SYNTHESIS OF FLOCCULANTS BASED ON POLYACRYLAMIDE

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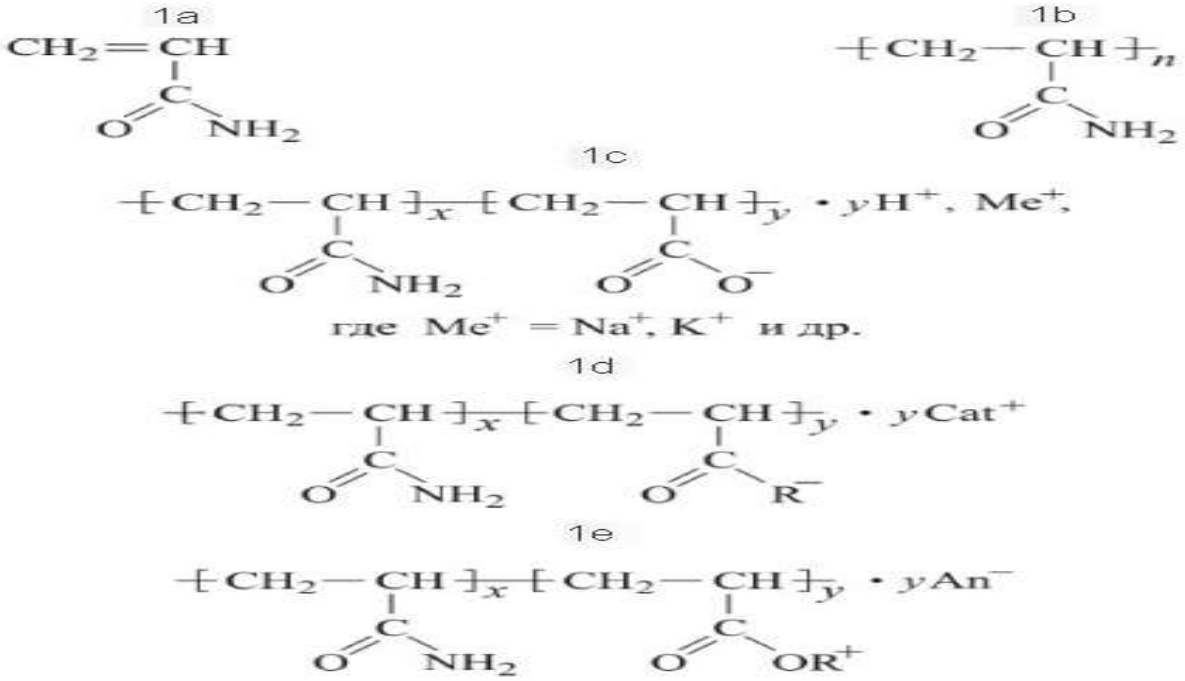
Abstract. The article investigates the concepts of flocculants and polyacrylamides,as well as their characteristics. In addition to this, the article presented the ways of synthesis of flocculants based on polyacrylamides.
Keywords: flocculants, polyacrylamide, methods, synthesis, characteristics.

Flocculants are water-soluble high-molecular compounds that, when introduced into dispersed systems, are adsorbed or chemically bonded to the surface of the particles of the dispersed phase and combine the particles into agglomerates (flocculi), contributing to their rapid settling [2.145-150].

Polyacrylamide is a high molecular weight compound, a polymer acrylamide (AA). Polyacrylamides is a common name for a group of carbon chain polymers and copolymers based on AA (Pic. 1a) and other unsaturated amides [3]. This group includes PAA, a nonionic polymer (Pic. 1b) anionic derivatives (Pic. 1c, d), for example, partially hydrolyzed polyacrylamide (Pic. 1c) and cationic derivatives(Pic.1e):



Pic. 1. Polyacrylamide and its derivatives

Polyacrylamide is one of the available and relatively inexpensive water-soluble polymers with a unique set of applied properties [4.3-7]. Today it is difficult to find any field of engineering and technology where polyacrylamide reagents would not be used. In particular, they are highly effective flocculants in the extraction and enrichment of minerals, in the treatment of drinking and industrial wastewater. They have found wide application as drilling fluid thickeners, dehydrators, agents that reduce the hydraulic resistance of liquids in the oil and

gas industry, as soil structure formers in agriculture and road construction. As film formers, they are used in the production of mineral fertilizers and long-acting medicinal devices, in the creation of photoresistor compositions and microcircuits in the radio-electronic industry. [5]. The examples given are by no means a complete list of applications for polyacrylamide. The industrial production of polyacrylamide began in the early 1950s and has been intensively developed in recent years on a qualitative and quantitative level.

