THE EXPLANATON OF THE SELECTION OF BASIC DETERGENTS AND SECONDARY DETERGENTS FOR THE DEVELOPMENT OF FOAM MEANS WITH MINIMUM IRRITANT ACTION: A REVIEW

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Introduction. Modern detergents are different from those products which satisfied the needs of consumers of the last century (for example, they had a stable foam, a bright color due to synthetic dyes, sometimes rich liquorice smells, etc.). At the present time, the consumer has became more selective when choosing foaming agents of different orientation. According to expert data, he prefers precisely the foaming agents which, firstly, have a corresponding purifying (washing) effect; form a volumetric cream-like foam in water of any rigidity (except for shampoos based on non-ionic detergents or for special purposes such as "green"); well distributed and easy to wash off from skin, hair and mucous membranes; have the most low irritant action (due to the content of detergents and complex of additional "soft" action detectives); have a nice color and smell, the corresponding pH value; are economical to use and have a convenient packaging (for example, a bottle with a disk top or a trigger) [1-4].

Analyzing the entire information space, we noticed that manufacturers develop foam materials on the basis of classical technology, that is, they combine anionic, amphoteric, nonionic detergents, and also add auxiliary substances such as viscosity regulators, corients, pH values, and others. We also noted that the modern manufacturer began to prefer detergents or even their combinations, which in turn would have less irritant activity on the skin and mucous membranes [4-6].

In the development of any foaming agents in the first place, it is necessary to clearly understand for which part of the body it will be used. Because the composition and nature of detergents, viscosity and pH modifiers, as well as active substances, will vary depending on the field of application [7,8].

Therefore, the main task of our study was to analyze and learn the basic physical, chemical and technological properties of the most used detergents in order to further rational choice of components for the creation of foaming agents with low irritant action.

Materials and methods. As materials we used informational and literary sources that highlighted the main characteristics of modern basic and additional detergents. Also, we used conventional methods of research, namely historical, logical, comparative and structural.

Results. Usually, in formulations of foaming agents, which are represented in the Ukrainian market, mostly detergents of anionic nature, such as sodium laureth sulfate, sodium lauryl sulfate, are presented. The washing properties in them provide a surface-active anion: a negatively charged particle of a molecule. In water, it breaks up into a positively charged ion of sodium and negatively charged ion (anion) of lauryl sulfate. It is the anions that give a massive foam. But since the surface of our skin has a polymozaic charge, the efficacy of cleaning with such a detergent is not the best one. Therefore, lately, modern manufacturers combine either nonionic and amphoteric detergents or combine them with mild anionic substances such as sodium mentresulfate, sodium laurylsarkosinate, magnesium laureth sulfate, and etc [2,9,10].

After analyzing literary sources and taking into account the manufacturer's advice, we identified the main "soft" surfactants that are currently used:

Magnesium Laureth Sulfate - an anionic deretgent that has a mild effect, does not irritate the skin and eyes, is widely used in intimate hygiene products. Trademarks and brands: Basf (ex-Cognis), Naterol SP3, Naterol BS (Cisme), Rexsoft L, Alkonix SSU (Oxiteno), Elfan 240 S / T (Akzo), Elman 10N / P (Kao), Empicol LAT / LHN / LMA / LMN / LMM (Hidrior), Rewopol MLS / NLS / NEHS (Degussa); (II) series Cosmacol AES, Daclor and Marlinat (Sasol), series Ztesol (Zschimmer & Schwarz) and others [11,12].

Sodium Lauroyl Sarcosinate - an anionic detergent that works great in hard water, as well as in shampoos, conditioners and skin care products, with the removal of fat. Sodium Lauroyl Sarcosinate also has the following properties: does not irritate the eyes and skin; forms abundant and stable foam; is absorbed into the hair and reduces the accumulation of static electricity; Compatible with various noninogenic detergents; reduces the "point of opacity" of the system [12-14]. Today, the following trademarks and manufacturers of Sodium Lauroyl Sarcosinate: Silaphos ME 16 K30, Perlastan TCG 30, Perlastan SLG 38, Perlastan SC25 NKW, Perlastan SC25 NK (Schill + Seilacher GmbH), Aminol LS- 30 (Suzhou Eleco Chemical Industry), NaterolL LS90 (Cisme Italy), Maprosyl 30-B (Stepan), Sodium Lauroyl Sacosinate (Spec-Chem Industry) and others. Also, unlike many other anionic detergents, it is classified as an easily biodegradable substance and also harmless to the environment.

