

Effect of Storage Time and Temperature on the Stability and Rheological Properties of Bambara Groundnut Starch-Soluble Dietary Fibre Nanocomposite Stabilised Emulsion

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Abstract

Emulsions are thermodynamically unstable systems due to different densities between the oil and aqueous phases as well as the unfavourable contact between oil and water molecules. Stabilisers, such as biopolymers, increase the kinetic stability of emulsions by retarding the movement of droplets through the system. The effects of storage time (20 days) and temperature (5, 20 and 45°C) on the rheological and stability properties of Bambara groundnut starch-soluble dietary fibre nanocomposite (STASOL) stabilised emulsions were evaluated. Emulsions were formulated with orange oil (30%), water (50%) and STASOL (20%). Creaming stability evaluated the rate of separation of emulsions while the loss of turbidity was determined in diluted emulsions stored at 20-25°C. The backscattering profile of the emulsions stored at 5 and 45°C showed the least and most separation between scans, respectively. On day 20, the creaming indexes of emulsions stored at 5, 20 and 45°C were 5, 63 and 73%, respectively and the emulsions stored at 45°C had completely separated into two layers. The pH of emulsions stored at 5, 20 and 45°C increased significantly ($p = 0.000$) from 3.47 (Day 1) to 3.68, 3.77 and 4.05, respectively on day 20. The mean droplet sizes increased significantly ($p < 0.05$) from 4.47 μm (Day 1) to 15.11 and 32.36 μm for emulsions stored at 5 and 20°C, respectively, on day 20. At the end of the storage period, no droplets were observed in the micrograph of the emulsion stored at 45°C. The viscosity of emulsions stored at 5°C significantly ($p < 0.05$) decreased after day 9 while that of emulsions stored at 20 and 45°C decreased after day 3. Both temperature and time largely affected the extent of destabilisation, with emulsions stored at 5 and 45°C showing the least and most destabilisation over time, respectively. Therefore, refrigeration storage of STASOL stabilised emulsions is highly recommended.