular-weight star-like or micellar HPMA copolymers synthesized by free or controlled Reversible addition-fragmentation chain transfer (RAFT) radical polymerization form an efficient platform for preparation of various drug delivery systems.

The drugs can beused also in combination to improve anticancer activity. Besides polymer conjugates for oncotherapy, polymer conjugates with various immunomodulatory agents or signal transducer and activator of transcription 3 (STAT3) inhibitorswere synthesized and characterized in vitro and in vivo. Their combination with polymer-bound chemotherapeutics should help the immune system to treat cancers more effectively.Polymer carriers can be employed also for diagnostics purposes, e.g. using noninvasive multispectral optical imaging of fluorescently labeled copolymers.4Here, far-red or near-infrared fluorescent dyes are covalently bound to polymer carriers.

HPMA-based polymer-drug conjugates are very promising to be used for the future personalized medicine.

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EVALUATION OF NATURAL POLYSACCHARIDES FOR CONTROLLED RELEASE OF MEXIDOLE

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Drug delivery directly into the eye is complicated due to removal mechanism of corneal area, resulting in decrease of therapeutic response. Conventional ocular delivery systems like eye drops, suspensions and ointments show some disadvantages such as rapid corneal elimination, repeated instillation of drug and short duration of action. Moreover, regular drug installation is danger for eye and can result in toxicity, the risk of unwanted side effects. The development of polymeric drug delivery systems is the fundamental direction of polymeric and pharmaceutical technology.The application of polymeric materials in ophthalmology has led to the development of novel strategies for the treatment of ocular diseases.

The aim of the present work is the evaluation of natural polysaccharides chitosan and alginate as carriers for controlled release of ophthalmic drug mexidole. Immobilization was carried out by means of salt formation with water-soluble natural polysaccharides.The interaction of drugs with polymers was studied from the viewpoint of thermodynamic behavior. The free drug concentration was determined from residual drug concentration; the binding constants were calculated from Klotz equation. The data obtained show that the thermodynamic parameters and their temperature dependence show the existence of electrostatic and hydrophobic interactions between drugs and polysaccharides. The release of drugs into model biological medium at 37°C was studied.

Films containing various doze of mexidole, are received from 2,5% solutions of chitosan by means the putting of solution on a horizontal glass surface and their subsequent drying within 2-3 day. Influence of various factors on process of drug release from films in conditions «in vitro» was investigated. It was shown that pharmacology active substance practically completely diffused in Ringer-Lock solution within 4-6 hours, not undergoing any changes. With increase in thickness of film process of drug diffusion is slowed down. So, the 50 % of drugs from system by thickness 0,3 mm was released for 0,5-0,7 h, but the same quantity of drugs by thickness of film 0,6 mm was diffused for 1,3-1,5 h. The profile of kinetic curves testifies that process of release occurs according to the first order kinetic and controlled by diffusion of the therapeutic agent in polymeric matrix. In according with Higushi equation, describing kinetic of drug diffusion from monolithic systems with the dissolved therapeutic agent, dependence of amount of diffused drugs from chitosan films versus root of square time had linear character. Values of the diffusion coefficients has appeared within the limits of 2,5-3,0x10-7 sm2/s for four concentration that testified to absence of significant influence of drug loading for rate release from films.

Polymeric biomaterials were used for treatment of age-related macular degeneration at 24 patients. The experimental and clinical tests show that implantation to suprahoroidal area did not cause the pathological changes in the membrane of eyes and help to activate the formation of vascular anastomoses in 1 month. The positive effect is prolonged up to 6 month in 63 %. The results obtained in the present work have shown the perspectives of use chitosan-alginate based nanomaterials as a matrix for mexidole delivery for application in ophthalmology for the treatment age-related macular degeneration.

SUSTAINED RELEASE OF TILOZINE FROM CALCIUM ALGINATE MICROPARTICLES

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Controlled drug delivery technology using biodegradable polymers as carriers represents one of the actual and advanced areas of modern science and technology. Among polymeric carriers, applied in drug delivery systems, microparticles based on alginic acid and its derivatives are of particular interest due to many advantages.

The aim of present is the development of modified gel microparticles of calcium alginate, containing surface layer of chitosan, for immobilization of antibacterial drugs tilozine. Modified microparticles were obtained in the following way: at the first stage a solution of drug in 2,5% solution of sodium alginate was prepared, then the obtained solution was filtered and syringed dropwise into a mixed solution of chitosan in 0,1 M of calcium chloride, at a constant dropping rate of 1,0 ml/min. The obtained modified microparticles of calcium alginate were treated by the solution of calcium chloride for 30 min, washed with distilled water and physiological solution. As a result gel microparticles of calcium alginate were obtained, containing immobilized drug and surface layer of chitosan. For the determination of kinetics of drug release from alginate microparticles a special device was applied, consisting of a metallic basket.. The release of drug was studied under conditions in vitro at 37°C. The influence of the concentration of a polymer and the time of modification upon thickness of a surface layer of alginate gels has been studied. It has been established that with an increase in the concentration of a polymer from 0,3 up to 1,5 mass % thickness of the modified layer increases from 5 up to 60 micron, and an increase of the time of gel exposition in a 2,5% solution of chitosan from 30 min to 24 h results in an increase in thickness of a layer from 5 up to 20 micron respectively.

The composition of the polycomplex depends on pH of the medium. With low pH values a non-stechiometric complex, enriched by the links of alginic acid, is formed. In the neutral medium with pH of 7,2 aminogroups of chitosan are mainly in the non-ionized state and possess form of compact tuber, and sodium alginate macrochain is in the unfolded state. In the given case carboxylate anions interact only with the available protonated aminogroups of chitosan, located on the surface of chitosan tubers, and the formed polycomplex is enriched by the links of a polybase. In a weakly acidic medium with pH of 4,8 the formation of polyelectrolyte complex of an equimolar composition takes place, which is testified by wider range of minimum value of running through of a solution with the content of alginate of 40–60 %.

It has been shown that with an increase in thickness of a cover the release of drug decreases significantly. Thus, in the absence of a chitosan coating rifampicine diffuses from microparticles practically by 95–100% for 40–50 min. Upon the use of alginate particles with the coating thickness of 55 and 100 mkm the same quantity of the preparation is released for 180 and 240 min respectively. Maximal thickness of a chitosan coating provides a diffusion of the tilozine by 50–60% for 240–250 min. Noteworthy is the presence of an induction period of 10–20 min, when no release of the drug from the modified microparticles is observed. This time interval seems to be necessary for the passing of tilozine molecules through a layer of a chitosan cover, followed by a diffusion into the volume of the solution. After alginate microparticles are in the physiological solution for 4 hours, their complete destruction is observed, stipulated by the substitution of calcium ions for sodium ions. The use of such systems makes it possible to the constructions with controlled delivery of drugs to the organism in accordance with the pre-set time program.

NEW CORROSION AND SCALING INHIBITORS BASED ON MODIFIED MALEIC ANHYDRIDE COPOLYMERS

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New polymeric corrosion and scaling inhibitors have been developed by modifying copolymers of maleic anhydride polyoxyethylene sorbitan trioleate (Tween-85) and aniline. The synthesis was carried out in two stages. At the first stage, maleic anhydride was reacted with polyoxyethylene sorbitan-trioleate (Tween-85) in a solution of dipolar aprotic solvents using the method of catalytic esterification. Tertiary amines have been investigated as a catalyst. In the second stage, the nitrogen-containing compound brand SMATWEEN-A is obtained by amidation of the carboxyl group with aniline.

The structure and composition of the copolymer are characterized according to the data of IR-spectroscopy, X-ray phase analysis. On the IR spectrum of the obtained compound, the appearance of new absorption bands is observed. Thus, the band in the region of 3382 cm-1 refers to the vibrations of the O-H group, the band in the region of 1724 cm-1k vibrations of the C = O bond in the ester, 1640 cm-1 refers to the amide bond (N – C = O, amide I). The bands in the region of 1600–1500 cm–1 are related to the stretching vibrations of the aromatic ring. The band in the region of 1168 cm-1 can be attributed to the asymmetric vibrations of C – O – C in the ester bond (O – C = O). The results of X-ray phase analysis indicate the presence of nitrogen in the compound SMATWEEN-A.

Analyzing the structure of the synthesized compound, it was assumed that the new reagent can exhibit the properties of a corrosion inhibitor and scaling. In this regard, studies were conducted to identify the inhibitory activity of the new reagent on steel plates of the St3 brand.

According to the research results, it was revealed that the introduction of the developed compound on the basis of a modified maleic anhydride copolymer allows increasing the degree of protection of steel against corrosion and scaling.

It is noted that the inhibitor efficiency increases with increasing reagent consumption, and reaches 91.2% with a reagent consumption of 200 ppm with respect to the corrosion process, as well as 88.9% with respect to carbonate deposits.

Thus, the synthesized reagent brand SMATWEEN-A combines the high efficiency of inhibiting the processes of corrosion and scaling, which allows it to be used as a complex agent for protecting pipelines and equipment of the oil industry.

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DEVELOPMENT OF COMPOSITE POLYMER REAGENTS AND WEGHTED DRILLING MUD FOR DRILLING OIL AND GAS WELLS

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For obtaining and development of drilling fluids for drilling oil and gas wells use more than 3000 kind of chemicals in the world.The quality of the construction of oil and gas wells, and the quality of the opening of the productive formation, largely depends on the used chemicals and drilling mud because the drilling fluid is a technological fluid that interacts with the newly opened rock. Based on the analysis of basic research in the field of chemistry and biochemistry of carbohydrates, generalizing the practice of drilling wells, polysaccharides are used as polymer reagents for regulating the filtration and rheological properties of drilling fluids. The main reason for the choice of polysaccharides is their ability to chemical and biological destruction, due to which is possible to destroy and remove the formed clogging layer during the drilling process, and almost complete recovery of reservoir properties.

We have developed new compositions and technology of obtaining for production of composite polymer reagents by using of high molecular weight sodium carboxymethylcellulose, alkali, water-soluble modified powdered gossypol resins and organic-mineral additives of various ratios (10:25:65) to improve the physico-chemical properties of drilling fluids. Water-soluble modified powdery resins contain hydrophobic additives based on sodium salt of fatty acids and ionic surfactants. The use of these reagents for drilling fluids used in drilling oil and gas wells ensures the preservation of the regulated rheological and filtration properties of polymer systems at 80-190 ° C for 30-40 days.

Formation of weighted drilling fluids realize by adding special weighting agents as a barite or hematite. Barite weighting agent BaSO4 (barium sulfate) is a mineral containing 65.7% BaO and 34.3% SO3, as well as impurities: Sr, Ca, Pb, Ra, Fe2O3. It can be white, gray, red and yellow. Its density is 4.2- 4.7 g / cm3; Mohs hardness is 2.5-3.5.

Developed composite polymer reagents for drilling in salt and chemical corrosive environments, as they are stable to cations of polyvalent salts (Mg ++, Ca ++, Na +, K +). Composite polymer reagent KXR-UR is mainly gossypol about resin 60-65% and has a high lubricity properties due to the content in its composition of about 35-40% of polymerized fatty acids, pigment, glycerin and other useful components.

According to the result of testing work in the drilling process of oil and gas wells, it can be seen that with an increase in the KXR – UR concentration from 0.5 to 4%, the densityof solution weighted with bariteis about 1.85g / cm3, conditional viscosity of the T500 increases from 40 to 60 s, the pH of the solution increases from 7 to 9 without any sodium, the water loss decreases from 14 to 3 cm3 in 30 minutes and the stability of the solution reaches up to 0.05 g / cm3. The expected economic efficiency in the use of 1000 tons of composite chemical reagents will be about 3.54 billion soums.

As a result, research and study of the physicochemical properties of the developed composite polymer reagents and weighting agents have been proposed new compositions of weighted drilling fluids, as well as recommended to use in drilling oil and gas wells with abnormally high reservoir pressure (AHRP).

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ON THE POSSIBILITY OF QUANTITATIVEDETERMINATION OF THE CROSS-LINKING DEGREE WITHIN THE SPATIAL NETWORK OF COVALENTLY-LINKED POLYMERIC CRYOGELS

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Chemically cross-linked polymeric cryogels are promising materials for their use in various applied fields; especially these materials became very popular in biotechnology, medicine, catalysis, analytical chemistry, environment protection, etc. [1-4]. However, for these objects, such an important problem as the quantification of the cross-linking degree of the spatial polymer network and the content of residual pendant reactive groups in such gel matrices formed as a result of cryotropic gelation remained practically unexplored. With that the influence of cryostructuring conditions on the same indicators was also unclear.

The aim of the present work was to elaborate the approach to measure quantitatively the cross-linking degree of the 3D network in the respective covalent cryogels and to study the dependence of this parameter and the amount of unreacted residual functional groups on the conditions of the cryotropic gel-formation.

