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Foamability and Foam Stability of Gelatine-Sodium Dodecyl Sulfate Solutions

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Abstract : Gelatine foams are widely explored materials due to their biodegradability, biocompatibility, and availability. They exhibit outstanding properties and are currently subject to increasing scientific research due to their potential use in different applications, such as biocompatible cellular materials for biomedical products or biofoams as an alternative to fossil-fuel-derived packaging. Gelatine is a highly surface-active polymer, and its concentrated solutions usually do not require surfactants to achieve low surface tension. Still, anionic surfactants like sodium dodecyl sulfate (SDS) strongly interact with gelatine, impacting its viscosity and rheological properties and, in turn, their foaming behaviour. Foaming behaviour is a key parameter for cellular solids produced by mechanical foaming as it has a significant effect on the processing and properties of cellular materials. Foamability mainly impacts the density and the mechanical properties of the foams, while foam stability is crucial to achieving foams with low shrinkage and desirable pore morphology. This work aimed to investigate the influence of SDS on the foaming behaviour of concentrated gelatine foams by using a dynamic foam analyser. The study of maximum foam height created, foam formation behaviour, drainage behaviour, and foam structure with regard to bubble size and distribution were carried out in 10 wt% gelatine solutions prepared at different SDS/gelatine concentration ratios. Comparative rheological and viscometry measurements provided a good correlation with the data from the dynamic foam analyser measurements. SDS incorporation at optimum dosages and gelatine gelation led to highly stable foams at high expansion ratios. The viscosity increase of the hydrogel solution at SDS content increased was a key parameter for foam stabilization. In addition, the impact of SDS content on gelling time and gel strength also considerably impacted the foams' stability and pore structure.

Keywords : dynamic foam analyser, gelatine foams stability and foamability, gelatine-surfactant foams, gelatine-SDS rheology, gelatine-SDS viscosity
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