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SPECIFIC PROPERTIES OF SURFACTANTS AND THEIR CLASSIFICATION

JizPI "Chemistry" department assistant
Karimova Sidora Bakhtiorovna
Sarabekova Marjona Yadgor qizi
Rakhimova Haydar qizi
Abdurasulov Sherali Sabir o'g'li
Jonzakov Tolkin Fazliddin o'g'li
Students of JizPI, III stage

Abstract: This article describes the importance and development of surfactants. About their use and relevance in today's marriage. There was also talk about their properties.
Keywords: Surfactant (SFM), hydrophilic, hydrophobic, anionic SFM, cationic SFM, amphoteric SFM, nonionic SFM, diphilic, alkylsulfates, alkylarylsulfonates.

In recent years, the production of synthetic detergents in the world has reached 10 million tons. However, most of them, i.e. 70%, are used by the population of developed countries. Synthetic laundry detergent used by the population is used for general laundry. Anguilla and the US call it "heavy" laundry. Produced 3 - 7 times a week. This laundry is mainly done in washing machines. About 20% of laundry detergents are used for "light laundry". Synthetic detergents used for light laundry should not have a negative effect on the skin and other organs, often create foam and wash the laundry well in water with a temperature of 25-45 degrees. Despite the advent of synthetic laundry detergents, soap has yet to take its place.

Typically, typical surface-active substances are organic compounds with a diphilic structure, that is, their molecule contains atomic groups that differ greatly in the intensity of interaction with the environment (in practice, in water). Thus, surfactant molecules contain one or more hydrocarbon radicals forming the oleo- or lyophilic part (hydrophobic part of the molecule) and one or more polar groups - the hydrophilic part. Hydrophobic groups that interact weakly with water determine the tendency of the molecule to move from an aqueous (polar) environment to a hydrocarbon (non-polar) environment. Hydrophilic groups, on the other hand, hold the molecule in a polar environment or, if the surfactant molecule is in a hydrocarbon liquid, determine its transfer to a polar environment. The surface activity of surfactants dissolved in these non-polar liquids depends on hydrophilic groups, and those dissolved in water depend on hydrophobic radicals [5].

Classification of surfactants. All surface-active substances are divided into two groups according to the nature of adsorption and the mechanism of stabilization of dispersed systems: lower molecular compounds with a diphilic character, containing hydrophilic ("head") and hydrophobic ("tail") groups in their composition; high molecular compounds with alternating hydrophilic and hydrophobic groups evenly distributed along the entire length of the polymer chain.

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].

Depending on the type of hydrophilic groups, surfactants are divided into ionic or ionogenic and nonionic or nonionic types. Ionic surfactants dissociate in water into ions, some of which have adsorptive (surface) activity, others (counterions) are not adsorptive. If anions are adsorptively active, surfactants are called anionic or anionactive, otherwise - cationic or cationic.

Anionic SFM - organic acids and their salts, cationic - bases, usually amines of different degrees of substitution and their salts. Some SFM contain groups with acidic and basic properties. Depending on the conditions, they exhibit anionic or cationic SFM properties, so they are called amphoteric or ampholytic SFM Anion SFM. This type of SFM includes the following compounds.

Carbonic acids (RCOOH) and their salts (soaps) (RCOOMe, where R is an aliphatic hydrocarbon radical with 12-18 carbon atoms, Me is Na+, K+, or NH4+). Carbonic acid soaps have good washing properties only in alkaline environments, such surfactants have low washing ability in poorly soluble fatty acids and hard water (due to the formation of insoluble calcium and magnesium salts). Soaps are completely biodegradable.

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 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 - reduction of esters of higher fatty acids, oxosynthesis, extraction from ethylene through organo-aluminum compounds (alphaol process).

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 detergency of alkyl sulfates decreases with the penetration of the sulfate group deeper 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.

Cation SFMs.

They include aliphatic and aromatic amines (primary, secondary and tertiary) and their salts, quaternary ammonium bases and their salts, quaternary phosphonium and tertiary sulfonium bases, pyridine compounds.

Cation SFM is well adsorbed on negatively charged surfaces (metals, many minerals, plastics, cell membranes, cement). Therefore, they are used as antistatic agents, corrosion inhibitors, bactericides, fungicides and disinfectants. Quaternary ammonium compounds with a hydrocarbon

radical length of C12-C18 have a bactericidal effect and are about 300 times more effective than phenol in terms of their destructive effect against microorganisms. Salts of pyridine bases are used in the textile industry as a fixative for dyeing, as well as for the purpose of processing finished fabrics.

Amphoteric or ampholyte are substances containing acidic and basic groups in the molecule of surfactants. They can be obtained by introducing amino acids into anion-active groups or by introducing acidic groups from cation-active groups. At pH<4, ampholytic surfactants exhibit the properties of cationic compounds, anionic compounds at pH 9-12, and nonionic compounds at pH 4-9. These types of surfactants contain many natural substances, such as amino acids and proteins. Their synthetic analogues are alkylamino acids, for example, cetylamine acetic acid C16H33NH-CH2COOH and others. The production of such substances is quite difficult and expensive, and they have not yet been widely used as surface-active substances.

Nonionic SFM is the most promising and rapidly developing class of surfactants. In this case, 80-90% of surfactants are obtained by adding ethylene oxide to alcohols, alkylphenols, carboxylic acids, amines, etc. Polyoxyethylene ethers of alkylphenols are the most numerous and widespread group of nonionic surfactants. For example, RC6H4O(CH2CH2O)nH, where n is the average number of oxyethyl groups. Polyoxyethylene esters of alcohols RO(CH2CH2O)nH are of important industrial importance because they are easily biodegradable under natural conditions.

As components of detergents, nonionic surfactants are indispensable in high-quality soaps, so they are used in water of any hardness and with different pH values. They usually have low foaming ability and can be used as defoamers [7, 8]. 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 micellar-forming surface-active substances are higher than the critical concentration of micelle formation (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 found in many food products and are also used in leather processing and photography. They can be placed on metal surfaces, thus protecting them from corrosion.

Surfactants are used to promote the flow of oil through porous rocks and in the flotation of minerals or other solid particles. They also increase the wettability of the mineral particles, while foaming agents allow the particles to adhere to the bubble and float. Surfactants help the dyes to penetrate the fabric evenly during the dyeing process.

They interfere with the formation of latex particles by forming stabilizing micelles of monomers before polymerization. Polymerization The polymerization initiators reach the micelles and induce the monomer molecules to polymerize to form latex particles.

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