The macromolecular precursor for the preparation of cryogels of interest was the copolymer of N,N-dimethylacrylamide (DMA) with allyl glycidyl ether (AGE – the epoxy-containing comonomer) obtained via the redox-initiated radical copolymerization in aqueous solutions; D,L-dithiothreitol (DTT) was used as the cross-linking bi-functional thiol. The formation of the target cryogels was carried out in the moderately frozen aqueous media at different cryosynthesis temperature. The concentration of the polymeric precursor and the ratio of epoxy/thiol functional groups were also varied. For the quantification of the number of nodes in the spatial network the elemental analysis for sulfur content was used, and the amount of the unreacted residual thiol groups was measured spectrophotometrically using 2,2'-dipyridyl disulfide (such groups remained in the network matter when the crosslinker was able to couple with the copolymer only through one end thiol group).

It was found that the approach used allows obtaining quantitative data on the number of nodes of the spatial network in the chemically cross-linked polymeric cryogels. The gel-fraction yield, swelling characteristics of the polymeric phase (the walls of macropores) and, what was the major goal of this study, the cross-linking degree of these gel systems depended on the amount of epoxy-groups in the chains of DMA/AGE-copolymer, on the copolymer concentration in the feed solution, on the epoxide/thiol ratio, as well as on the temperature of the frozen gel-forming system.

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PROCESS OF COMPLEX FORMATION IN THE SYSTEM Fe (II) – Fe (III) – ACRYLAMIDE – WATER AND THEIR CHEMICAL MODELS

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Acrylamide (AA) has unique complex formation properties [1, 2], it can form polymeric coordination compounds in the presence of various transition metals under certain concentration conditions and pH. In formation of heterovalent coordination compounds, for example, iron (II) and iron (III) or cobalt (II) and cobalt (III) with acrylamide based on them, hydrogels with adjustable water absorption can be obtained. Such hydrogels are of great practical importance, since they can be widely used in medicine, in almost all areas of the agricultural industry [3, 4].

In connection with the above, we have studied the complex formation of iron (II) and iron (III) in acrylamide solutions at 298 K and the ionic strength of a solution of 1.0 mol / l using the Clarke-Nikolsky oxidative potential.According to theory of this method, experimental dependences of oxidative potential of the system on indicators of concentration parameters: hydrogen ions (pH), oxidized iron (pCO), reduced iron (pCr), ligand (pCL) with a constant ionic strength of the solution, which was maintained using ion perchlorate H(Na)ClO4. Curves analysis of experimental dependences showed that in the system: Fe (II) -Fe (III) -AA-H2O, the complex formation processes take place in a wide range of pH from strongly acidic to alkaline.

At the same time, coordination compounds of various composition were formed: [FeOH]2+,[FeL]3+, [Fe2L2]6+, [FeL(OH)]2+, [Fe2L2(OH)2]4+, [Fe2L2(OH)4]2+, [FeIIIFeIIL2(OH)2]3+, [FeL]2+, [Fe2L2(OH)2]2+. To calculate the stability of the resulting complexes and determine their other model parameters, the oxidative function and computer programs were used, which allowed us quickly and reliably calculate the thermodynamic parameters.

It was established that out of 9 coordination compounds were formed, the most stable is the heterovalent complex of the composition: FeIIIFeIIL2(OH)2+. Calculated value of its formation constant by iterating the experimental and theoretical oxidative functions were βqpslk=16,58; 14,24; 15,52; 16,02 and 18,68.

Molar fractions of the complexes were determined and diagrams of their distribution on the pH scale were constructed. Compiled tables of model parameters that exist in the studied system of acrylate iron complexes in two degrees of oxidation. Using these parameters, optimal conditions for the isolation of heterovalent acrylate iron complexes were determined. On the basis of such complexes, hydrogels with increased water-absorbing ability were obtained in the Moscow State University after M.V. Lomonosov. Such hydrogels were tested as moisture accumulators in laboratory, vegetative, and micro-plot experiments in the soil under cotton crops of the variety “108-F” at the Institute of Plant Physiology in the Academy of Sciences of the Tajikistan Republic.

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POLY(VINYL ALCOHOL) CRYOGELS FORMED IN THE PRESENCE OF LOW-MOLECULAR-WEIGHT AMINO ACIDS

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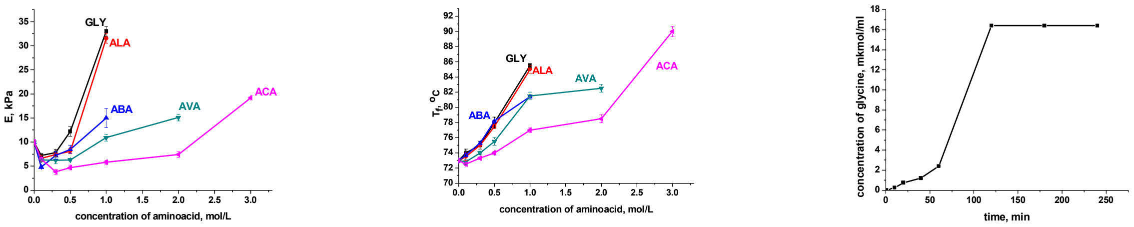
Various poly(vinyl alcohol)-based gels are known for a long time and they are related to the gel materials of significant scientific and applied interests. Among different poly(vinyl alcohol) (PVA) hydrogels those formed via the so-called cryotropic gelation approach, i.e. PVA cryogels [1,2], attract special attention owing to, firstly, simplicity of their preparation and, secondly, very good properties of such matrices. Characteristic features of this physical (non-covalent) gel matter are its high strength in combination with rubber elasticity, the presence of a system of interconnected macropores, excellent biocompatibility and non-toxicity. Therefore, PVA cryogels have been applied for a set of biomedical and biotechnological purpose, e.g., for the use as the wound dressings, drug delivery systems, artificial cartilages, and so forth [3,4].

The properties and microstructure of PVA cryogels depend on the characteristics of the gel-forming polymer itself, its concentration in the feed solution, presence or absence of soluble and insoluble (fillers) additives, as well as on the conditions of cryogenic processing [1,2]. In this regard, diverse chaotropic and kosmotropic additives exert rather pronounced influence, deteriorative or enhancing, respectively, on the properties of PVA cryogels. Therefore, such solutes can be used for adjusting the matrices' characteristics to the desired level.

In this study the PVA cryogels have been prepared from the aqueous solutions of the polymer that also contained the additives of one of the series of amino acids that are differed by the amount of methylene units between the amino- and carboxylic groups. Rheological and thermal properties of the resultant cryogels have been measured and compared (Figs. a and b). It was found out that the length of the oligomethylene chain affected the mechanical and thermal properties in the following way: the longer the chain was the weaker cryogels were formed. In turn, it was also demonstrated that similar gel matrices can perform as the efficient depot-forms of the above-indicated solutes (Fig. c), i.e. the spatial polymeric network of the carrier did not interfere the diffusion of the amino acids from such "model drug release system".


(a) (b) (c)

Influence of the added amino acid concentration on the elastic modulus (a) and fusion temperature (b) of the PVA cryogels formed in the presence of the following solutes: glycine (GLY), β-alanine (ALA), γ-aminobutiric acid (ABA), aminovaleric acid (AVA), aminocaproic acid (ACA), as well as the dynamic of glycine release from the respective cryogel (c).

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APPROACHES TO THE SYNTHESIS HELICAL POLYMER ON THE BASIS OF BETULIN

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According to the known method [1], we propose a scheme for the synthesis of a helix polymer based on biologically active betulin [2] (Figure 1).

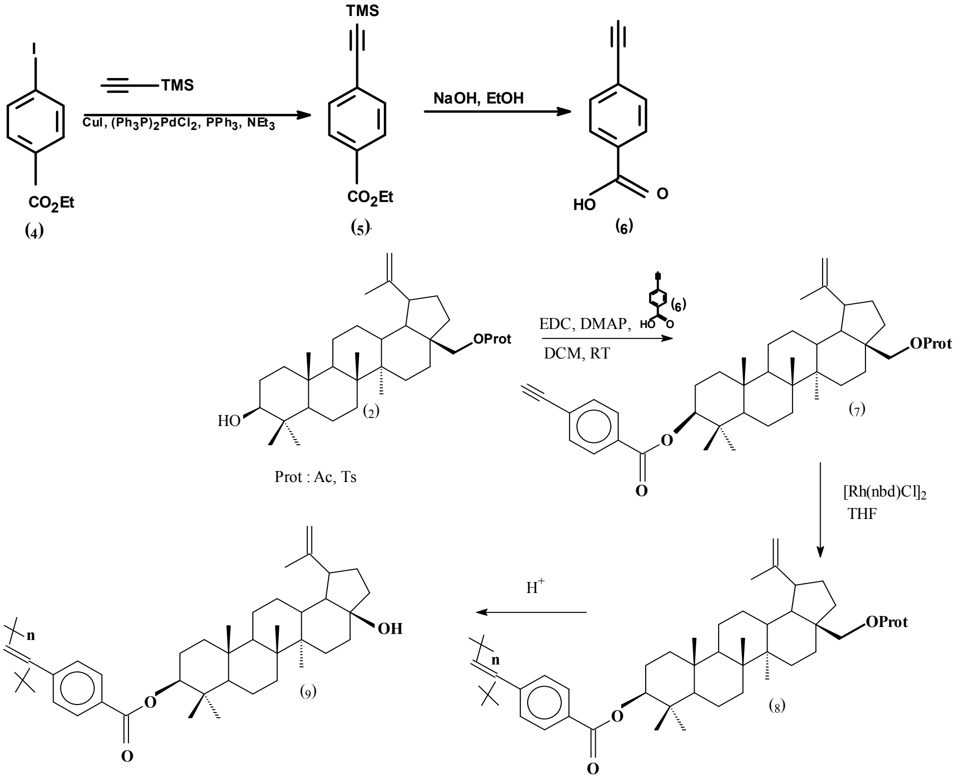

Figure 1. Scheme for the synthesis of a helix polymer based on biologically active betulin

At the moment, we have obtained betulin diacetate and acetate (2) (Figure 2), the structure of which is proved by spectral methods and X-ray analisys [3].

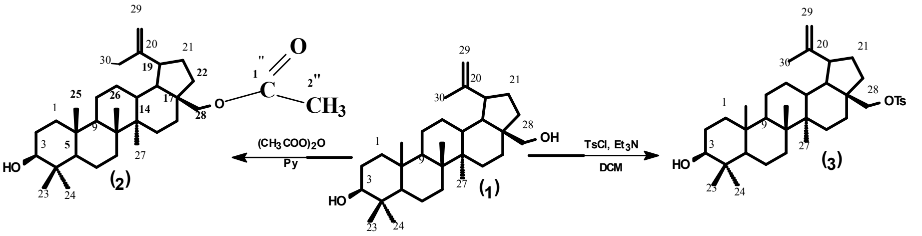

Figure 2. Protection of betulin by acetylation and tosylation

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NEW METHOD OF SYNTHESIZING ALBUMIN NANOPARTICLES USED FOR TRANSPORT OF DRUGS

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Albumin is one of the well-studied and widely used in medicine biopolymers. In particular, albumin is often used to produce nanoparticles capable of transporting drugs to target organs. Albumin nanoparticles are usually synthesized by the method of desolvation with alcohol followed by stabilization with aldehydes [1]. The method for producing albumin nanoparticles (HSA and BSA) using L-Cysteine, which crosslinks protein macromolecules as a result of a disulfide exchange reaction, has been developed [2]. The use of this approach will allow exclusion of non-protein nature inclusions in the composition of albumin nanogels and thus reduce the toxicity of the polymer carrier. In this study, optimal conditions for obtaining albumin nanoparticles with satisfactory characteristics, namely nanoparticle size 156±6.7 nm, polydispersity index 0.09-0.22, zeta potential -20 ± 5 mV, yield 70 ± 6% have been found. Using the methods of adsorption and incorporation, the antineoplastic drug hydroxyureais immobilized into albumin nanoparticles. The method of incorporation is the most effective one, when the efficiency of binding reaches more than 80% and the release of hydroxyurea from the polymer matrix occurs prolonged. The methods of DLS, SEM, TG-DSC, FT-IR-Spectroscopy, and UV-spectrophotometer et al. have been used to study the physico-chemical characteristics and the nature of the interaction between the components of the system.

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IN VIVO STUDIES OF CHITOSAN/POLY (2-ETHYL-2-OXAZOLINE) FILMS FOR OCULAR DRUG DELIVERY

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The current applications of mucoadhesive dosage forms include drug delivery to the eye, nose, oral cavity, gastrointestinal tract, vagina, rectum and urinary bladderю Typically, all water-soluble polymers have some mucoadhesive properties; however, either positively or negatively charged polyelectrolytes exhibit better ability to stick to mucosal tissues compared to non-ionic macromolecules. Chitosan (CHI) and poly (2-ethyl-2-oxazoline) (POZ) are highly promising polymers for the design of dosage for transmucosal drug delivery. In this work, these polymers were used in combination to prepare mucoadhesive films for ocular drug delivery. These films were prepared with sodium fluorescein (NaFl) as a model compound.

