AL-FARABI KAZAKH NATIONAL UNIVERSITY

Faculty of chemistry and chemical technology

Department of chemistry and technology of organic substances, natural compounds and polymers

Confirmed
On the Scientific Council Meeting Faculty
Protocol №_10_ from __28 May__ 2013
Dean of the faculty
_____ Ongarbayev E.K.

Approved by the University scientific-methodical Council meeting
Protocol №_6_ from __21 June__ 2013
Vice-Rector for Academic Affairs
_____Akhmed-Zaki D.Zh.

"__21___"_____June_____2013

Educational-methodical complex of the discipline

Intramacromolecular Complexes and their Application in High Technology
(discipline name)

Speciality Code 6M060600 Chemistry
(code, speciality)

Education Form__full time__
(full time, part-time)

Almaty, 2013

Educational-methodical complex of the discipline is compiled by prof., Mun G.A._ On the basis of experimental educational program and catalogue of elective disciplines of specialty 6M060600 Chemistry

Considered and recommended at the chair meeting of Department of chemistry and chemical technology of organic substances, natural compounds and polymers

On "_14_" _____May_____ 2013, Protocol №_40_

Head of the Chair _____prof. Abilov Zh.A.

Recommended at the methodical Council (bureau of the faculty)

On «_23_»___May__ 2013, Protocol №_9_

Chairman_____ Syzdykova L.I.

Foreword

Introduction

Cooperative intramacromolecular reactions of polyelectrolytes, neutral macromolecules, biopolymers - a way to understanding of transport of macromolecules and the recognition phenomena in biological systems. Physical and chemical properties of hydrophilic grids and polyelectrolytes. Superswelling polymeric hydrogels. Stimullisensetive polymeric systems - future materials, their application in medicine, biology, biotechnologies.

The aim of discipline:

This module aims to:

- To acquaint undergraduates with specifics of behavior of macromolecules in solution, with structure polymer - polymeric complexes and composites, theoretical and experimental data about receiving and properties of polymeric complexes and composites,
- acquaintance with the last achievements in the field of intramacromolecular complexes and creation of polymeric composites, regularities of intermolecular reactions of macromolecules, the mechanism of formation of intramacromolecular complexes and the main properties of intramacromolecular complexes and composites on their basis, prospect of use of polymeric complexes and composites in high technologies

The purpose and tasks of the course: To acquaint undergraduates with the main regularities polymer - polymeric interactions in solutions, research of properties and structures polymer - polymeric complexes and the composites, actual problems and prospects of use of polymeric complexes and composites in high technologies

Learning Outcomes

By the end of the module undergraduates should be able to:
- specifics of intermolecular reactions of macromolecules;
- the formation mechanism of intermacromolecular complexes and interaction of components of polymeric composites on their basis;
- methods of receiving, their research and main properties.

Knowledge and skills after the course

As a result of studying the discipline undergraduates should know:
- the specifics of intermolecular reactions of macromolecules;
- mechanism of formation of interpolymeric complexes;
- methods of their research and main properties.

Be able to: Undergraduates should be able to have an idea about the main regularities polymer - polymeric interactions in solutions, research of properties and structures polymer - polymeric complexes and the composites, actual problems and prospects of use of polymeric complexes and composites in high technologies

Methodology of the course: To develop the mental ability, to teach students to use the acquired knowledge and skills for use of polymeric complexes and composites in high technologies

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of Chemistry Faculty
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The Dean of Chemical Faculty
_____Ongarbayev E.K.

"_____"_____2013

SYLLABUS
by profile elective module

« **Intramacromolecular Complexes and their Application in High Technology**» **3 credits**

INFORMATION about lecturer:
prof. of Department of chemical technology of organic substances, natural compounds and polymers prof. Mun G.A.
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Prerequisites: higher mathematics, physics, inorganic, analytical, physical, organic chemistry, macromolecular chemistry, chemical physics, structure of matter, quantum chemistry, advanced organic chemistry problem the theoretical foundations of catalytic processes hydrocarbon processing technology.

Postrequisites: general courses "Modern problems of physical chemistry of polymers and surface phenomena" and "Modern Problems of Chemistry and Technology of Polymers" special courses in various specializations.