Sodium Myethyrsulphate is one of the anionic detergents found in many personal hygiene products (soaps, shampoos, toothpastes, etc.). Sodium myethyrsulphate is an inexpensive and highly effective foaming agent and emulsifier. The main advantage of this detergent is that it has a satisfactory washing properties - it effectively dissolves mud and sebum, forms a stable foam when dissolved in water, is easily washed away from the surface of the skin and its appendages. Trademarks and brands: Texapon K 14 S Spez 70% (BASF) [5,8,15].

Disodium Lauryl Sulfosuccinate is an anionic detergent, mixes well with anionic, nonionic, and amphoteric detergents. It exhibits high foaming capacity, emulsification, dispersion properties, and purification from contaminants. It helps to reduce skin irritation from other anionic detergents and possesses a good ability to dissipate calcium soap in the fight against hard water. Excellent cleaning ability and ease of washing. Trademarks and

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manufacturers of Plantapon PSC (BASF), MICONATE DLS (N) (Miwon Commercial Co., Inc.) are widely used in shampoos, bath foam and hand-washing agents. [...] Ltd.), Galaxy LSS P (Galaxy Surfactants Ltd.), Mackanate LO (Solvay Novecare), Galaxy SN 8215, Galaxy SN 8501D, Galaxy SN 8501 (Galaxy Surfactants Ltd.), Euranaat LS3 (EOC Group) [12,16].

Disodium Laureth Sulfosuccinate is a mild anionic detergent. Despite the fact that the name sounds like lauryl sulfate, they are completely different, because sulfosuccinate does not contain sulfates, it is not sulfated in the process of obtaining. Succinate is a salt of amber acid, not sulfuric acid. The sulfate sulfuric acid ion in sodium lauryl sulfate (SLS) in succinate is replaced by a milder and more stable ionic sulfosulfur.

In its structure sulfosuccinate is a much larger molecule than other detergents, so it can hardly penetrate into the skin. By its properties it is absolutely toxic free even in high concentrations. It helps to reduce skin irritation, even in the presence of aggressive detergents (SLS / SLES) in the agent. It possesses excellent foaming ability, well washed, gives a stable foam, even in hard water. Widely used in children's shampoos, intimate hygiene products, bath products, handwashing agents, can be used as an industrial detergent. Trademarks and brands: OLI-4601 (Shanghai Oli Enterprises Co., Ltd), MICONATE LES (B) (Miwon Commercial Co., Ltd.), MICONATE LES (S) (Miwon Commercial Co., Ltd.), Texapon SB 3 KC ((BASF), SABOSOL SSE SB (SABO SpA), Mackanate EL P (Solvay Novecar), Chemccinate ™ DSLS-BA (Lubrizol) [1-3,13].

Disodium Ricinoleamido MEA-Sulfosuccinate - anionic detergent, well soluble in water, remains stable in strongly acidic and alkaline environments. It is used as an auxiliary detergent, has a moisturizing, dispersing, emulsifying and cleansing ability. Trademarks and brands: Euranaat RMS (EOC Group), REWODERM S 1333 KM 5 (Evonik Nutrition & Care GmbH, BL Personal Care) [4,7,10].

Sodium Laureth-11 Carboxylate is an anionic detergent used in combination with anionic and nonionic detergents to enhance the stability of the remedy, while improving the softness and lowering of dermatological activity. AKYPO SOFT 100 BVC (KaoCorporationGmbH) [1,2,16]

Laureth-7 Citrate is an anionic detergent based on citric acid, has a mild effect, has good sensory, moisturizing and conditioning properties. It shows solubilizing properties and is stable in the pH range 4-7 [...]. Trademarks and manufacturers: Plantapon LC 7 (Basf (ex-Cognis)), Akypo RLM 100 (Kao Chemicals Europe), Oxarol C80 (Cisme Italy), Neominox CPG (Oxiteno), Mackamine ™ CAO (Solvay), Caloxamine CPO (Pilot chemicals), Cocamidopropylamine Oxide (CAO-30) (Ronas Chemicals), Masurf G-2C (Mason Chemical) and others [4,17,18].