In vivo experiments on ocular administration of fluorescent films (CHI and CHI/POZ) were conducted using chinchilla rabbits (2.5 – 4.0 kg). The behaviour of each polymeric disc on the eye was controlled visually and images were taken at different time intervals with a high-resolution digital camera. Each type of polymeric film was tested on 3 rabbits and each experiment was conducted until a film was detached or dislodged.

In vivo experiments were carried out in rabbits with round-shaped 10 mm CHI and CHI/POZ films containing 0.1 mg/mL NaFl. Each formulation was placed on corneal mucosa of a chinchilla rabbit's left eye and their retention was monitored visually by taking photographs at regular time points until the films detached and an UV lamp was used to enhance the detection of fluorescence. The in vivo results indicate that pure CHI and CHI/POZ films could achieve from at least 10 min to up to 50 min residence on the ocular surface, which is consistent with in vitro results. Generally, all the films exhibited excellent adhesion to the cornea. However, the presence of a nictitating membrane on chinchilla rabbit cornea often led to the dislodging or a complete removal of the films from the corneal surface into the lower fornix of conjunctiva. No significant differences ($p > 0.05$) were observed between all film formulations in terms of their retention on the rabbit's cornea.

The results indicate that these films are biocompatible and do not cause any irritation to the eye. They also exhibit ability to adhere to the cornea and to retain for up to 50 min, providing a sustained drug release.

POLY(VINYL ALCOHOL) COMPOSITE CRYOGELS CONTAINING DIFFERENT CELLULOSE-BASED FILLERS

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The intensive works are being carried out for recent years in the field of creating new materials based on poly(vinyl alcohol) (PVA) cryogels [1]. Such gel materials are fabricated via the cryogenic processing technique – consecutive freezing initial solutions of the polymer, their keeping in the frozen state, and final thawing. Due to the unique combination of the properties, PVA cryogels are widely used in such areas, as biotechnology, bioengineering, medicine, food industry, construction, etc. However, in some cases more rigid materials are required than it is possible to create with the use of the above-indicated "traditional" procedure. One of the efficient ways of imparting new functional properties to the PVA cryogels is the incorporation of certain fillers or/and modifying additives into the gel matrix. In this case the properties of the resultant composites largely depend on the characteristics of the fillers (nature, size and shape of the particles), as well as on their compatibility with the continues gel phase [2,3].

This work is devoted to the study of the properties of composites formed from the hydrophilic components: gel-forming polymer PVA and various cellulosic fillers. Morphology, physico-mechanical and thermophysical properties of the composite cryogels that contained dispersed particles of microcrystalline cellulose, bacterial cellulose and sawdust have been investigated. It was shown that entrapment of these fillers possessing different physical characteristics (size, density, porosity) into the PVA cryogels resulted in the growth of rigidity and heat endurance of the composite materials compared to the unfilled cryogels. This fact indicates that such dispersed particles perform the function of "active" fillers. With the help of electron microscopy the tight inclusion of dispersed or fibrous particles of cellulose-based filler in the polymeric gel phase has been found. This effect is explained by the good compatibility of the gelling polymer and cellulose filler because of hydrogen bonding of the OH-groups of both components in the system. An additional increase in the strength and heat endurance of these composites can be reached via the implementation of multiple cryogenic cycles, as well as by introducing kosmotropic additives into the system. The individual characteristics of the cellulose-based fillers like the particles' size and shape, their purity, as well the conditions of the cryotropic gel-formation determine not only the properties of composite PVA cryogels, but also the fields of possible their applications. Thus, the respective composites filled with sawdust particles gave been demonstrated to be the efficient water-proof systems that are of interest as the antifiltration screens and other watertight elements for dams of thawed or frozen types, reinforcement of ground beds for motor roads and railways under the conditions of permanently and seasonally frozen soils [2]. In turn, PVA cryogels filled with micro-/nano-cellulose particles are of interest in biotechnological and medical areas [3].

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POLYMER PROBES TARGETED BY PEPTIDE USED FOR FLUORESCENCE-GUIDED ENDOSCOPIC SURGERY OF EGFR-POSITIVE TUMORS

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Poly(N-(2-hydroxypropyl)methacrylamide) labeled with a fluorescent dye Dyomics 633 or Cy-7 and targeted by oligopeptide GE-11 was designed, synthesized and characterized as the targeted polymer probe. Peptide belongs to specific targeting ligands binding to epidermal growth factor receptor (EGFR) that is overexpressed on surface of many tumor cells. The targeting peptide was conjugated to the polymer precursor using a "click" reaction between the N-terminal azide group of the peptide and dibenzocyclooctyne group attached to the polymer precursor. The fluorescently labeled polymer-peptide probe was designed as a diagnostic tool for a successful fluorescence-guided endoscopic surgery. Specific accumulation of the polymer conjugate in the tumor mass is accompanied with the fluorescence signal from the malignant cells, which enables more precise resection of the tumor without damaging the heathy tissue.

Flow cytometry was used for examination of the binding efficacy of the oligopeptide-targeted conjugates to EGFR on the cell membranes of the malignant cells. It was shown that the highest binging efficacy was achieved with polymers bearing GE-11 targeting peptide reaching to 146 % of the binding of the control polymers with a scrambled peptide in human hypopharyngeal carcinoma cells (FaDu) and up to 250 % in human breast adenocarcinoma cells (MDA-MB-231).

The GE-11 peptide-targeted polymer conjugate can be used as polymer probe used for fluorescence-guided endoscopic surgery as confirmed by in vitro experiments using flow cytometry and confocal microscopy and also by in vivo tumor accumulation in mice bearing EGFR-positive tumor cells.

This work was supported by the Czech Science Foundation (No. 17-08084S).

A GRADIENT HYDROGEL-BASEDDRUG DELIVERY SYSTEM

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In controlled release system, it remains challenging in expanding the release kinetics to obain sustained medication1-2. In this work, a gradient hydrogel with a gradient component distribution was prepared by copolymerization of cationic monomer 2-methacryloyloxyethyl trimethylammonium chloride (DMC) and acrylamide (AM) under direct current electric field (DC-EF). Sodium salicylate (SS) was used as a drug model to in-situ loading into the hydrogel by elestrostatic interaction with DMC. Both DMC and SS are gradiently distributed from the cathode side to the anode side, and higher contents of DMC and SS were found at the anode side.A gradient hydrogel prepared in applied voltage of 2.5 V has a slower release rate than a hydrogelprepared without electrophoresis.The release behavior can be adjusted to achieve the desired release by changing the energization voltage. This method presents a new idea for the control release system.

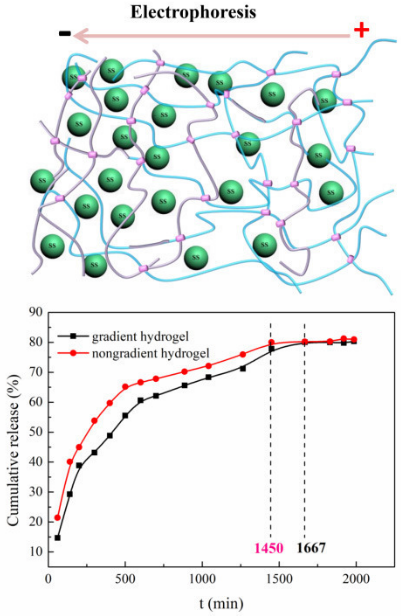

Figure 1. Schematic of gradient hydrogel and the release curve of the gradient hydrogel;

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PS

INDOL SYNTHESIS HETEROCYCLICATION OF AROMATIC AMINES WITH GLYCOLES

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Nitrogen-containing heterocyclic compounds of the pyrrole and indole series are very valuable raw materials for the production of a number of practically important preparations.

One of the most common methods for producing indole and its derivatives is their synthesis based on aromatic amines and glycols. In recent years, scientists have proposed a number of new catalysts, and optimal conditions for the process have been established. The synthesis is carried out either in the liquid phase under pressure or in the gas phase at high temperatures during the condensation of substituted anilines (R1 = H; R2 = -OH; -Hal; -CN) with ethylene glycol in the ratio of aniline: ethylene glycol = 10: 1 under pressure 15 atm and a temperature of 330-390 ° C, indole was obtained with a yield of 76%. A mixture of cadmium bromide and potassium bromide was used as a catalyst [1].

The catalytic synthesis of indole and its derivatives from aniline and ethylene glycol has been studied. Cyclocondensation of aniline with ethylene glycol belongs to a complex parallel-research process, including the stages of dehydration, dehydrogenation and dehydrocyclization. When selecting a catalyst, the role of each component is taken into account when activating individual stages of the process.

By physico-chemical methods of analysis, it was established that the catalytic condensation of aniline with ethylene glycol forms a complex mixture of 2-aminophenyl ethanol, N-vinylaniline, 2,3-dihydroindole, indole and resin, in which 2,3-dihydroindole and indole prevail. The selectivity of the formation of the above compounds depends mainly on the composition of the catalyst and the process temperature.

With an increase in temperature from 380 to 460 ° C, an increase in the yield of 2,3-dehydroindole and indole is observed (Fig. 1).

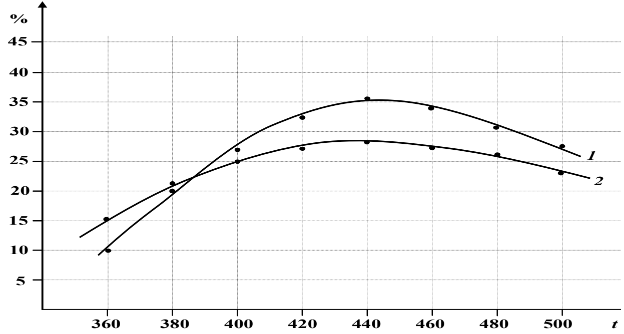
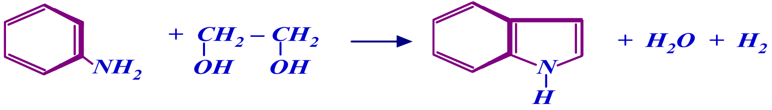


Figure 1. The effect of temperature on the output of indole (1) and 2,3-dihydroindole (2).

Catalyst CHA; volumetric feed rate of 0.1 hour – 1;

ratio C6H4NH2: C2H4 (OH)2 = 2: 1

A further increase in temperature leads to a decrease in the yield of the target products due to the occurrence of side reactions - polymerization, decomposition, etc. This is proved by thermodynamic calculations for gross processes:



ΔH298 = 15 cal / mol; ΔS298 = 54,28 cal / mol; ΔG298 = -552 cal / mol; ΔG698 = -22692 cal / mol

As can be seen, the reaction of heterocyclization of aniline with ethylene glycol has an endothermic effect and is difficult to perform under normal conditions. The decrease in Gibbs energy with increasing temperature also confirms that with increasing temperature, the yield of target products increases.

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THE PREPARATION OF PHENOL-FORMALDEHYDE FOAMUNDER MICROWAVE IRRADIATION

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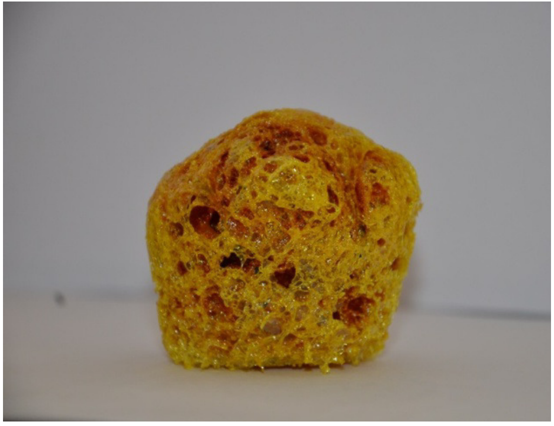
Phenolic foams prepared from phenol formaldehyde resoles have been known for many years. It is generally agreed that phenolic foams have the best fire rating of any known foam insulation. Phenolic foams do not burn even when contacted by the flame of a blow torch and give off minimal amounts of toxic gases. Phenolic foams can stand temperatures of 220° C without serious degradation.The general method for the continuous manufacture of phenolic foam insulation board is as follows. The foamable phenolic resole composition is prepared by continuously feeding into a suitable mixing device the aqueous phenol formaldehyde resole, the blowing agent, the surfactant, the optional additives, and the acid curing catalyst. The ratio of these ingredients is varied depending on the density, thickness, etc. desired in the final product. The mixing device combines these ingredients into a substantially uniform mixture which is continuously applied evenly onto a moving substrate, usually a protective covering such as cardboard which adheres to the foam. The foaming composition is usually covered with another protective covering such as cardboard which becomes adhered to the phenolic foam. The covered foaming composition is then passed into a double belt press type apparatus where the curing exotherm continues to vaporize and expand the blowing agent, thereby foaming the composition as it is cured.This process takes a lot of time and up to a dozen different auxiliary reagents are spent on its implementation [1].

We have been synthesis of phenol-formaldehyde foamfrom phenol and urotropineunder microwave irradiationin household microwaveoven. Other reactants haven’t been used. The process takes 3-5 minutes [2,3].



