THE STUDY OF THE FOAMING ABILITY OF SOME SURFACTANTS

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The foaming ability of some surfactants, namely such parameters as the height of the foam column and foam stability, has been studied. It has been found that in solutions with one surfactant there is no specific dependence between the foam height and foam stability. It has been proven experimentally that the active phase of foaming (the height of the foam column) lasts up to 100-150 s. Starting from 150 s the height of the foam decreases, and this process lasts up to 300 s. It has been shown that despite the fact that the surfactants studied form foam in solutions, there is no possibility to select the optimal surfactant. According to the studies conducted it is due to the fact that a stable foam is formed by combining two or more surfactants. The data obtained show that the test solutions are not suitable for use in the drug composition because it is impossible to guarantee the quality of the foam. Therefore, to ensure the quality of foam-forming composition it is rational to continue further studies of the combination of two or more surfactants in solutions.

Natural and synthetic surfactants are an essential component in the foaming compositions. The ability to absorption at the interphase boundary and aggregation in the bulk solution is significant for each surfactant [6, 7]. Adsorbing at interfaces and forming micelles the surfactants contribute to dissolution, emulsification, foaming and some other processes that occur in solutions [4].

Along with the surface activity of the surfactant itself, the foaming ability of a surfactant is characterized by the mechanical strength and viscosity of the films formed [2, 4, 6].

Methods for determining the ability of the foaming ability can be divided into static and dynamic although this division is rather conventional; and taking into account the equipment used in the studies in some cases there is no difference between these methods [5, 6]. Determination by dynamic methods is carried out under continuous mechanical action on the solution to prevent the possibility of running off the foam from it [3, 5]. Under dynamic conditions the volume of the foam measured is determined by the ratio between the rate of its formation and its destruction, and the volume of foam under static conditions is dependent on the speed of bubbles dissolution. The foaming ability of surfactant solutions is the characteristic that must be considered when developing foam formulations. This is due to the fact that formation of a stable foam is a guarantee of quality of the foam formulation.

The aim of this study was to investigate the foaming ability of some surfactants determining such indicators as the height of the foam column and foam stability.

Materials that Methods

The foaming ability of the surfactant solutions was determined on a Ross-Miles device at 50±2°C according to the GOST 22567.1-77 [1].

The objects of the study were such surfactants as sodium lauryl sulfate, emulsifier No.1, OC 20 (macrogol cetostearyl ester), polysorbate 80, sorbitan laurate, sodium docusate, PEG 6 stearate (glycol stearate), sucrose palmitate, PEG 75 stearate (cetyl alcohol and glyceryl stearate), cocamidopropylbetaine, PEG 100 stearate (glyceryl stearate and PEG 100 stearate), glycercyl laurate, distilled monoglycerides, wax emulsion, dodecyl dipropylenetriamine, polysorbate 20, dodecyl-dimethyl ammonium chloride, polyhexamethyleneuguanidine, miramistin.

Test solutions were prepared with the surfactant concentration of 7%.

Results and Discussion

Fig. 1 (A, B, C, D) presents the results of our studies in the form of a graphical dependence of the height of the foam column on time (300 s).

A comparative analysis of the data in Fig. 1 shows that the indicator of the height of the foam column of such surfactants as PEG 6 stearate, PEG 75 stearate, PEG 100 stearate, wax emulsion, emulsifier No.1, distilled monoglycerides, sucrose palmitate and glycercyl laurate is inferior to the height of the foam column of such surfactants as sodium lauryl sulfate, OC 20, polysorbate 80, sorbitan laurate, sodium docusate, cocamidopropylbetaine, dodecyl dipropylene triamine, polysorbate 20, dodecyl-dimethyl ammonium chloride, polyhexamethyleneuguanidine and miramistin. The active phase of foaming (the height of the foam column) lasts up to 100-150 s. Starting from 150 s the height of the foam decreases, and this process lasts up to 300 s.

When developing a drug the indicator of the foam stability is also an important characteristic because, in our opinion, it directly affects the therapeutic activity of the drug. Fig. 2 shows the results of the study of the foam stability of the surfactants mentioned above.
Fig. 1. The foaming ability of surfactants depending on time.
It has been found experimentally that sodium lauryl sulfate, emulsifier No.1, polysorbate 80, sorbitan laurate, PEG 6 stearate, sucrose palmitate, PEG 75 stearate, cocamidopropylbetaine, PEG 100 stearate, glyceryl laurate, distilled monoglycerides, wax emulsion and polyhexamethyleneguanidine form a stable foam. It should be noted that there is no direct relationship between the height of the foam and its stability.

CONCLUSIONS
The data obtained show that despite the fact that the surfactants studied form foam in solutions, there is no possibility to select the optimal surfactant. According to the studies previously conducted a stable foam is formed by combining two or more surfactants; therefore, foam-forming properties of mixtures of hydrophilic and hydrophobic surfactants will be studied in future.

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ИССЛЕДОВАНИЕ ПЕНООБРАЗУЮЩЕЙ СПОСОБНОСТИ НЕКОТОРЫХ ПОВЕРХНОСТНО-АКТИВНЫХ ВЕЩЕСТВ
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Ключевые слова: поверхностно-активные вещества; пенообразующая способность; устойчивость и высота пены

Изучена пенообразующая способность некоторых поверхностно-активных веществ, а именно такие показатели как высота столба пены и устойчивость пены. Установлено, что в растворах с одним поверхностно-активным веществом нет зависимости между высотой пены и ее устойчивостью. Экспериментально доказано, что активная фаза пенообразования (высота столба пены) продолжается до 100-150 с. Начиная с 150 с, высота столба пены уменьшается, а данный процесс длится до 300 с. Показано, что исследуемые поверхностно-активные вещества в растворах хотя и образуют пенную, но выбрать оптимальное поверхностно-активное вещество не представляется возможным. Это связано с тем, что стойкая пена, согласно проведенным исследованиям, образуется при сочетании двух и большее поверхностно-активных веществ. Полученные данные свидетельствуют о том, что исследуемые растворы не пригодны для использования в составе препарата, так как невозможно гарантировать качество пены. Поэтому целесообразно дальнейшее изучение сочетания двух и более поверхностно-активных веществ в растворах для гарантированного качества пенообразующего состава.