As additional detergents in foaming agents, various amphoteric, nonionic, some anionic and crypt-anionic (AKURO product group) detergents are commonly used. The usage of additional detergents can significantly improve foam characteristics, viscosity and dermatological properties. The concentration of them or a combination of several, as a rule, is 20-30% of the concentration of the main detergent, that is, in the ratio 1: 3-1: 4. We noticed that the cost of these substances is 2-3 times higher than the cost of some anionic detergents, especially in such foam products as baby shampoos, gels for intimate hygiene, etc.

Table 1 gives data on the ability of some widespread "soft" additional detergents to reduce irritant activity (eg, sodium laureth sulfate).

Table 1. Characteristics of the most commonly used additional detergents [1,5,8]

Naming substances according to INCI classification	Effect of thickening	Feeling on skin and hair after washing	Consumer abilties
Sodium Laureth-11 Carboxylate And Laureth-10	+	++++	+++
Cocamidopropyl Betaine	+++	++	++
Cocamidopropyl Hydroxysultaine	+++	+++	+++
Disodium Cocoamphodiacetate	++	+++	+++
Lauryl Hydroxysultaine	++++	++++	++++
Sodium Laureth-6 Carboxylate	++	++++	++++
Sodium Cocoamphomonoacetate	+++	++++	++++
Sodium Laureth-11 Carboxylate	+	+++++	+++++

Note: "+" is almost absent, "++" is the minimum ability, "+++" is average, "++++" is the maximum ability.

Analyzing the table data, we noted that Cocoamphodyacetate remains one of the most common

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additional detergents in children's detergents. The main disadvantages of these substances are low thickening and yellowish color of the product itself. When storing Cocoamphodyacetates, a significant increase in viscosity is usually observed.

The new generation of Cocoamphoacetates retains all the benefits of traditional sodium Cocoamphoacetate, but has a number of important advantages: satisfactory thickening ability and electrolyte content are close to the properties of traditional Cocamidopropyl Betaine, good dermatological properties, significantly increased resistance to water hardness and color of the product itself [2,15].

Nowadays, the most common amphoteric detergents are betaine, primarily Cocamidopropyl Betaine (CABL), which remain for the long time the most popular supplementary detergents and are used throughout the range of foaming agents. This is due to their high thickening ability, good foaming properties, which are achieved by a combination of Sodium Laureth Sulfate, as well as a pleasant sensation on the skin after application, that is, satisfactory sensory properties.

There is also an enormous interest in Sulfobethene, in particular, Cocamideopropyl Sulfobetamine (SARSS) and Laurylsulfobetamine. Among the main advantages of these detergents we should mention their satisfactory dermatological properties, including in relation to the mucous membrane of the eyes (so-called shampoos without tears) and very high thickening abilities, especially in the case of Laurylsulfobetaine. With a minimal difference in cost, Cocamideopropyl Sulfobetamine is the best alternative to traditional Cocamideopropyl betaine in many formulations. Laurylsulfobetamine in its price class is best used in children's products and products for sensitive skin. Laurylsulfo-betaine is a practically colorless, clear liquid, and is therefore ideally suited for transparent products [4,8,19].

Thus, Sulfobetaines and Cocoammonoacetate give manufacturers of foaming agents a wide range of opportunities for the creation of means for both children and dermatological-specific agents.

It should be noted that the requirements for the level of impurities have significantly increased recently, which significantly increase the detergent's irritating effect. For example, the content of Sodium Monochloroacetate (SMAA) is not more than 20 ppm, and free amines and amidoamines - no more than 1%.

Cryptaanone laurylethoxycarboxylates have very high chemical and physical stability, excellent washing ability, create a dense foam, easy to wash, do not irritate the eyes and skin, have good sensory properties, increase the effectiveness of cationic detergents, facilitate the introduction of active gums, is a leveling agent for hair dyeing, have no smell and color. Especially interesting product of Akypo Soft 100 VVS, which is the cheapest of soft detergents among all presented in the market, is offered in liquid form and with very high content of active substance (about 70%). The disadvantage of Akypo Soft 100 VVS is its low thickening ability, comparable to lauryl sulfates, so it is recommended to use it in combination with other highly thickening additional detergents [5,17].

