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THE IMPORTANCE OF SURFACTANTS AND AREAS OF APPLICATION

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Abstract: Today, the use of surface-active substances in various fields is increasing significantly around the world. This article analyzes the use of surfactants in various fields of industrial production, agriculture and everyday life.
Key words: surfactants (SFM), synthetic detergents, micelles, ionic SFM, nonionic SFM, hydrophilicity, hydrophobicity, washing properties, biodegradability.

One of the major sectors of the petrochemical industry is the production of surfactants (SFM). Adding small amounts of SFMs to technological processes or to the finished product has a large economic effect.

The world production of surfactants is 2-3 kg per capita per year. About 37 percent of the produced surfactants are used for household chemicals, and the rest are used in industry and agriculture. Along with the annual increase in the production of surfactants, the ratio between their use in everyday life and their use in industry is changing in favor of industry [2,3].

Surfactants are used in more than 100 sectors of the economy. Most of the produced surfactants are used in detergents, in the production of fabrics and products based on synthetic and natural fibers. Major consumers of surfactants include oil and chemical industry, building materials industry and a number of other industries [4].

Surface-active substances (SFM) are chemical compounds that, when concentrated (adsorbed), cause a decrease in the surface energy GS and, accordingly, the surface tension - σ. The main quantitative characteristic of a surface-active substance is its surface activity, that is, the ability of the substance to reduce the surface tension at the σ1,2 phase boundary.

In addition to the ability to adsorb on the interfacial surface, many surfactants have another important property: under certain conditions, self-assembled nanoagents consisting of tens and hundreds of surfactant molecules or ions in surfactant solutions (micelles) are formed. Due to these properties, surfactants are widely used in many technological processes and in everyday life.

Among the surfactants produced in the world, the leading place is occupied by the cheapest and most comprehensive anionic surfactants, which make up at least 60% of the surfactants produced

in the world; Up to 30% are nonionic surfactants, about 10% are cationic and a small percentage are synthetic ampholyte surfactants [3, 6].

Alkylarylsulfonates are salts of aromatic sulfoacids RArSO3Me. They are cheap synthetic SFMs. Such surfactants show a good cleaning effect in acidic and alkaline environments and in hard water.

Alkylsulfonates RSO3M (R mainly S10-S20). These surfactants have good washing properties and good biodegradability in different pH conditions and in hard water.

Alkyl sulfates ROSO3M (R is usually S10-S18). Alkyl sulfates belong to the III generation of SFMs, which are biochemically degraded to inorganic substances (water, carbon dioxide, and sodium sulfate). Primary alkyl sulfates are obtained by sulfation of primary higher fatty alcohols with ROSO2ONa and subsequent neutralization of the resulting sulfoether with sodium hydroxide. The alcohols required for this are currently obtained mainly by synthetic methods - as a result of reduction of esters of higher fatty acids, oxosynthesis, extraction of organoaluminum compounds from ethylene.

Secondary alkyl sulfates are obtained by reacting RCH(CH3)OSO2ONa sulfuric acid with α-olefins or sulfation of secondary higher alcohols.

Among alkyl sulfates, only those derived from primary alcohols with the correct chain of carbon atoms have maximum cleaning ability. The washing ability of alkyl sulfates decreases with the deeper penetration of the sulfate group into the molecule and the branching of the carbon chain. Therefore, the most suitable raw materials for the production of alkyl sulfates are primary alcohols and C12-C8 α-olefins with straight carbon chains.

The widespread use of alkyl sulfates in synthetic detergents is hindered by their slightly higher price compared to alkylbenzene sulfonates. However, as the production processes of raw materials (primary and secondary alcohols and α-olefins) improve, this obstacle will be overcome.