The global production of polyacrylamide reagents continues to grow steadily, but the growth rate is far from sufficient to meet the growing demand for it (annual demand for polyacrylamide reagents increases by more than 6%). Polyacrylamide reagents are produced in the form of solutions, dispersions, granules or powder with a wide range of properties, depending on the purpose, they can be obtained as soluble, partially swelling rubber-like gels and insoluble. At present, the world production of polyacrylamide reagents exceeds 200 thousand tons/year.[1].

The main method for the synthesis of flocculantss based on polyacrylamide and other unsaturated amides is radical polymerization, which can be carried out by all known methods. In solution, these are polymerization processes in solvents in which both the monomer and the polymer are soluble. For polyacrylamide, the number of such solvents is small; water, acetic and formic acids.

Emulsions are inverse emulsion polymerizations. An aqueous solution of a hydrophilic monomer is dispersed (up to a particle size of 1 - 10 μm) in a hydrophobic organic phase (aromatic, aliphatic and halogenated hydrocarbons) in the presence of water-in-oil type emulsifiers.[2]. You initiate the process with an oil-soluble or water-soluble initiator. The process of polymerization in inverse emulsions has been little studied; there is no quantitative theory of polymerization.

Suspensions. The initial system is obtained by dispersing an aqueous solution of the monomer in the form of small drops with a diameter of 0.1 - 5 mm in an organic liquid with mechanical stirring in the presence of stabilizers (protective colloids). [4.3-7]. As a dispersion medium, aromatic and aliphatic saturated hydrocarbons can be used. Initiation of polymerization is provided by the use of various water-soluble initiators, UV- and γ-irradiation.

Each of the methods has its own characteristics, which determine the properties of polymers and technical and economic indicators of production.

Among the methods for the synthesis of flocculants based on polyacrylamide, an important place is occupied by polymerization in aqueous solutions [1]. The main factors determining the prevalence of this polymerization method are high rates of polymer formation and the possibility of obtaining a polymer with a high molecular weight under these conditions. It is assumed that the reason for the specific effect of water on the polymerization of acrylamide is the protonation of the radical, which leads to the localization of the unpaired electron, as a result of which the reactivity of the macroradical increases, which is expressed in high values of the chain growth rate constant. The mutual repulsion of like-charged radicals is responsible for limiting the rate constant of bimolecular chain termination. In the non-protonated radical, which exists during polymerization in non-aqueous solvents, the conjugation of an unpaired electron with pi-electrons of the C=O group leads to stabilization of the radical and a decrease in its activity. In addition, the high reactivity of acrylamide in aqueous solutions can be associated with the suppression of autoassociation of this monomer molecules due to the formation of hydrogen bonds with water molecules.

Other reasons for the widespread use of flocculants in water include a reduction in energy costs for the isolation of the initial monomer in crystalline form, which is also associated with the likelihood of its spontaneous polymerization, and for the regeneration of organic solvents, a decrease in environmental pollution, and the exclusion of the stage of dissolution of polymeric reagents. usually used in the form of aqueous solutions.

Conclusion. Taking into account the above-mentioned data it can be concluded that it is difficult to find any field of engineering and technology where flocculant reagents would not be used. In particular, they are highly effective polyacrylamides in the extraction and enrichment of minerals, in the treatment of drinking and industrial wastewater. They have found wide application as drilling fluid thickeners, dehydrators, agents that reduce the hydraulic resistance of liquids in the oil and gas industry, as soil structure formers in agriculture and road construction. The article presented some methods of synthesis of flocculants based on polyacrylamide. Among the methods for the synthesis of flocculants based on polyacrylamide, an important place is occupied by polymerization in aqueous solutions. The main factors determining the prevalence of this polymerization method are high rates of polymer formation and the possibility of obtaining a polymer with a high molecular weight under these conditions.

References:

1. M. Kuruppuarachchi, H. Savoie, A. Lowry, C. Alonso, R. W. Boyle Polyacrylamide Nanoparticles as a Delivery System in Photodynamic Therapy. Molecular pharmaceutics. 2011.

2. Куренков В.Ф., Бударина Л.А., Заикин А.Е. Практикум по химии и физике высокомолекулярных соединений. М.: Колос, 2008, 395 с.

3. Куренков В.Ф. Водорастворимые полимеры акриламида // Соросовский образовательный журнал.

4. Т. А. Байбурдов, А. Б. Шиповская. Синтез химические и физикохимические свойства полимеров акриламида // ФГБОУ ВПО «Саратовский государственный университет имени Н. Г. Чернышевского». Учебное пособие для бакалавров Института химии СГУ. Саратов. 2014. С. 3-7.

5. Холмберг К.. Йенссон Б., Кронберг Б., Линдман Б. Поверхностно- активные вещества и полимеры в водных растворах. Пер. с англ. М.;