STRUCTURE AND CONTENT OF DISCIPLINE

Week	Lectures title	Hours	MSS
1	**Lecture 1** «Introduction. Concept about intermacromolecular complexes. Properties of polymeric solutions» **Seminar 1** Types of intermolecular interaction.	2 1	**MSS 1** Interpolimeric interaction of neutral polymers.
2	**Lecture 2** «Main regularities of intermacromolecular	2	

	reactions behavior» **Seminar 2** Effect of various factors on thermodynamic affinity in system polymer-solvent.	1	
3	**Lecture 3** «Interaction reactions of polyelectrolytes, polyacids and polybases.» **Seminar 3** Factors of polycomplex's stability.	2 1	
4	**Lecture 4** «Effect of various factors on complexing ability of not ionic polymer - polyacrylic acid system» **Seminar 4**. An assessment of system to a complex formation ability.	2 1	
5	**Lecture 5** «Research methods of intermacromolecular reactions» **Seminar 5** Application of fluorescent spectroscopy method for research of intermacromolecular reactions	2 1	
6	**Lecture 6** «Effect of ionic force on stability of various nature intermacromolecular complexes» **Seminar 6** Thermodynamic quality of solvent and intermacromolecular reactions	2 1	
7	**Lecture 7** «Thermosensitive polymers and their complexing with polycarboxylic acids» **Seminar 7** Regulation by thermosensitivity of polymers by complexing with polycarboxylic acids	2 1	
8	**Lecture 8** «The critical phenomena in complex formation processes» **Seminar 8** Effect of organic solvents additives on polycomplexes stability.	2 1	**MSS 2** Polyelectrolitic complexes obtaining.
9	**Lecture 9** «Interpolimeric hydrophilic associates – a new class of polymeric materials» **Seminar 9** Polymeric hydrogels – a special class of polymeric composite materials.	2 1	
10	**Lecture 10** «Intermacromolecular interactions on the interface of hydrogel - water polymer solution» **Seminar 10** Interactions of hydrogels with linear functional polymers	2 1	
11	**Lecture 11** «Intramacromolecular reactions in water-organic and organic medium» **Seminar 11** Physical-chemical properties of water-soluble derivative of cellulose and their interactions with polycarboxylic acids.	2 1	
12	**Lecture 12** «Polymeric mixture and polycomplexes» **Seminar 12** Use of critical phenomena for receiving composite materials with certain properties	2 1	
13	**Lecture 13** «Composite materials based on polycomplexes» **Seminar 13** Use of film materials based on polycomplexes as leaky membranes	2 1	

14	**Lecture 14** «Use of composite materials based on polycomplexes in membrane technologies and biomedicine» **Seminar 14** Systems with controlled release of medicinal substances based on polycomplexes.	2 1	
15	**Lecture 15** «Prospects of use intermacromolecular complexes and associates in nanoelectronics» **Seminar 15** Use of thermosensitive polycomplexes and associates in a nanoelectronics	2 1	

Key concepts of discipline in knowledge system and competences: Polymeric mixes, polycomplexes, complex formation, thermosensitive and intermacromolecular polycomplexes, interpolimeric hydrophilic associates, etc.

Literature:

Required reading:

1. Hydrogen-bonded interpolymer complexes. Formation, structure and applications. Khutoryanskiy V.V. & Staikos G. (editors) World Scientific, Singapore, ISBN 978-981-270-785-7, (2009), 371 p.

2. . Bekturov E.A., Bimendina L.A. Interpolymer complexes // Adv. Polym. Sci. 1981. V.41. P.99-147.

3. Tsuchida E., Abe K. Interactions between macromolecules in solution and intermacromolecular complexes // Adv. Polym. Sci. 1982. 45. P.1-121.

4. Nurkeeva Z. S., Mun G. A., Khutoryanskiy V. V. Interpolymer Complexes of Poly(glycol vinyl ethers) and Related Composite Materials (Review)// Polymer Sci., Т.43Б, №3, С.146-155, 2001.

Recommended Reading:

1. Nurkeeva Z.S., Mun G.A., Khutoryansky V.V. Interpolymer complexes of water-soluble nonionic polysaccharides with polycarboxylic acids and their applications (Review) // Macromol. Biosci. 2003, 3, 283-295.

2 Khutoryanskiy V.V., Dubolazov A.V., Nurkeeva Z.S., Mun G.A. pH Effects in the Complex Formation and Blending of Poly(acrylic acid) with Poly(ethylene oxide), Langmuir, 2004, 20, 3785-3790.

3 Papisov I. M. Matrix polymerization and other matrix and pseudo-matrix processes as way of receiving composite materials//Naval Forces. 1997 . T.39. B. No. 3. Page 562-574.

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Prof., Mun G.A.

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