All surface-active substances are divided into two categories according to the mechanism of physico-chemical action in the solvent environment (according to the classification of P.A. Rebinder). The first category includes surfactants that form micelles (colloid-soluble SFM), and the second category includes surfactants that do not form micelles (solubilizers). When micelle-forming surface-active substances are higher than the critical micelle-forming concentration (MIC), colloidal particles (micelles) consisting of tens or hundreds of molecules (ions) appear. When the solution (more precisely, the colloidal dispersed system) is diluted to a low concentration, the micelles break down into individual molecules or ions. Thus, micelle-forming surfactant solutions occupy an intermediate position between true (molecular) and colloidal solutions (sols), so they are often called semi-colloidal systems.

Micelle-forming surfactants include all detergents, emulsifiers, wetting agents, dispersants, etc. True soluble surfactants have no stabilizing properties and are poor wetting agents and poor foaming agents [5].

Surfactants are widely used in industry, agriculture, medicine and everyday life. Areas where surfactants are used the most are: production of soaps and detergents for technical and sanitary-hygienic needs; textile auxiliaries, that is, in the processing of fabrics and the preparation of raw materials for them; the field of production of varnish and paint products. Surfactants are used in many technological processes in the chemical, petrochemical, chemical-pharmaceutical and food industries.

Currently, 80% of surfactants produced worldwide are used as synthetic detergents. SYuV is of great importance in meeting people's needs and is also used in various industries. With the

development of production and daily life, the need for synthetic detergents and their production is growing rapidly. For example, at present, 1.7 million tons of products are produced in Russia per year, of which 0.2 million tons are exported and 0.1 million tons are imported [2]. The development of the market of synthetic detergents is accompanied by strict requirements regarding their ecological properties.

The basis of SYuV is surface-active substances and auxiliary components that enhance the cleaning effect, as well as fillers (soda, phosphates, sodium sulfate). Surfactants are used to stabilize dispersed systems - emulsions, suspensions, foams, as well as to disrupt them, including reducing the strength of treated surfaces, fighting corrosion, environmental protection and other purposes.

Currently, among the surfactants produced in industry and used as synthetic detergents, anionic surfactants are widespread, their production is almost 68% of all synthetic detergents. The production of nonionic detergents is significantly less - only 29% of the total amount, but now their production (polyoxyethylated alcohols) is significantly increasing [7]. According to the scale of production, alkylaryl sulfonates take the first place among anionic synthetic detergents. SYuV obtained on the basis of alkylarylsulfonates is biochemically poorly oxidized in water bodies, as a result of their accumulation, oxygen exchange is disturbed and foam appears. Alkyl sulfates of primary alcohols (primary AlkCH2OSO2ONa) and secondary alcohols (secondary Alk(Alk')CHOSO2ONa) which are salts of sulfoethers, which are completely biodegradable to surfactants of the III generation (inorganic compounds, i.e. water, carbon dioxide and sodium sulfate) and they occupy the second place among anionic SFM in terms of production volume.

According to washing properties, primary alkyl sulfates are the best type of surfactants, while secondary alkyl sulfates are inferior in quality.

Detergents based on alkyl sulfates are produced in liquid form (containing 20-40% active substance) and in powder form. They are used for washing clothes and fabrics, wool, etc. [1,9]. Today, various authors are testing various surfactants in the industrial and agricultural fields.

Currently, surfactants are used in the intensification of various technological processes in the oil refining industry. A distinctive feature of the modern development of the oil industry is significant changes in the composition of reserves, an increase in the share of oil that is difficult to restore. Surfactants are used to fully extract oil from formations during drilling of oil pipelines (increasing oil), to accelerate the development of oil fields, to fight against corrosion caused by paraffin and salt deposits in oil equipment in the process of oil production, environment - it is used to prevent environmental pollution, to reduce losses during oil transportation, and in other processes.

The use of oxidized surfactants in oil production is associated with increased oil production: they are injected with oxyethylated SFM solutions into wells called contour flooding, which helps to move oil from the collector to the production well. Certain processes, such as demulsification and desalination, cannot be carried out without the use of SFM [9-14].

