Stability of Foams Produced Using Various Surfactants

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Abstract:

In this study, the stability of foams produced by various surfactants was investigated. Chemical (anionic, nonionic, and cationic) surfactants and biosurfactant were used in this study. Of the surfactants investigated, for equivalent weight, Cetyltrimethylammonium bromide (CTAB) had the most stable foam.

Introduction:

Foam is a nonequilibrium dispersion of gas bubbles in a relatively smaller volume of liquid. In general, aqueous foams typically consist of 95 % air and 5 % liquid and remarkably the liquid is 99 % water. The remaining 1 % consists of surfactants and other additives such as alcohols and polymers [1]. Foams are characterized based on number of faces including method of production, structure and liquid content [2]. Foam have a wide spectrum of application in the manufacture of detergents, cosmetics and foods, oil recovery, and a host of physical and chemical separation techniques [3]. Foams are intrinsically stable and tend to become coarse over time. The stability of foams depends upon the size and shape of the bubbles, density, packing type, and hydrophobity of the additives. They can also be used as oxygen/air carriers, and possibly as sorptive phase to bind organic contaminants, and toxic ions.

Objective:

The overall objective of this study was to investigate the stability of foams produced by various surfactants.

Testing program:

The surfactants used in this study were Sodium dodecyl sulfate (SDS, anionic), Triton X-100 (cationic), Cetyltrimethylammonium bromide (CTAB, nonionic) and UH – biosurfactant, produced from used vegetable oil. The foams were produced by hand shaking the 10 g/L of surfactant solution (higher than the CMC of the surfactant) for several minutes. The stability of the foams were monitored by taking digital photographs at various time intervals.

Images of foams:

The digital images (10 times magnification) of the foams produced using various surfactants are shown in Fig.1. The surfactants with different surface tension (28 to 37 dynes/cm) and CMC (0.1 to 2.3 g/L) produced foams with similar appearance. Analyzing the shape of bubbles, it is found that the bubbles formed had polyhedral or hexagonal shapes. With time different surfactants had different collapse mechanism. Analyzing the shape of bubbles, it is found that the bubbles so formed had polyhedral or hexagonal shapes. The foam produced by UH -biosurfactant collapsed in 2 hours completely as seen from the figure. Foam produced using CTAB was the most stable in the 2 hour period investigated (Fig.1).

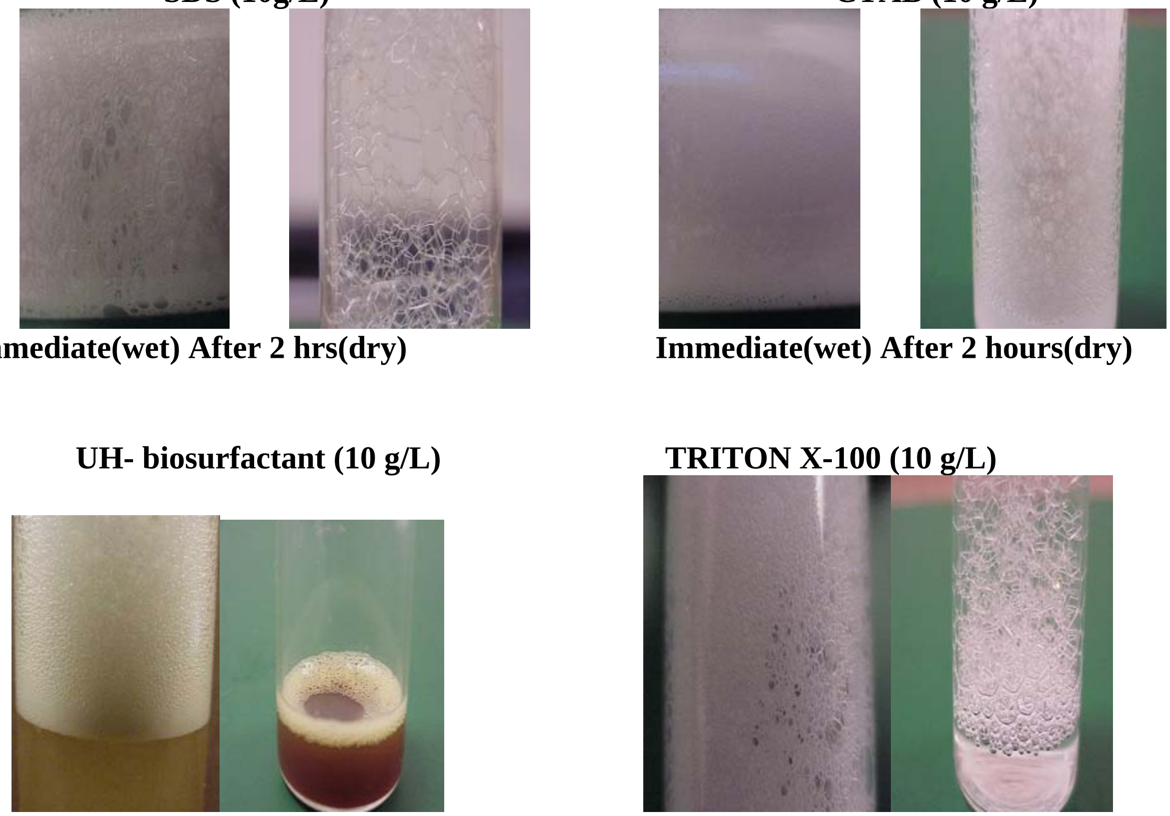

FIG.1. DIGITAL IMAGES OF FOAMS PRODUCED BY SURFACTANTS

Conclusion:

Stability of the foam produced by hand shaking depended on the type of surfactant used. During the 2 hrs of observation, total collapse of bubbles to partial drainage was observed.

Acknowledgement:

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References:

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