Phenol: Urotropine (8:2); 3 min, 200W

Phenol: Urotropine (6:4); 3 min, 500W

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SPIN-SELECTIVE CHARGE RECOMBINATION IN HALOGEN-CONTAINING DERIVATIVES OF POLY–N–EPOXYPROPYL CARBAZOLE DOPED WITH POLYMETHINE DYE

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Polymer composite films based on semiconductor polymers and organic molecules attract the attention of researchers due to their using in electroluminescent and photovoltaic cells. Semiconductor polymers doped with organic molecules have properties that are not possessed by pure polymers. They are used as elements of organic electronics, and as a model system for the study of the formation and recombination of charge carriers in organic semiconductors. But a degree of influence of the heavy atom effect on magnetic spin processes in semiconductor polymers was been studied a little. Further research in this area is interested.

Properties of recombination luminescence of polymethine dye in matrices of derivatives of poly-N-epoxypropyl carbazole (PEPC) with heavy atoms of various chemical nature were investigated. The observed luminescence kinetics is formed by the fluorescence of the dye and recombination luminescence associated with the formation and recombination of electron-hole pairs (EHP). The presence of heavy atoms in the structure of the polymer increases the rate of singlet-triplet transitions in the dye molecule due to the growth of the spin-orbit interaction. Measuring the external magnetic field effect on the kinetics of dye luminescence in a wide time range allowed to determine the characteristic times of the recombination processes with the participation of EHP formed from singlet and triplet excited electronic states of the dye molecules. Rates of the formation and the recombination of singlet EHP are higher than the deactivation rate of the S1 state of dye molecules. A rate of the recombination of triplet EHP is significantly lower than the photo processes rate connected with deactivation of the S1 state of dye molecules and the singlet EHP recombination. A comparison of the dependence of the magnetic effect g on the magnetic field induction B shows the competing influence of the external magnetic field and the spin-orbit interaction (SOI) on the spin state of the EHP. The competing influence manifests itself in different ways in the curves of dependence of g on B for the EHP with the initial singlet and triplet states of the pair. For singlet EHP, the growth of SOI in films leads to an increase in g(B). For triplet EHP, the presence of SOI reduces the value of g(B). These results suggest about growth in singlet-triplet transitions rate, upon increased SOI in films.

OC

SPECTRAL-LUMINESCENT PROPERTIES OF POLYMETHINE DYES OF DIFFERENT IONICITY, DOPED IN THE PHOTOCONDUCTIVE POLYMER MATRIX

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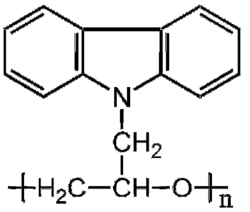
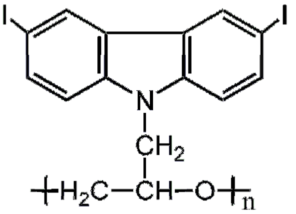
Recently, solar panels based on thin organic films are referred as an alternative to solar cells based on inorganic semiconductors. Dyes are the ones of the active elements involved in the formation and recombination of electron-hole pairs in organic solar cells. Polymethine dyes, not containing a heavy atom in their compositions, have a high quantum yield in the singlet excited state and a small quantum yield into the triplet state. However, the population of the triplet state of polymethine dyes can be achieved by increasing spin-orbit interaction in the dye molecule under the influence of an external heavy atom, which is included in the structure of the polymer moleculeThis will lead to the growth of the long-lived triplet dye molecules concentration and will increase the probability of electron-hole pair formation in the semiconductor polymer matrix.

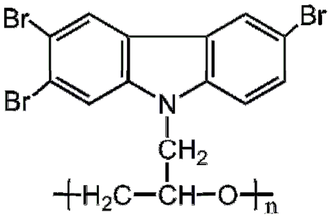
This work presents the results of researching spectral-luminescent properties of a cationic (K1) and anionic (K2) polymethine dye in polymers – derivatives of poly-N-epoxypropyl carbazole with heavy atoms of different chemical nature – 2IPEPC and 2IPEPC.



PEPC



2IPEPC



3BrPEPC

The concentration of the dye in the polymer films was equal to 1 % with respect to the weight of the polymer. The registered spectral-luminescent properties of dye molecules are presented in the table.

Table – Spectral-luminescent parameters of polymethine dyes in polymer

Polymer	PEPC	2IPEPC	2IPEPC
K1			
a λ max, nm	561	565	562
f λ max,nm	587	590	587
τfl, ns	1.3	1.5	1.4
φfl	0.05	0.02	0.02
K2			
a λ max, nm	540	555	555
f λ max,nm	575	580	583
τfl, ns	1.5	1.6	1.6
φfl	0.08	0.03	0.03

The table shows that in the polymer matrices with a heavy atom, a bathochromic shift occurs both in the absorption and in the fluorescence spectra of the dyes. In this case, a more noticeable effect is observed for the anionic dye. A noticeable quenching of the intensity, as well as the fluorescence quantum yield φfl, is the result of enhanced interconversion to the triplet states of the dye due to an increase in the spin – orbit interaction in the dye molecules.

IMMOBILIZATION OF CYCLOPHOSPHAMIDE IN THE ALBUMIN STRUCTURE

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Currently, there are many anticancer drugs, but long-term use of these drugs leads to significant side effects, which significantly reduce the efficiency of treatment.In this regard, the urgent task is the creation of novel dosage forms such as nanoparticles, which prolong the effect of the drug in the treatment of malignant tumors.

At present, nanoparticles are widely studied in pharmaceutical research as drug delivery systems. As a rule, nano-carriers protect the drug from degradation, improve drug's absorption bydiffusion through the epithelium. Polymeric nanoparticles can be made of polysaccharides, proteins or synthetic polymers. Nanoparticles made of natural hydrophilic polymers, such as albumin, have proven to be effective in terms of the best ability to load the drugs and biocompatibility. In this regard, albumin was chosen as the carrier for drug delivery in our study, as it is a non-toxic, biocompatible, and biodegradable polymer[1-2].

We have carried out the studies on immobilization of the anticancer drug "Cyclophosphan" (cyclophosphamide) into the albumin nanoparticles and have selected the optimal conditions for synthesizing the nanoparticles with satisfactory characteristics. Albumin nanoparticles immobilized with cyclophosphamide using various drug concentrations (2 mg / ml; 4 mg / ml; 8 mg / ml) were obtained by the adsorption method. The physicochemical characteristics of synthesized polymeric nanoparticles were determined using photon correlation spectroscopy. Thus, for each concentration, the average sizes of nanoparticles were 200.1, 234.3, and 263.6 nm, and the values of polydispersity indices (PDI) were 0.078, 0.218, and 0.095, respectively. The degrees of binding of the anticancer drug "Cyclophosphan" with albumin nanoparticles, determined using UV spectrophotometry were 73.6, 81.0 and 81.7% (correspondingly), which indicates to the promising technique of immobilizing Cyclophosphan into albumin nanoparticles.

Thus, we have developed the method for producing albumin nanoparticles immobilized with the antitumor drug «Cyclophosphan» with satisfactory physicochemical parameters and high values of the binding degree which makes possible to use them in future for the drug delivery.

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DETERMINATION OF THERMO-KINETIC PARAMETERS OF DECOMPOSITION OF HEAVY OIL

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It should be noted that in the world there is a tendency of reducing of traditional hydrocarbon reserves including classical oil. In this regard, much attention is paid to the search for effective methods of processing of heavy high-viscosity oils. For carrying out thermal, thermocatalytic and hydrogenation processes it is necessary to have empirical values of thermokinetic parameters of these processes determined by the method of thermogravimetry.

Experimentally determined thermo-kinetic parameters of thermal decomposition of heavy oil of field Karazhanbas of the Republic of Kazakhstan in the presence of Fe3O4 nano-catalyst, catalytic additives (microspheres obtained from the ash of coal, nickel catalytic additive on the microspheres) and polymers as hydrogen-donors (polyethylene glycol, polystyrene). The method of thermogravimetry was appliedin an inert atmosphere of nitrogen. The dependence of the thermo-kinetic parameters of heavy oil decomposition from the presence of nanocatalysts, catalytic additives and hydrogen-donors in two ways: by the method of T.V. Bukharkina [1] and method of Professor A.M. Gulmaliyev [2].

Thermogravimetric curves of mass loss and rate of mass loss in an inert atmosphere for high-viscosity oil (HVO) are shown in Fig. 1.

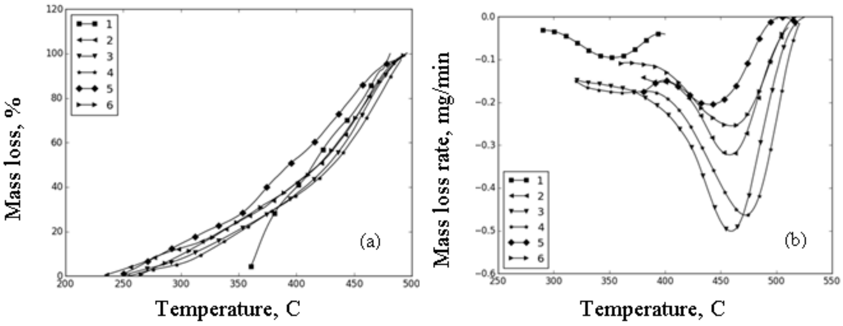

Figure 1.Thermogravimetric curves of mass loss (a) and mass loss rate (b) for high-viscosity oil: 1 – high-viscosity oil, 2 – HVO in the presence of polystyrene, 3 – HVO in the presence of polystyrene with nanocatalyst Fe3O4, 4 – HVO in the presence of polyethylene glycol, 5 – HVO in the presence of polyethylene glycol with NiO/microsphere, 6 – HVO in the presence of polyethylene glycol with microspheres.

According to the values of the activation energy, it can be judged that the process of decomposition of high-viscosity oil takes place in the diffusion-kinetic and kinetic regions.

Comparison of the methods of T.V. Bukharkina and A.M. Gulmaliev show that they complement each other, using the first method allows to find a pre-exponential factor and the activation energy, and to determine the kinetic parameters in a narrow temperature range, and the second method allows to determine the rate constants of the processes.

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PS

OBTAINING AQUATIC FORM OF PYRROLIDINE N-METHYL-1-[4-CITYNYL] FULLEREN-C60- [1.9C] IN POLYMER COMPOSITION FOR COPYING

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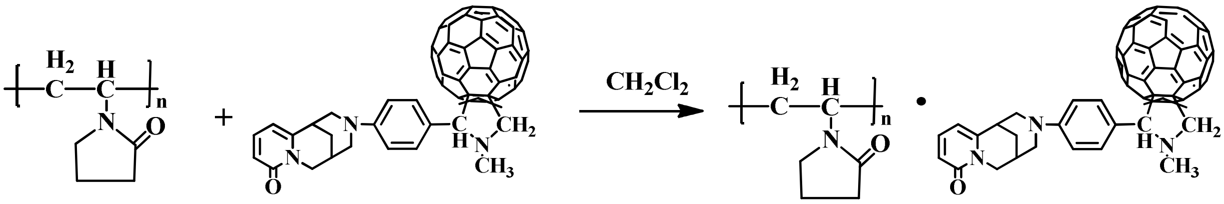
The discovery of fullerene biological activity, manifested in such processes as enzyme inhibition, antiviral activity, DNA cleavage, etc. [1-3], gave impetus to research in the field of obtaining water-soluble fullerene derivatives or translating it into a water-soluble state by solubilizing various surfactants or complexing with polymers. There are various ways to produce fullerene-containing polymers, resulting in two different types of corresponding products. The first way is the reaction of fullerene and its derivatives with polymers, as a result of which covalent incorporation of fullerene into the chemical structure of the latter occurs; the second is the mechanical introduction of fullerene into polymers (doping), which is not accompanied by the formation of a covalent bond between them. The attention of researchers to the doping of polymers with fullerene is obviously due to the simplicity of its introduction (either in the native form or in the form of solutions in organic solvents) and the possibility of using small amounts of the modifier. In addition, a smaller distortion of the electronic structure and, therefore, the properties of fullerene molecules in the absence of covalent interaction "fullerene fragments of the polymer chain" was expected.

We study the reaction of the synthesis of fullerene C60 derivatives with natural compounds. To obtain a water-soluble form of N-methyl-1- [4-cytizinyl] fullerene-C60- [1.9s] pyrrolidine (2) previously synthesized by us (2) [4], we used the method of complexation of fullerene C60 with polyvinylpyrrolidone (PVP) (1):



(1) **(2)** **(3)**

The formation of complex (3) occurs as a result of the solubilization of the fullerenpyrrolidine (2) with PVP chains (1) and the physical interaction of the lactam group with the fullerene sphere. The resulting complex (3) is soluble in water. Structure (3) is established by 1H and 13C NMR spectroscopy. A change in the physicochemical properties (2) during the transition from individual molecules to aggregated forms leads to a change in their properties, which ultimately substantially changes the response of the biological system. The study of properties (3) continues.

