"THE LONG-RANGE EFFECT"A NEW METHOD OF CONTROLLING THE REACTIVITY OF THE POLYMER HYDROGELS.

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As the complexity of tasks to study hydrogels properties in an aqueous medium the problem about study of hydrogels remote interaction possibility in an aqueous medium in the absence of direct contact between them appeared. Formulation of such a problem was linked with the fact, that the studied hydrogels are substances of overmolecular structure of a macroscopic scale.

A methodology of the study of such intergel systems consisting of two or more hydrogels was developed. Intergel systems – are a multi-component systems consisting of two or more a hydro or organogels and mutual solvent. Contact interactions between these substances do not play a significant role.

As is known, the occurrence of selectivity at functional polymers is due to heteroatom affinity toward metal ions and polymer chain flexibility, what enables multiple ligands simultaneously interact with the complexant. Heteroatoms in flexible chains can form a spiral or spiral-like structures. Chains with bulky side substituents are particularly prone to such conformational transformations. In case of spirals pore size or similar structures to ion size compliance a maximum binding of metal ion by polymer is observed. Metal ions hydration shell is completely or partially replaced to hydrogel links heteroatoms.

In order to create highly selective systems from cationic hydrogels such as polyethyleneimine, poly-4-vinyl-pyridine, poly-2-methyl-5-vinylpyridine and anionic hydrogels – polyacrylic and polymethacrylic acid a few intergel systems were created.

Study of pH, conductivity and swelling coefficient showed that electrochemical and volume-gravimetric properties of intergel systems strongly depend on initial state, molar ratio of polymer networks and remote interaction time. The obtained results allowed to assume that remote interaction is an effective tool for control hydrogels reactivity in intergelevyh systems. These experimental results also indicated to possibility of sorption activity regulating and selectivity of polymer networks due to "long-range effect." Subsequent studies showed that intergel systems polyacrylic acid (polymethacrylic acid) gel – poly-4-vinylpyridine (poly-2-methyl-5-vinylpyridine) gel have high sorption capacity to K^{+}, Ca^{2+}, Cu^{2+}, La^{3+} и Au^{3+} ions, which are different classes metals. Sorption capacity of individual gels in intergel systems increases from a few tens per cent to three hundred per cent in comparison with original hydrogels.

The overwhelming majority of hydrogels are polyelectrolytes. The conformational behavior of polyelectrolytes is greatly influenced by macromolecular coils ionization degree. In intergel systems ionization degree of each hydrogel is determined by concentration of second hydrogel. Feature of ionization process in intergelevyh systems is the lack of counterion at ionized groups. This is a consequence of intergel interactions, the result of what is hydrogels mutual activation and formation of uncompensated charges along polymer chain. Uncompensated charge is formed by deprotonation of carboxyl group during acid hydrogel dissociation and binding of this ion by basic hydrogel heteroatom in an aqueous medium. In this case basic hydrogels charge density is limited by acid hydrogel dissociation degree. Consequently, both hydrogels are ionized and do not have a counterions at charged links.

As it is known, at present three research directions to create polymer structures selective to low molecular ions are formed: molecular imprinted polymers, polymer crown ethers and ion exchange resins.

The obtained results by intergel systems sorption capacity and selectivity are much higher than previously studied the above mentioned system. Advanced study of intergel systems complexing properties with different classes of ions allows to create an "selectivity algorithm", which determines the order of the sequential and parallel separation of different nature ions from

water systems of various origins. It is assumed that polymer networks long-range effect will give significant impetus to the development of new technologies for production of materials, elements extraction, water treatment, in microelectronics and in other fields.

There are following areas of intergel systems "long-range effect" practical application:

1 Water treatment and purification technology of different origin water systems from the ions;

2 Development of the technology of parallel and sequential selective separation and extraction of metal ions from industrial water systems;

3 Development of methods and technology for production highly ionized polymer materials;

4 Creation of methods and technology for chemical compounds synthesis using intergel systems;

5 Polymer catalysis.