Adding SFM to them is the most promising way to speed up the production process of oxidized bitumen and improve their quality. Such additives increase the reactivity of raw materials and improve the physico-chemical properties of oxidized birtum.

As a rule, the amount of surface-active substances does not exceed one tenth of a percent. Their use is effective as well as inexpensive.

Therefore, the use of surfactants in the processing of oil residues is a promising direction of technology, which allows to activate various technological processes and improve the quality of petroleum products, in particular, petroleum bitumen [15, 16].

Modifier additives of surfactants improve the operational properties of bitumen, as well as wet the surface of mineral materials with bitumen, forming an adsorption layer consisting of polar groups facing the surface of the mineral material and a layer consisting of hydrocarbon parts facing the bitumen volume. This significantly reduces bitumen aging processes, as well as reducing the temperature and time to obtain a uniform mixture. Also, as a result of the use of surface-active substances, a monomolecular chemisorption layer is formed, which helps to form a strong bond at the border of mineral and bitumen surfaces. Cationic surfactants are often used for such purposes, and anionic and ampholyte additives are used less often [17-19].

In various technological processes, great importance is attached to improving the performance characteristics of lubricants and extending their service life. The traditional method of improving the quality of mineral oils is the use of various additives. Most of the applied coatings are oil-soluble surfactants according to their chemical structure and properties. Such detergent-dispersing compositions provide the necessary cleanliness to the parts in friction joints, giving them the property of oil washing [20].

Industrial production of polymers and rubbers is carried out in emulsions and surfactants are used as stabilizers [21].

In modern construction, surface-active additives are widely used in order to improve the properties of concrete and save cement. The main goal of this is to increase the plasticity of cement, the specified mobility of concrete and the water demand of the mixture, as well as to reduce the consumption of cement. Surfactants have a positive effect on the structure of cement stone, help to increase the resistance to cold and water and other properties of concrete, and also increase the productivity of mills (10-15%) and reduce energy consumption [17, 19].

According to the effect on the properties of cement and cement stone, surface-active substances are divided into hydrophilic-plasticizers, which increase the wetting of cement powder with water, and hydrophobic-plasticizers, which reduce its wetting. Based on this, portland cements with hydrophilic additives are called plasticized, and those with hydrophobic additives are called hydrophobic portland cements.

Hydrophobic additives form waterproof films on the surface of cement grains. Such cements are characterized by low water absorption. During their long-term storage, they remain active even in conditions of high air humidity and do not stick together. Hydrophobic-plasticizing additives affect the solidification process of cement with a uniform and fine particle structure.

Polymer-cement mastic compositions, solutions and concretes based on aqueous polymer dispersions are widely used in plastering and tile casting, floor coverings, wall fixing, waterproofing of concrete and reinforced concrete structures. The stability of polymer dispersions in these building materials is determined by the presence of surfactants - stabilizers in the dispersion medium. In construction practice, nonionic surfactants are usually used to stabilize polymer dispersions. Such surfactants are plasticizers for cement mixtures [19].

In modern conditions, it is possible to use heat-insulating foam concrete to optimally solve the problem of increasing the environmental cleanliness of housing and heat-insulating properties of protective structures and reducing the cost of their construction. Foam concrete has a number of advantages compared to other building materials, in particular, among all types of walls, foam concrete is the most energy-saving. The active basis of foaming agents is SFM. [22].

It should be noted that the fields of application of surfactants are expanding significantly every year. The most promising in this regard are liquid crystals and organized media. These are micellar colloidal systems that are anisotropic in at least one direction and combine the

properties of solid and liquid phases at the same time. Such systems are very sensitive to even small external influences and can serve as excellent sensors to detect them.

Based on the above-mentioned information, we can conclude that today the scope of use of surfactants in various fields is expanding. The use of such substances not only improves the quality of the manufactured product, but also gives it various properties. It also provides economic benefits in various production areas.

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