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ORGANOCLAY'S DEVELOPMENT FOR INTRODUCTION INTO THE POLYMERIC MATRIX

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The introduction of nanoclays into solutions and melts of polymers with the production of nanocomposites with enhanced mechanical properties has recently become widespread.[1-3].Today Tagan bentonite has the greatest interest in terms of technology and its processing.[4]. The peculiarity of the layered structure of the Tagan bentonite is that this type of clay consists mainly of montmorillonite (95%) and also swells quite well in water, which makes it possible to study it in the processes of intercalation and exfoliation.Thus obtained nanoclays have a line of properties of the original clays, which opens up great prospects for their use in nanotechnology.Such organoclays can be used in various areas, i.e., as a composite in construction, in medicine and cosmetics, and also as fillers for polymeric mediumor organically medium.In this work, we studied the possibilities of obtaining hydrophobic montmorillonite clays by intercalating the sodium form of super hydrophobic surfactants into Tagan bentonite, controlling this process by measuring the contact angle and other various methods.Super hydrophobic clays were synthesized by exfoliating octadecylamine (ODA) into clay matrix, and the wetting angle of clays with water is ~1500. X-ray analysis confirmed the fact of intercalation.The possibility of hydrophobic modification of clay layers using Tetrakis (decyl)ammonium bromide(TKAB) is also described.The modification consists in stirring the mixture of clay slurry with a surfactantsolution for 10 hours at a temperature of 60-80o C.The concentration of surfactant should be higher than its CMC.Then the clay is separated from the solution, washed and dried. Drying temperature should be in the range of 50-100oC. By controlling the surface charge of clay particles, it can judge the intercalation of surfactant molecules into the interpacket space of montmorillonite.Electrokinetical potentials of organoclays are determined usingZetasizerQ500.Thermogravimetric analysis of organoclays was performed in the temperature range from 50° C to 600° C в Pyris 1 TGA, equipped with a high-temperature furnace.Scan speed was 10°C/min.The distribution of montmorillonite particles is determined by ZetasizerQ500. The magnitude of the wetting angle measured on the device Goniometer LK-1 [5]. Of great importance here are solids with a high hydrophobicity of the surface.Hydrophobization of clay is interesting because it expands the possibilities of their use.These surfaces are necessary, above all, to create a variety of "smart" devices. They are capable of self-purification from pollution.Such bodies are widely used in solar batteries, in the manufacture of paints, exterior architectural glass and "green" houses, as well as in the heat-conducting surfaces of air conditioners.

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OC

OPTICAL AND ELECTRICAL PROPERTIES OF COMPOSITIONAL FILMS BASED ON SEMICONDUCTOR POLYMERS DOPED BY Ag -TiO2 AND Ag-SiO2 NANOSTRUCTURES

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One of the promising materials for polymer electronics is nanocomposite films based on semiconductor polymers with the addition of nanoparticles (NP's) of metals and nanostructures (NS's) based on them. NS's with a plasmonic Ag nanoparticle as a core and a protective shell of TiO2, SiO2 allow changing both the optical and electrical properties of nanocomposite films.

The paper presents the results of a study of the optical and electrical properties of composite films based on semiconductor polymers P3HT and PEDOT: PSS with the addition of Ag NP's and Ag-TiO2, Ag-SiO2 NS's.

Polymer mixtures with Ag-TiO2 NS's and Ag-SiO2 NS's in chlorobenzene with polymer concentrations of 0,001% and 1% by weight of solvent were investigated. The selected polymer concentrations in solution are two systems with strong and weak intermolecular interactions. Adding Ag-TiO2 nanostructures to a solution with a P3HT polymer leads to an increase in the optical density of the long-wavelength part of the absorption spectrum of the polymer. At the maximum concentration of NS's in the long-wavelength part of the P3HT absorption spectrum, additional absorption bands appear. With increasing concentrations of polymer and NS's, the P3HT band gap decreases.

Adding Ag-TiO2 NS's to the solution only leads to a decrease in the fluorescence intensity of the polymer. At low concentrations of Ag – SiO2 NS's in the solution, an increase in the fluorescence intensity of the polymer is observed. As the Ag-SiO2 NS's concentration increases, polymer fluorescence is quenched. A study was also conducted of the effect of NP's and NS's on the optical properties of PEDOT: PSS solutions and films.

Measurements of the surface resistance (ρ) of the PEDOT: PSS films showed that the addition of Ag NP's and Ag-TiO2 NS's reduces the ρ films. In the case of Ag-SiO2 NS's, an increase in the electrical resistance of the films is observed. An increase in the dielectric constant of a composite film containing Ag NP's and Ag-TiO2 NS's was found. The electrical properties of composite films based on P3HT with the addition of Ag NP's and Ag-TiO2, Ag-SiO2 nanoparticles are also studied.

SYNTHESIS OF NEW DOSAGE FORMS OF "CYCLOPHOSPHAMIDE" BY DOUBLE EMULSION

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Different types of cancer are the leading cause of death worldwide. Billions of dollars are spent on cancer treatment. The world health organization (who) estimates that the number of cancer cases will increase by 70% over the next 20 years. It is very dangerous for humanity. In most cases, cancer can be cured if it is detected in the early stages of the disease by surgery, radiation therapy or chemotherapy. Chemotherapy is the most common method, but adverse effects on the quality of life of patients are present and can cause reverse effects. This situation can be changed with the help of modern achievements, for instance nanotechnology. Nanotechnology is a great advance in engineering and science, and scientists have revolutionized the way that it can be used in small quantities, in length, in atomic particles, in all fields of production, and in medicine.

A drug delivery system such as nanoparticles is an indispensable material that improves the pharmacological and therapeutic properties of anticancer drugs. Nanoparticles, play an important role in drug delivery, absorption and stability in the body. With nanoparticles, you can reduce the toxicity of the drug by injecting anti-inflammatory drugs into nanoparticles. Various therapeutic agents are used to treatment cancer. Examples include cyclophosphamide, doxorubicin, paclitaxel and cisplatin. This paper presents methods for obtaining anticancer drug "Cyclophosphane" in the form of polymer nanoparticles. The reason for choosing this drug is its solubility of active substances. Structure of Cyclophosphamide is a synthetic alkylating agent compound exhibiting high hydrophilicity.

The effect of PVA concentration (1%, 2%, 6%, 5%, 7%) was investigated nanoparticles. As a result, the average diameter of the nanoparticles immobilized by the double emulsion method was 129 nm, 239 nm, 328 nm, 612 nm, 300 nm, respectively, and the polydispersity was 0.436, 0.643, 0.862, 0.786 and 0.652. As the concentration of PVA increases, the size and polydispersity of nanoparticles increases. The yield of nanoparticles was determined by gravimetric method and they reached the following values: 73.1% (PVA 1%), 78.6% (PVA 2%), 81.2% (PVA 5%), 84.3% (PVA 6% 85.3% (PVA 7%).

A spectrophotometric method was used to determine degree of binding with polymer of drugs. The degree of binding determined equal to 77,6% (1%), 96,82% (2%), 90,78% (5%), 96,82% (6%), 97,5% (7%), accordingly.

The morphology of the obtained polymer nanoparticles was evaluated through scanning electron microscopy (SEM). According to the obtained micrographs, the average particle size in different concentrations of PVA was in the range of 300-2000 nm. The sizes of nanoparticles obtained in the PVA ratio of 1% from 200 to 300 nm and have a spherical structures.

Research at the nanoscale level offers new hope for a molecular solution to some of the most severe human diseases, significantly improving cancer prevention, detection and treatment.

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PS

ANION-EXCHANGE MATERIALS ON THE BASE ACRYLIC FIBER NITRON

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One of the eventual forms of ion-exchange polymers are ion-exchange fibrous materials. In contrast to granulated ionites, ion-exchange fibrous materials possess more developed surface what promotes to high velocity of sorption.

Given work is devoted to obtain of anion-exchange materials by chemical modification of industrial acrylic fiber nitron. The modification of nitronicfibre was realized by interaction of the nitrile groups of the polymer with nitrogen-containing bases - an hydroxylamine (HA), hydrazine (HD), N,N-dimethylhydrazine (DMH), hexamethylenediamine (HMD) and ethylenediamine (EDA).

By interaction of fibrenitron with HA in presence of cross-linking agent-HD are obtained the sorption fibres.The kinetics of the chemical modification in water solution was studied within the temperature from 333 to 373K at different concentration HA and HD. On the base of obtained results the acceptable conditions of the obtain of ion-exchange fibres with static exchange capacity (SEC) on 0,1N HCl 5,0-5,5 mg-equ/g were determined.

On the base of IR-spectroscopic and potentiometric studies the following chemical structure of modified nitronicfibre are obtained.The chemical modification of acrylic fibers with HD and particularly with N,N-dimethylhydrazine, in water solution was occurred difficulty. So before modification by these reagents “nitron” was activated by 1% solution of NaOH at 363K during 1-3 min. A result of such processing formed links of acrylic acid accelerated the reaction -CN groups with HD and DMH. At equal terms of hydrazidation values of SEC of activated fibres were much more, than fibres, obtained without activation.It was determined the catalytical action of HA on hydrazidation reaction of nitron. In the presence of HA in reaction mixture the reactions of nitrile groups of the polymer with HD and DMH occurred easier and with more high degree of the conversion.The ion-exchange fibrous materials, containing as weak- and so strong-basic, so strongalkaline functional groups were obtained by treatment of nitron with HMD and EDA. In these cases the diamines simultaneously execute the function of cross linking agent and modifier of nitrile groups. The reaction of nitronfibre with HMD, without solvent or in organic solvent was carried out at the temperature 403-433K. Obtained in these condition sorption materials (SMA-1) contained, strong alkali amidine groups. This reaction also can be conducted in water medium. In this case in ionite composition will be more a weak-basic- primary and secondary amine groups. It was determined that HA additives to 3% in reaction mixture have brought to sharp growth of SEC in obtained fibres. Consequently in these systems HA also formed with SEC intermediate product, which easy interacted with HMD.The study of ion-exchange characteristics of the obtained fibres shows that fibres, especially SMA-1, effectively sorb dichromatic ions. The sorption process of these ions by fibre SMA-1 increased at increasing of the concentrations of solution and decreasing of temperature from 288 to 308K. It was determined that obtained sorbents effectively extracted the chromium ions at concentration 1mg/l in interval pH from 1 to 10 what showed the perspective of the using it for purification of the sewages from trace amount of chromium (VI) ions. Sorption characteristics of fibre were retained after tenfold using of them in processes the sorption-desorption.The modified fibres show high sorption ability to iodine ions from solutions. The iodine’s content in this sorbent reaches to 23%. It was determined that filtering of polluted water through the iodine-containing fibers provided the sharp improvement of its sanitary- bacteriologic quality, destroying different pathogenic microbes.Thus, the obtained ion-exchange fibre sorbents are perspective for using in hydrometallurgy, at clearing of industrial sewages from toxic metal ions, disinfection of drinking water from natural sources, as well as for production of bactericidal materials for medicine.

SYNTHESIS AND STUDY OF THE PHYSICO-CHEMICAL AND MECHANICAL CHARACTERISTICS OF FULLY CHARGED POLYAMPHOLYTE HYDROGELS

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The researches in the field of polyampholyte hydrogels are one of the rapidly developing areas of high-molecular compounds. Tough polyampholyte hydrogels can be used in medicine [1, 2], protein chemistry [1, 34], chemical industry [5], environment protection and cultivation to enhance soil moisture efficiency to restrict water use [6].

In this work polyampholyte hydrogels based on positively charged monomer - 3-acrylamidopropyl-trimethylammonium chloride (APTAC) and negatively charged monomer 2-acrylamide-2-methyl-1-propanesulfonic acid (AMPS) sodium salt were synthesized by free radical (co)polymerization and their physico-chemical and mechanical properties were studied. Figure 1 shows the stress-strain curves of hydrogels with different content of AMPS.

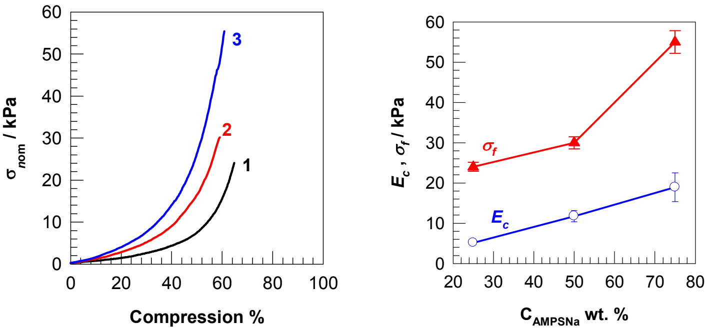

Figure 1. Stress-strain curves of hydrogel samples plotted against the compressive strain ε. R = 3 mm.min-1 (a). The compressive moduli Ec, and fracture stresses σf of hydrogels plotted against the AMPSNa composition (b). [AMPS] = 25 wt. % (1); 50 wt.% (2); 75 wt.% (3).

