18c Evolution of Liquid Holdup Profile Due to Syneresis in Protein Stabilized Foams

Zebin Wang and Ganesan Narsimhan

It is important to understand syneresis in a foam in order to describe its stability. In many formulations, gums and other macromolecules are added in order to increase the viscosity of the continuous phase so as to provide the required texture and shelf life to the foam. Since the addition of gums results in Non-Newtonian (power law) behavior of the aqueous medium, existing models of foam drainage for Newtonian fluids are not applicable to such systems. Evolution of liquid holdup profile and foam height in a standing foam formed by whipping and stabilized by beta lactoglobulin in the presence of xanthan gum when subjected to 16g and 29g centrifugal force fields were measured using magnetic resonance imaging. Drainage resulted in the formation of a separate liquid layer at the bottom at longer times. Proposed model for velocity of drainage of a power law fluid in a Plateau border was incorporated in a model for foam drainage to predict the evolution of liquid holdup profiles. Mobility of air-liquid interface was characterized in terms of surface shear viscosity and bulk viscosity. A dimensionless velocity coefficient was defined which is used to convert average velocity in a circular tube to that in the actual Plateau border geometry. It is shown that the dimensionless velocity coefficient depends only on the flow behavior index of a powerlaw fluid and dimensionless inverse surface viscosity. The dimensionless velocity coefficient was solved for different flow behavior index and different dimensionless surface viscosity. These results were then incorporated in the foam drainage model to predict the evolution of liquid holdup profiles. The effects of interfacial mobility, bubble size and rheological parameters on the evolution of liquid holdup profile were demonstrated. The predicted evolution of liquid holdup profiles was compared with the experimental data.