However, the addition of only some detergents in the foaming agent will not allow the manufacturer to create a good product. Because sometimes their mixture will have the appearance of a solution (it has no structural and mechanical properties). In this case, manufacturers add to their composition or non-ionic (eg Glycereth-2 Cocoate, Cocamidopropylamine Oxide, CocoGlucoside (and) Glyceryl Oleate, PEG-4 Rapeseedamide, PEG-7 Glyceryl Cocoate, PEG-150 polyglycerol-2 stearate and Laureate-3) Surfactants, which at the same time can act as viscosity modifiers [2,8,12,19].

The addition of viscosity modifiers implies such characteristics of the future product as the corresponding value of structural viscosity (from 2000-30000 mPc * s), satisfactory extrusion properties and, accordingly, consumer characteristics.

To create a stable foaming agent, manufacturers sometimes use various thickening mechanisms (i.e. surfactant, electrolyte (salt) and polymer), mixed micellar structures (i.e., SLES / CAPB) and the use of non-ionic detergents (alkanolamide derivatives). Sometimes this approach can provide a stable structure of foaming agent and different pH intervals.

Conclusions. The analysis of the nomenclature and characteristics of modern detergents of different nature of origin, namely anionic, amphoteric and nonionogenic, is carried out. It has been established that a wide range of detergents is currently used, which can be used in various applications, for example, from children's foam to shower gels. It is noted that due to the use of detergents with minimal irritant action, it is possible to create a group of sputum funds not only with satisfactory consumer and physicochemical indicators, but also with a limited interval of pH.

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Introduction. Modern detergents are different from those products which satisfied the needs of consumers of the last century (for example, they had a stable foam, a bright color due to synthetic dyes, sometimes rich liquorice smells, etc.). At the present time, the consumer has became more selective when choosing foaming agents of different orientation. Analyzing the entire information space, we noticed that manufacturers develop foam materials on the basis of classical technology, that is, they combine anionic, amphoteric, nonionic detergents, and also add auxiliary substances such as viscosity regulators, corients, pH values, and others. We also noted that the modern manufacturer began to prefer detergents or even their combinations, which in turn would have less irritant activity on the skin and mucous membranes. **Materials and methods**. As materials we used informational and literary sources that highlighted the main characteristics of modern basic and additional detergents. Also, we used conventional methods of research, namely historical, logical, comparative and structural. **Results.** Usually, in formulations of foaming agents, which are represented in the Ukrainian market, mostly detergents of anionic nature, such as sodium laureth sulfate, sodium lauryl sulfate, are presented. The washing properties in them provide a surface-active anion: a negatively charged particle of a molecule. It is the anions that give a massive foam. But since the surface of our skin has a polymozaic charge, the efficacy of cleaning with such a detergent is not the best one. Therefore, lately, modern manufacturers combine either nonionic and amphoteric detergents or combine them with mild anionic substances such as sodium mentresulfate, sodium laurylsarkosinate, magnesium laureth sulfate, and etc. After analyzing literary sources and taking into account the manufacturer's advice, we identified the main "soft" surfactants that are currently used: Magnesium Laureth Sulfate, Sodium Lauroyl Sarcosinate, Sodium Myethyrsulphate, Disodium Lauryl Sulfosuccinate, Disodium Laureth Sulfosuccinate, Disodium Ricinoleamido MEA-Sulfosuccinate, Sodium Laureth-11 Carboxylate, Laureth-7 Citrate. As additional detergents in foaming agents, various amphoteric, nonionic, some anionic and crypt-anionic detergents are commonly used. **Conclusions.** The analysis of the nomenclature and characteristics of modern detergents of different nature of origin, namely anionic, amphoteric and nonionogenic, is carried out. It has been established that a wide range of detergents is currently used, which can be used in various applications, for example, from children's foam to shower gels. It is noted that due to the use of detergents with minimal irritant action, it is possible to create a group of sputum funds not only with satisfactory consumer and physicochemical indicators, but also with a limited interval of pH.

Key words: foaming agent, detergents, additional detergents, anionic, amphoteric, nonionic

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