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SOME PECULIARITIES OF THE INTERACTION OF SCANDIUM AND YTTRI IONS WITH ACTIVATED HYDROGELS

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The sorption of scandium ions and yttrium was studied by an intergel system consisting of a polyacrylic acid hydrogel (hPAA) and a poly-4-vinylpyridine hydrogel (hP4VP). Dry systems were studied without activations of polymer hydrogels in the intergelsystem. The maximum degree of extraction of scandium ions occurs at an equal molar ratio of hydrogels in the intergel system of 67% molpPA - 33% mol hP4VP, and the degree of extraction of yttrium ions occurs at an equal molar ratio of hydrogels 33% mol hPAA - 67% mol hP4VP. In the hPAA-hP4VP intergel system, the highest sorption of scandium ions is observed at a ratio of hydrogels of 67% mol of hPAC-33% / mol of hP4VP and is equal to 61.5%, and in yttrium ions it is observed at a ratio of hydrogels of 33% mol hPAA - 67% mol of hP4VP and equal to 75% respectively. The results showed significant changes in the electrochemical, conformational and sorption properties of the starting polymer hydrogels in the intergel system[1].Polymeric hydrogels are widely used in various fields related to medicine and biotechnology. A number of unique properties make these polymer systems very attractive for a number of areas of medicine and medical biotechnology, such as tissue and cell engineering, technology of implants and biologically active systems and capable of binding metal ions. This contributes to the fact that such polymers have a sorption capacity with respect to metal ions, including rare-earth ions.The sorption of Sc3 + and Y3 + ions by the intergel system was studied: a weakly acidic polyacrylic acid hydrogel (hPAA) containing functional acidic carboxyl groups –COOH, and a weakly basic poly-4-vinylpyridine hydrogel (hP4VP). The process of the intergel system of hPAA: hP4VP in an aqueous medium without activation was studied, during which the specific electrical conductivity and pH of aqueous solutions were measured.In this case, the highest sorption occurs at the ratios of 67% mol of gPAA-33% mol of hP4VP, 61.5% mol is extracted. The largest amount (75%) of yttrium is extracted at a ratio of 33% mol gPAA-67% mol hP4VP at 3.5 h [2-3].The original hydrogels were dry and subjected to activation in distilled water for 4 hours. At this time, the electrical conductivity of aqueous solutions was measured every 30 minutes, and according to the data obtained, gradual increase in the specific conductivity of aqueous solutions and a noticeable increase in the concentration of hydrogen ions were observed, indicating an increase in the dissociation of acidic carboxyl groups in the chain of polyacrylic acid macromolecules.During the process with an equal molar ratio of hydrogels, the degree of swelling of the hydrogel of polyacrylic acid takes the value $\alpha = 33.17$. Thus, an increase in the acidity of the solutions is especially noticeable when the ratio of PAA: P4VP hydrogels is 4: 2, where pH = 6.2 after 4 hours of activation. Activated hydrogels were used for the process of sorption of scandium ions and yttrium from an aqueous solution of scandium nitrate and yttrium, the concentration of C (Sc (NO3) 3 * H2O) = 80.5 mg / l and C (Y (NO3) 3 * 6H2O = 100 mg / l .During the process, parameters of the solutions were measured such as electrical conductivity, pH, salt concentration. The highest sorption activity with respect to Sc3 + ions was shown by an intergel system with a molar ratio of PAK: P4VP polymer hydrogels of 4: 2, while according to the results of the residual salt concentration in solution, the highest degree of sorption (61% mol) is observed after 7.5 hours after the start of the sorption process. Moreover, analyzing the pH data of the solutions, it was found that during the process of sorption, the acidity of the solutions increased due to the substitution of Sc3+ ions for H + ions in the structure of polyacrylic acid, thereby displacing the latter into the salt solution.

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SYNTHESIS, CHARACTERIZATION, AND CATALYTIC PROPERTIES OF METAL POLYMER COMPLEXESBASED ON COPOLYMERS OF POLYETHYLENE(PROPYLENE)GLYCOL MALEATES WITH ACRYLIC ACID

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One of specific features of metal–polymer composites is that active components in the form of nano- and microcrystals are distributed in the bulk of the polymer matrix, which stabilizes them, preserving the high activity of metal particles and remaining a highly elastic support. The metal/polymer composites combining unique properties of the polymer and metals acquire some new properties that the materials taken separately do not have. These materials of a new class are used as electrode materials for making high-sensitivity selective electrodes, chemical sensors, and various detectors giving response to ions and molecules of dissolved substances being analyzed in monitoring of various natural objects. Metal/polymer composites are efficient as catalysts and electrocatalysts [1, 2].

New mono- and bimetallic polymer complexes p-EGM: AA/Ag, p-EGM:AA/Ni, p-EGM: AA/Ag–Ni, p-PGM:AA/Ag, p-PGM:AA/Ni, and p-PGM:AA/Ag–Ni, exhibiting catalytic activity in hydrogenation, were prepared by immobilization of metal particles in supports of p-EGM(PGM) : AA copolymers. The reaction can be performed under mild conditions with high yield using the p-EGM : AA/Ag–Ni catalyst containing 0.9% Me.

The structure of all the mono- and bimetallic polymer complexes synthesized was confirmed by IR spectroscopy. According to the SEM data, themetal nanoparticle size depended on the pore size in theinitial polymer matrices, p-EGM:AA and p-PGM:AA.For MPC-1,2 samples prepared from p-EGM:AA(14.8/85.2 wt %), the particle size was 80±10 nm,which corresponds to the denser structure of the support.For MPC based on p-PGM:AA (15.1/84.9 wt %), theparticle size was 85 ± 5 nm, in agreement with the TEMestimation of the pore size.The EDX data show that the distribution of Ni0 andAg0 over the polymer cross section is relatively uniform.The mean number of metal particles per 25 μmis ~1800 ± 100 for Ag and ~1200 ± 100 for Ni.

The reaction rate in the presence of bimetallic systems increases by a factor of ~5–6 compared to monometallic nickel and by a factor of ~10–11 compared to the system without catalyst; correspondingly, the selectivity to piperidine increases by a factor of ~3–4.

Our results show that the optimum conditions for electrocatalytic hydrogenation of pyridine are as follows: 1.5 A, 35°C, bimetallic catalyst p-EGM:AA/Ag–Ni (0.9% Me), on which the reaction rate and selectivity with respect to piperidine are the highest.

Its reuse leads to only a minor loss of the activity.It should be noted that the systems obtained can be readily separated from the reaction products and repeatedly used without activity loss.

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FEATURES OF DISTANCE INTERACTION AND MUTUAL ACTIVATION OF HYDROGEL POLYMETHACRYLIC ACID AND ANIONITE AV-17

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The remote interaction of a polymethacrylic acid hydrogel (PMAA) and AV-17 anion exchange resin was studied depending on their molar ratio in the aqueous medium.The electrical conductivity dependencies showedthat in course of timetheelectricalconductivityofthesolutiondecreasesatallratiosofhPMAA: AV-17.However, the nature of the change in electrical conductivity for different ratios is different. The minimum conductivity showed a ratio of 0:6, that is, the original AV-17. The minimum electrical conductivity of the intergel system is due to the binding of vinylpyridine by the heteroatom of the proton split-off from the carboxyl group of the nitrogen heteroatom [1-3].High values of electrical conductivity at the maximum point indicate high concentrations of charge carriers. Inthiscase, itcan be H+ ionsin the aqueousmedium, theconcentrationofwhichdepends, firstofall, onthedegreeofdissociationofthecarboxylgroups. However, there is a polybasic AV-17 anion exchanger in the system, which can easily attach H + ions and go into the charged state. Thisprocessshouldleadto a decreaseintheconcentrationofionizedparticlesinthesolution. Themaximumconductivityshowed a ratioof 6:0.Based on the data of changes in the concentration of hydrogen ions in an aqueous medium in the presence of the hPMAA:AV-17 system, it can be concluded that the rate of H + cleavage during the dissociation of a polyacid is higher than the rate of H+ binding with a polybase. The increase in pH is due to the fact that the proton cleaved from carboxyl group, joins methylamine, protonizing the ring heteroatom. Based on the data of changes in the concentration of hydrogen ions in an aqueous medium in the presence of the hPMAA:AV-17 system, it can be concluded that the rate of H + cleavage during the dissociation of a polyacid is higher than the rate of H + binding with a polybase. TheincreaseinpHisduetothefactthattheproton, cleaved fromthecarboxylgroup, joins methylamine, protoniruyupheteroatom ring. This is indicated by maxima at a ratio of 5: 1 hPMAA:AV-17, after 24 hours the pH increases, this is due to the fact that with a slower rate of swelling there is a decrease in the rate of dissociation of the –COOH groups. With an increase in the proportion of polybasic, the pH of the solution gradually decreases, passing through a minimum when the hPMAA: AV-17 ratio is 6: 0. The minimum pH values are observed in the presence of only polyacid in water. This is due to the fact that charged ions (H +, OH-) and groups (-COO–, ≡NH+) appear in the solution. The pH maxima indicate that the dissociation rate of the –COOH groups is lower than the protonization rate of the methylamine heteroatom, which indicates the process of ionization of the main hydrogel.Used for the study of hPMAA:AV-17physico-chemical methods indicate the presence of a remote interaction between the hydrogelPMAA and the AV-17 anion exchanger. As a result of the distance interaction, an additional activation of the hydrogel occurs, which means that the inter-nodal chains acquire an additional charge without counter-ions. Thus, as a result of the remote interaction of the hydrogel and the anion exchange resin, subjected to mutual activation, both become highly ionized state.

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IONIZATION POTENTIALS AND OXYDATIVE PROPERTIES OF SEVERAL NANOSTRUCTURES

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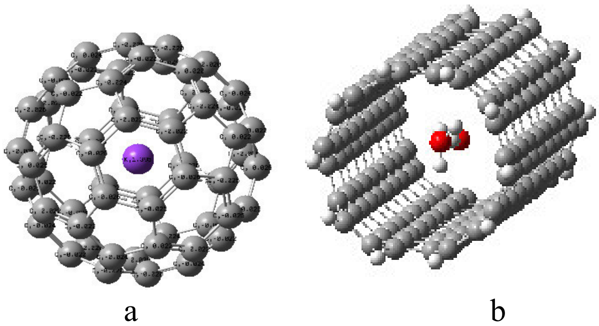
Ab-initio investigations of the severalknown nanoclusters, for example fullerenes, show thattheir ionization potentialsand electron affinityvaluesmore than analogous parameters for organic oxidizisermolecules.

The values of adiabatic ionization potentials (IP-a) and electron affinity (EA)molecules,
obtained by ROHF 3-21G method of quantum-chemical program package "Gaussian-2016" [1].

Molecules	IP-a,eV	EA, eV
Benzene	-8.027353971	-3.005932115
Naphtalene	-7.330990079	-2.120812238
Anthracene	-7.055584196	-2.284038300
Phenanthrene	-7.057676768	-2.052421324
Pyrene	-6.960387135	-1.703008053
Benzopyrene	-6.257701988	-0.881764686
Coronene	-6.075547538	-0.746210101
Fullerene-60	-7.859888342	0.938329439
Fullerene-70	-7.760024491	1.136029877

From calculated data presented in table it can be seen that one-electron adding to fullerenes molecules are the exothermic process.


a b

Pictures: a – complex C-60 with potassium atom; b – complex nanotube (5.5) with linear waters dimer, calculated by ab-initio ROHF 3-21G method.

Quantum-chemical investigation of complex fullererene-60 with potassium atom located in center of nanocluster has shown that molecule spherical electric field polarize alkali metal to value qK= +1.395.

Distribution of bimolecular linear waters complex, with quantum-chemical optimized hydrogen bonds structure, inside of nanotube (5.5)gave the monomolecular dissociation of dimer in cylinder electric carbon-tubes field.

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COMPARATIVE ANALYSIS OF THE THERMAL DECOMPOSITION KINETICS OF POLYETHYLENE GLYCOL FUMARATE–ACRYLIC ACID COPOLYMERS

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One of the most important applied issues of chemistry of high-molecular compounds is the creation of heat-resistant polymer and composite materials. Such materials will preserve its properties influenced of high temperatures, aggressive media, moist and other destructive factors. From this viewpoint, methods of dynamic thermogravimetry allow defining the activation energy of thermal destruction, which is used for characterization of mechanisms of thermal destruction and stability of polymers.

Issue on which method will be applied for definition of kinetic parameters of polymer destruction and composite materials seems to be urgent. Earlier the possibility to apply non-isothermal methods of calculation to define the thermodynamic parameters of polymers [1] was shown.

In this work we showed the possibility to apply isothermal models of calculation for defining main kinetic parameters of copolymers decomposition on the base of the polyethylene glycol fumarate with acrylic acid.

Authors have chosen the following models: Friedman [2], Flynn-Wall-Ozawa [3] and NPK [4]. They proved themselves well at processing of data of differential-thermal analysis of nonorganic compounds. NPK is the only method, which allows to estimate the influence of temperature and conversion on reaction rate.

Studies have shown that the simultaneous use of the TG/DTG data for kinetic analysis gave a more complete picture of the thermal destruction of the p-EGF–AA copolymers. This made it possible to evaluate the kinetic parameters using three kinetic methods and to compare the activation energies obtained from the experimental TG and DTG data.

