Abstract

Title of Document: **Influence of pH, Protein Concentration and Ionic Strength on the Stability of SBO-Water System using Ovalbumin as Emulsifier**

Charu Oberoi, M.Tech., 2018

Directed By: Dr. Prachi Thareja
Discipline of Chemical Engineering

Emulsions are thermodynamically unstable materials with their extensive application in food and pharmaceutical industries. The present study focuses on understanding the influence of environmental factors pH (2.6, 4.6 and 6) and ionic strength (0.1 M and 0.4 M) of NaCl and $CaCl_2$ on the SBO-water emulsion's stability using Ovalbumin as an emulsifier. To determine the influencing parameter, First and foremost the creaming stability measurements are conducted by evaluating the creaming rate of the emulsions to identify the optimum protein and oil concentration at which no phase separation is observed. Upon knowing the optimum value, The tensiometric experiments are conducted to evaluate the adsorption dynamics of the protein with varying pH and ionic strength at the oil-water interface. After this, the rheological behavior of the cream phase of emulsions is demonstrated, and how the parameters G' and G'' vary with change

in ionic strength, pH and protein concentration is studied. To analyze the microstructure, the arrangement of droplets and network strength, microscopic analyses of the cream phase is performed. The role of bridging and depletion flocculation behind the adsorption and rheological aspect of Ovalbumin is taken into consideration. No phase separation is found at 70 wt% SBO and 0.4-1 wt% OVA emulsions. The creaming rate decreases with increasing oil concentration owing to the closer packing of oil droplets. For a particular oil wt%, ionic strength doesn't make much difference in the creaming rate. At 70 wt% SBO, the creaming rate follows the decreasing trend with increasing protein concentration for pH-induced emulsions. The stability of emulsions is enhanced at pH 6 in comparison to other pHs mentioned at 70wt% SBO owing to depletion stabilization that leads to viscosity enhancement of the continuous phase. The IFT drop is high at pH 6 owing to the conformational changes by adsorbed positive patches of the protein onto the droplet and by addition of $CaCl_2$ due to compact conformation and reduced electrostatic screening. The oil droplets in the cream phase are densely packed as observed through microscopy at 1 wt% OVA due to depletion flocculation. The values of G′ (storage modulus) and G′′ (Loss modulus) enhances with OVA concentration due to smaller droplet sizes as observed from microscopy results. The moduli values are also improved with increasing ionic strength though not appreciably and they are high at pH 2.6 in comparison to pH 6 due to stronger flocs formed via the bridging mechanism. The rheology data contradicts the interfacial analysis in case of pH variation. However both the studies go hand in hand in case of the varying salt concentration.