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Foam and interfacial properties of Tween 20–bovine serum albumin systems

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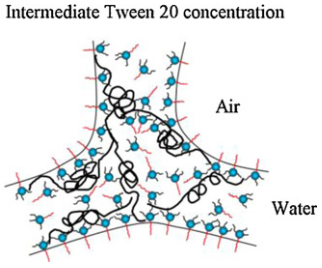
HIGHLIGHTS

- Tween 20–BSA systems have better foamability and foam stability.
- The optimal ratio of Tween 20 to BSA is determined for stable foams.
- Surface elasticity dominates corresponding foam stability.
- Foam stabilization mechanism relies on gel-like networks at air–gas interface.

GRAPHICAL ABSTRACT

The formation of gel-like network at the air–water surface distinctly improves the film stability.



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ABSTRACT

The foam properties of Tween 20 and BSA systems in Tris–HCl buffer solution were investigated by nitrogen-blowing method on a Foamscan. The foamability of Tween 20/BSA systems is obviously better than that of individual BSA system. The foams stabilized by BSA drained slower than Tween 20 systems with or without BSA. The foam stability of Tween 20 systems is enhanced by an addition of BSA. The optimal ratio of Tween 20 to BSA is determined for the most stable foams. Surface dilational rheological results indicate surface elasticity dominates the adsorbed layer and it is increased in the presence of BSA. The variation of surface elasticity accords with that of foam stability with an increase of Tween 20 concentration. It can be concluded surface elasticity dominates the corresponding foam stability.

1. Introduction

Foam is an important disperse system consisting of gas bubbles separated by water channels [1]. Foams are thermodynamically unstable systems because of their large surface area. Controlling the foam formation and stability are significant owing to their many industrial applications [2–4], such as floatation, dust and fire controls, enhanced oil recovery, food processing, personal care products, pharmaceutical formulations, coating, and so on. Foam stability is known to highly relate to the properties of foam films [5]. The character of adsorbed layer strongly influences the stability and physical properties of the resulting foams [6,7]. A great deal of effort has been spent in studying the character of foam films and exploring the certain correlation between interfacial properties and foam stability [8], especially focusing on the interfacial rheology [9]. The existing results indicate that the surface elasticity plays an important role in the foam stability [10], and the surface viscous component has also a stabilizing effect on foam films [11].

Surfactant and protein systems have drawn much attention on the study of interfacial and foam properties. Sorbitan ester ethoxylates (commercially known as Tweens) are common nonionic surfactants which contain short poly(ethylene oxide) chains attached to sorbitol and have a low molecular weight [12]. Tween surfactants are extensively used in the food, cosmetic, pharmaceutical preparations, bioresearch and chemical compounds detection owing to their nontoxicity, easy accessibility, emulsification, solubilization and other advantages [13–15]. Polyoxyethylene (20)

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