Thus, the Friedman and Flynn–Ozawa–Wall methods give the invariant part of the activation energy, but the kinetic description is too formal. The NPK method offers two main advantages: (a) the possibility of separating two or more steps of the complex decomposition reaction and (b) the possibility of discriminating between the degrees of conversion via the corresponding temperature functions from the rate equation.

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QUANTUM-CHEMICAL CALCULATIONS OF THE IONIZATION POTENTIALS OF SOME AMINO ACIDS

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Among high-molecular compounds occupy an important place proteins. Synthesis and study of the properties of polymers, which include both single units of natural amino acids and their sequence, is an important task, which lies at the junction of the chemistry of high-molecular compounds and biological chemistry.Of the amino acids, α-amino acids are the most important - the structural elements of protein substances, which are fragments of polymers. The number of amino acid residues in the peptide chain is very large, so the molecular masses of proteins reach several million. Based on this, the interest in this work was represented by an amino acid, since the capabilities of the machine do not allow the calculation of the whole protein[1].

Modern quantum chemistry is a powerful theoretical tool for computer calculation of the energy of separation of electrons from molecules and atoms and the accuracy of these definitions increases as newer computational technologies appear.If the experimental values of the ionization potentials of molecules are presented in reference books for a limited number of particles, due to the peculiarities of the instrumental methods for their determination, then quantum-chemical calculation methods make it possible to estimate the values of both adiabatic and vertical ionization potentials for almost any molecules and radicals, including for short-lived particles.

Table 1 presents the unrestricted Hartree-Fock (UHF) method using the small orbital basis of 3-21G quantum-chemical software package «Gaussian-2016», the calculated adiabatic and vertical ionization potentials (PI) and electron affinity (EA) for a number of amino acids.Focusing on the magnitudes of the ionization potentials is due to the fact that it is the electron detachment energy that is a measure of the redox properties of any molecule and the relative magnitude of this parameter can be used to judge what role the acid or base will show the substance in the corresponding chemical reaction.

Table 1. The ionization potentials of some amino acids, calculated by the method UHF in basis of 3-21G

AminoAcids	-IPa, eV	-IPv, eV	-EA, eV
Histidine	-4,970162952	-6,792904348	-0,246323024
Cysteine	-5,875832736	-8,988831112	-1,885274572
Proline	-6,653361212	-8,14781704	-2,38105
Alanine	-7,296925012	-11,32226011	-2,352994428
Glutamine	-7,437529416	-9,148483916	-2,160687224
Methionine	-7,512335204	-8,273971872	-2,123678904
Glycine	-7,709867112	-8,887085444	-2,486931892
Tryptophan	-	-6,828062252	-2,262187984

A number of the adiabatic ionization potential indicates an increase in the basicity of these compounds. This is also confirmed by electron affinity values. Judging by the negative values of the calculated values of the electron affinity, one can say that the process is endothermic. A dash in Table 1 indicates the fact that the calculations for the indicated parameters for the corresponding molecule fail, since the procedure of quantum chemical optimization of the corresponding ionized structures fixes unstable structural formations.

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SYNTHESIS OF TERPOLYMERS BASED ON POLYPROPYLENE FUMARATE, ACRYLIC ACID AND DIMETHYLAMINOETHYLMETHACRYLATE

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Unsaturated polyesters are interesting for theoretical and practical studies, because along with the simplicity, cost-effectiveness of production, they contain unsaturated double bonds in their composition, which makes it possible to obtain on their basis polymers of a spatially cross-linked structure. A unique feature of unsaturated polyesters is the ability to copolymerize with various monomers to form valuable products.

At present, there is considerable interest in the synthesis and study of the properties of polymeric materials that are susceptible to changes in the properties of the external environment. A special place among this class of compounds is occupied by polyampholytic polyelectrolytes, which are bipolar molecules of a linear and 3D structure, in the macromolecules of which contain basic acid groups [1]. In this regard, it was interesting to study the terpolymerization of polypropyleneglycolfumarate with acrylic acid and dimethylaminoethylmethacrylate.

Polypropylene glycol fumarate is synthesized by the reaction of polycondensation of propylene glycol and fumaric acid. The compositions of polypropylene glycol fumarate were determined according to elemental analysis, IR spectroscopy. The structural formulas of polypropyleneglycolfumarate were established by NMR spectroscopy.

Polypropyleneglycol fumarates is reacted by radical terpolymerization with acrylic acid and dimethylaminoethyl methacrylate, which forms terpolymers with polyampholytic properties. The found constants for the copolymerization of binary systems are polypylene glycol fumarate acrylic acid ($r1=0.82$, $r2=1.21$), polyprenylene glycol fumarate dimethylaminoethyl methacrylate ($r1=0.43$, $r2=0.88$) and acrylic acid-dimethylaminoethylmethacrylate less reactivity and prone to heteropolymerization reactions. The calculation of the microstructure of terpolymers showed that, depending on the composition of the initial mixture, statistical polymers are formed, the macromolecules of which are covalently linked to each other. Based on the analysis of the surface structure, it was found that a sample of polypropylene glycol fumarate-acrylic acid-dimethylaminoethyl methacrylate (3.24: 36.64: 60.12 mol%) has a macroporous developed surface with an average pore size of 52 μm. Taken together, the data on the physicochemical properties of the synthesized ternary polymers demonstrate the possibility of their use as matrix-type polymer systems, separators of proteins, dyes, heterogeneous sentences, etc.

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SUPRAMOLECULAR COMPLEX OF HYDRAZIDES O- AND P-HYDROXYBENZOIC ACIDS WITH β-CYCLODEXTRIN

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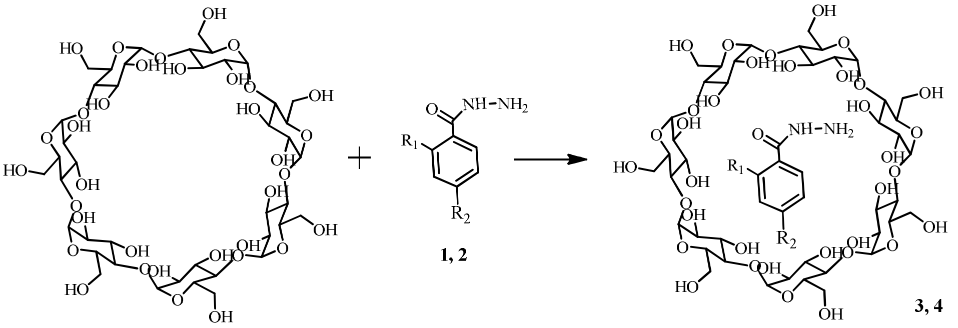
Hydrazides are used in medical practice as anti-tuberculosis, anti-microbial, antiviral, anti-tumor, psychotropic and other substances [1]. However, some of them have low solubility in water, in particular p-hydroxybenzoic acid hydrazide. Currently, various ways of increasing the solubility of drugs in water have been developed and are being used: the use of special excipients, including the inclusion of drugs in the cyclodextrin complex [2].

Cyclodextrins (CD) are cyclic oligosaccharides that have a hydrophobic internal cavity and a hydrophilic outer shell [3]. Hydrophobic molecules are able to integrate into the internal cavity of the CD, forming inclusion complexes of the type "host - guest" [4]. The formation of an inclusion complex can increase the stability of low-molecular substances that are sensitive to the action of light and oxygen, increase their solubility in water, bioavailability, and also reduce toxicity. Due to this, CSD is widely used in food, cosmetic, pharmaceutical industry, in the production of dyes, in analytical chemistry, in the elimination of environmental pollution by toxicants, etc. [5].

To obtain new derivatives of the inclusion complex (3, 4), hydrazides of o- and p-hydroxybenzoic acids (1, 2) and β-CD produced by Fluka (99% purity) were used.



R$_1$=OH, R$_2$=H (3); R$_1$=H, R$_2$=OH (4)

The composition and structure of the compounds was confirmed by IR, NMR 1H- and 13C-spectroscopy, as well as methods of two-dimensional NMR spectroscopy COZY (1H-1H) and HMQC (1H-13C), which allows to establish the spin-spin interactions of homonuclear and heteronuclear nature.

The resulting products form a mixture capable of dissolving in water or forming stable aqueous dispersions. The preparation of water-soluble complexes of these compounds should lead to an increase in their biological availability, which accordingly will significantly reduce their therapeutic concentration.

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SYNTHESIS AND CHARACTERIZATION OF AMPHOTERIC POLYAMPHOLYTE LATEXNANOPARTICLES

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The microemulsion polymerization process is one of the most useful methods for preparation of nanoparticles ranged between 10-100 nm with a very homogeneous particle size distribution [1]. Fully charged anionic monomer – sodium salt of 2-acrylamido-2-methyl-1-propanesulfonic acid (AMPS) and cationic monomer – (3-acrylamidopropyl)trimethylammonium chloride (APTAC), crosslinker – N,N'-methylenebisacrylamide and azo-initiator were used to synthesize the latex nanoparticles. Water solutions of APTAC and AMPS (molar ratio of monomers is 75:25; 50:50 and 25:75 mol.% respectively) were used in a quaternary system SDS/toluene-pentanol(1:1)/water to prepare inverse micellar region (L2 phase) which demonstrates an optically clear region in the oil-rich corner at 25 and 80 ºC. Different water content in microemulsion is responsible for the size of water droplets and effects on the size of latex nanoparticles. Average size of latex nanoparticles was measured by DLS and Cryo-SEM microscopy. After polymerization, a minor size changes were observed in relation to original microemulsion. Figure 1 shows the average size of APTAC-AMPS nanoparticles after polymerization, it is clearly seen that the low water content in microemulsion produces nanoparticles 4-5 nm in size and these dimensions increase with increasing of water content up to 11-12 nm. Thus, it is possible to tune the desired size of latex particles by varying water content in microemulsion. Furthermore, optically clear bicontinuous microemulsion was found after addition of water to microemulsion solution containing latex nanoparticles. Cryo-SEM images showed a sponge like structure, where pore walls consist of swollen spherical amphoteric latex nanoparticles in range of 40-80 nm and the pore size was several microns.

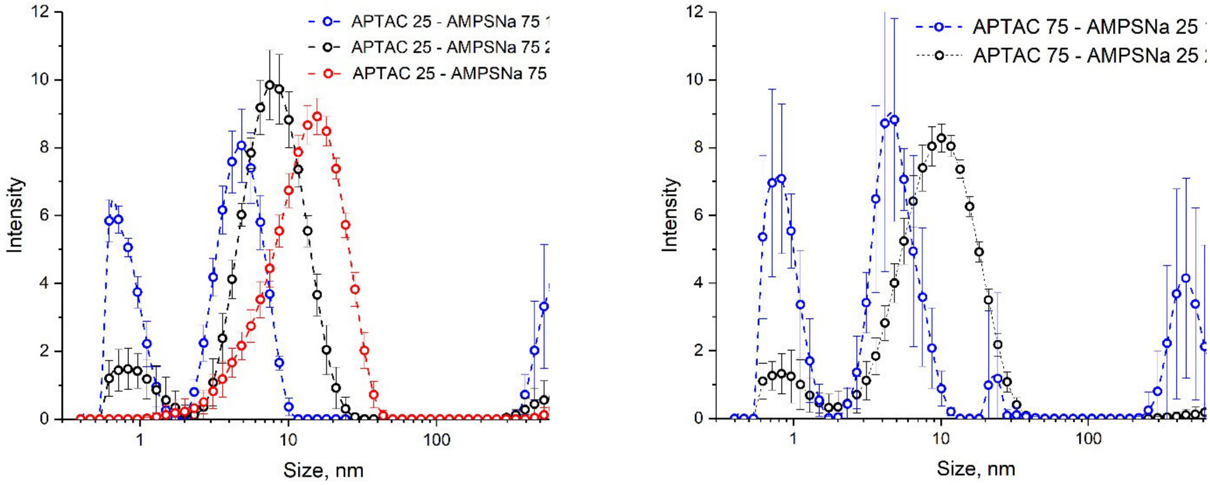

Figure 1 – Dependence of the average size of latex nanoparticles at different water content in microemulsion composition

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SELF-ASSEMBLY PROPERTIES OF POLYCARBOXYBETAINES PREPARED BY RAFT POLYMERIZATION

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Synthesis and characterization of novel amphiphilicpolycarboxybetaine is very important from the theoretical and an application points of view. As well asproblems related to crystallization and deposition of paraffin waxes during production and transportation of crude oil cause losses of billions of dollars yearly to petroleum industry.In this work, we report molecular weight-controlled amphiphilic polybetaine synthesis using Michael addition reaction various hydrocarbons with acrylic (methacrylic) acid followed by reversible addition−fragmentation chain-transfer (RAFT) polymerization. monomer and the resulting polycarboxybetaine were confirmed via FTIR, NMR, SEM. Polycarboxybetaines molecular weight was determined via gel permeation chromatography (GPC) measurements. Several types of self-assembled properties of polycarboxybetaines showed micelle structures from spherical, rod-like to fractal in water at different pH were observed using TEM (Transmission electron microscopy).Also long-chain hydrocarbon alkane molecules changed the surface properties of the long-chain hydrocarbon alkane nucleus and inhibited the growth of paraffin crystals,it's has been proven by crystal deposition and viscosity experiments.

SYNTHESIS OF COPOLYMERS BASED ON POLYPROPYLENEfUMarATEPHTALATEs WITH METACRYLIC ACID

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Unsaturated polyester resins are solutions of unsaturated polyesters in monomers or oligomers capable of copolymerizing with these polyesters. They are among thermorekivnyh materials with a very valuable set of properties: low viscosity, good mechanical and electrical insulating properties in the cured state. In addition, polyester resins are relatively cheap products, which in some cases makes materials based on them competitive with other types of plastics. [1].

Polymers derived from monomers of unsaturated polyester resins have a number of valuable chemical and physical properties. They are synthesized by the copolymerization reaction, which is the most promising in terms of ease of preparation and control.

To create polymers with improved quality characteristics, the study of the kinetics and determination of the constants and parameters of copolymerization of polypropyleneglycol fumarate phthalates (p-PGFPh) with methacrylic acid (MAA) is topical, and the development of new methods for controlling the radical polymerization of vinyl monomers and improving polymer characteristics are among the priority areas development of the chemistry of macromolecular compounds.

Polypropylene fumarate phthalates («unsaturated polyether») were obtained by polycondensation of propylene glycol with fumaric acid and phthalic anhydride (1.05:0.7:0.3 ratio) in a stream of nitrogen at 100 ° C for 7-8 hours, at 170-180 ° C - to a given acid number [2].

As a result of copolymerization, we obtained insoluble polymers of a network structure in five different ratios of 10:90; 25:75; 50:50; 75:25; 90:10. The kinetics of the copolymerization rate, with high degrees of conversion, without an induction period, was investigated. The output amounted to 61-87%, depending on the composition of the copolymer. The composition of the copolymers is proven by IR, mass spectroscopy. The degree of swelling varied in the range of 61-197% depending on the composition of the copolymer.

Thus, the presence of unsaturated double bonds in p-PGFPh molecules allows the use of the latter as a polymer matrix to obtain spatially cross-linked polymers in copolymerization with acrylic acid, with different ratios of the monomer mixture in order to study the physicochemical properties of the copolymers obtained.

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SYNTHESIS OF NEW "INTELLECTUAL" POLYMERS BASED ON THERMAL POLYPROPYLENE GLYCOLMALEINATE THERMAL POLYMERS WITH METACRYLIC ACID AND ACRYLAMIDE

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The Karaganda State University of the name of academician E.A. Buketov

Recent years have been characterized by a distinct trend of wider use in the chemistry of high-molecular compounds of special-purpose polymeric materials. In this regard, the attention of researchers working on the creation of new effective compounds with specific properties attract the so-called “smart” polymers. The search for new monomers with the corresponding functional groups for the production of polymers with high water-swellability from these positions is an urgent task [1].

Of considerable interest as potential “smart” polymers are co- and terpolymers based on unsaturated polyesters, hardened by ionic monomers of the acrylic series [2]. Given the hydrophobic nature of the unsaturated polyester and the hydrophilicity of the ionic acrylic monomer, a favorable hydrophilic-hydrophobic balance appears in the molecules of co-and terpolymers based on them, which gives hope for the latter to acquire satisfactory moisture sorption properties.

The starting polypropylene glycol maleate phthalate (p-PGMPh) was obtained by polycondensation of maleic and phthalic anhydrides with propylene glycol in a ratio of 0.7: 0.3: 1.1 mol [3].

p-PGMPhterpolymers with methacrylic acid (MA) and acrylamide (AAm) were obtained by copolymerization in dioxane solution in the presence of a benzoyl peroxide initiator ([PB] = 8 mol / m3) at an initial ratio of 4: 8: 88, 4:23:73 4:48:48, 4:73:23 and 4: 88: 8 mol.% And a temperature of 333 K for 52 hours.

Samples of the gels were washed with distilled water for 10 days, transferred to a Petri dish and kept in a drying cabinet under reduced pressure to constant weight at 313 K. The synthesized terpolymers were powdery substances from white to light yellow. The composition of the obtained terpolymerswas determined by gas chromatography-mass spectroscopy. The equilibrium degree of swelling α (%) was determined gravimetrically using an LV-210 electronic scale.

During the study of the sorption properties of the obtained terpolymers, it was found that the degree of swelling α(%) directly depends on the content of the same units of acrylic monomer in their composition. Thus, the maximum swelling capacity is typical for terpolymers with a content of p-PGMPh, MA and AAm, respectively, 3.15:4.55:92.3 and 3.01:79.45:17.54 mol.%. At intermediate values of acrylic monomer (respectively, 2.96:15.33:81.71 and 2.99:65.84:31.17 mol.%), The indicator α(%) is slightly lower, and it reaches its minimum value when the ratio is monomers 3.08:39.05:57.87 mol.%, i.e. with an initial ratio of ~4:48:48 mol.%. Thus, we can conclude that the highest degree of swelling is characteristic of terpolymer para –PGMPh with MA and AAm with compositions close to the binary systems of p-PGMPh–MA and p-PGMPh–AA, respectively.

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SYNTHESIS OF AZOBENZEN AND PHENYL ACRYLATE-CONTAINING MONOMER

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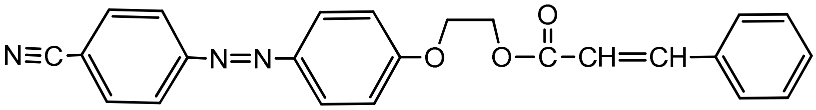
In recent years, the attention of researchers for the presence of high-molecular compounds has shown great interest in the creation of polymer liquid crystal (LC) systems [1-3], which determine success in the study of structures, and medicine [4-5], as well as the natural and specific macromolecular substances.The development of this field of research is inevitably associated with the development of methods for creating polymer LC systems and controlling the processes of structure formation in polymers in order to obtain polymeric materials with the required complex of physicochemical properties.

Maintaining the side groups into the composition of macromolecules that carry a certain functional load provides, under certain conditions, the manifestation of their functional properties.For example, the inclusion of comb-shaped photochromic fragments, such as azobenzene dye molecules, which undergo cis-trans isomerization under the action of light, makes them photo-optical sensitivity and opens up possibilities for obtaining new photosensitive LC polymers.

This paper describes the synthesis of a azobenzene-containing monomer, the side chains of which are the mesogenic group of 4-hydroxy-4-cyanoazobenzene. The combination of different side groups in the composition of the copolymers significantly expands the potential possibilities of comb-shaped polymers.



The monomer was synthesized by reacting 4-(2-hydroxyethyloxy)-4-cyano-azoxybenzene with cinnamoyl chloride in the presence of potassium-K2CO3 in DMF. The reaction mixture was stirred at 60–700°C for 24 hours. The precipitated salt was filtered, the monomer was precipitated with water, the orange product was filtered, washed several times with water, and dried under vacuum. The monomer yield is 70%.

The composition and structure of the compounds was confirmed by IR, NMR 1H- and 13C-spectroscopy, as well as methods of two-dimensional NMR spectroscopy COZY (1H-1H) and HMQC (1H-13C), which allows to establish the spin-spin interactions of homonuclear and heteronuclear nature.

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INULIN DERIVATIVES: OBTAINING, PROPERTIES AND POSSIBILITIES OF APPLICATION

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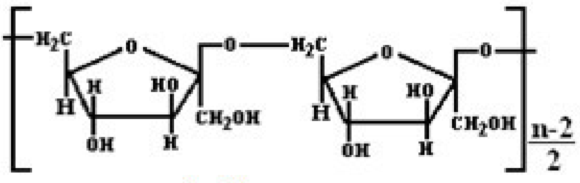
*Tashkent chemical-technology institute, Tashkent, Uzbekistan.*khusenov_82@mail.ru.

At the present time in the world, scientific research is being conducted for the production of a new range of medicines in the field of the production of inulin containing products.

Since inulin as cellulose is a polysaccharide and has three hydroxyl groups in its structure, all the esterification reactions carried out on cellulose are also suitable for the esterification of inulin.



inulin

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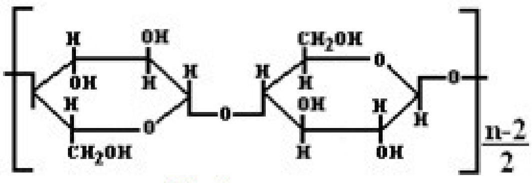

cellulose

We first obtained simple and complex derivatives of inulin, such as carboxymethyl, nitro, and inulin acetate. To obtain inulin derivatives, inulin was first isolated from topinambour tubers through the extraction with hot water.

The ether of inulin-carboxymethylcellulose was obtained by alkylation of inulin with monochloroacetic acid in an alkaline medium. The effects of various parameters on the esterification reaction (t-ra, time, ratio of components) on the yield of the main product were investigated. An increase in the concentration of sodium salt of monochloroacetic acid promotes an increase in the content of the basic substance: yield up to 80-90%, degree of substitution (SD) for carboxymethyl groups to 0.75-0.89, and solubility in water 97-99%.

Nitroinulin was obtained by esterifying inulin with a nitrating mixture of the following composition: HNO3 - 21%; H2SO4 - 70%; H2O-9.0%, which is usually used for the cellulose nitration. The influence of various parameters on esterification reactions was investigated. It was found that the main parameter influencing on the esterification reaction is the water content in the nitrating mixture. Nitrotinulin was obtained with a nitrogen content in the end product of 10.2-10.5%.

Another inulin ester, acetatinulin, was obtained by acetylating inulin with acetic anhydride in the presence of acidic catalysts. It was found that the main parameters influencing on the acetylation reaction are the temperature and type of catalyst. Under optimal conditions, inulin acetate was obtained with bound acetic acid content of 59-60%.

The obtained inulin derivatives were studied with the help of IR-, NMR- spectroscopic, X-ray structural, electron microscopic, chromatographic, and other methods of analysis.

The obtained samples of inulin derivatives were studied for antimicrobial activity, and some of them showed high antimicrobial activity for some strains.

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OBTAINING A COMPOSITE MATERIAL BASED ON CARBON WASTE AND A SYNTHETIC POLYMER

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Currently, there is considerable interest in research related to the development of new methods for producing composite materials based on coal mining waste and polymer raw materials. The combination of coal mining waste with polymers leads to the creation of new composite materials whose properties are quantitatively and qualitatively different from the properties of each of its components. By varying the composition of the matrix and filler, you can get a wide range of materials with the desired set of properties. Therefore, many composite materials are superior to traditional materials in their mechanical properties. It should be noted that very little attention has been paid to the development of composite materials based on coal mining waste with synthetic polymers. One of the most important problems arising from the creation of such composites is associated with the need for a uniform distribution of the polymer matrix. In this regard, it is advisable to develop methods for producing composite materials based on coal mining waste - burnt rocks in combination with polymeric raw materials.

To obtain a composite material, a urea-formaldehyde resin obtained in laboratory conditions.Improvement of a number of properties of urea-formaldehyde resin (UFR) is possible when modified with various additives. As is known, the function of the modifier is to create conditions for deepening the process of polycondensation and to obtain a flexible regular spatial structure with optimal density. In addition, the modifier must be water soluble, well combined with UFR, contain groups capable of interacting with UFR, with formaldehyde contained in the resin.

The filler in the composition of composite materials used burned rock (BR) - a product of oxidative self-firing of waste rock extracted along with coal to the surface.Composite material based on coal mining waste and polymer raw materials was obtained by copolycondensation of burnt rock in combination with a urea-formaldehyde resin modified with sodium humate at different ratios of the initial reagents. The copolycondensation process was carried out at 80°C for half an hour and was completed in an acidic medium (H3PO4, pH = 3). The study found that temperature has a great influence on the copolycondensation reaction of the composite. At a relatively low temperature, for example, up to 60°C, mainly initial, low degree of condensation products are formed, completely soluble in water and containing the greatest amount of free formaldehyde.

The original sodium humate is well combined with a solution of urea-formaldehyde resin, does not stratify, self-cures over time. The combined solution has a low viscosity, which favorably affects the wettability and uniform distribution of the filler in the composite, which contributes to a better cellular structure.

The burning rock and sodium humate, which constitute the basis of the composite material, belong to highly dispersed particles, which, during the formation of the polymer composite, are embedded in the elements of the cellular structure, ie, are intrastructural, which should lead to an improvement in the physicomechanical characteristics, due to the reinforcement of the strength elements of the cellular structure.

The resulting composites are not-stratifying complexes of different composition with improved properties. Their resistance to delamination is due to the action of intermolecular forces.When they are watered on glass substrates, sufficiently strong composites are formed. Improvement of the mechanical properties of the composite can be achieved due to uniform distribution of the solid phase in the elements of the cellular structure.The resulting composite materials can be used as building materials.

The work was done with the financial support of the program № BR05236438 MES RK.

Author Index

PROCEEDINGS

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