Rheological Evaluation of Wall Materials and β-Carotene Loaded Microencapsules

Authors : Gargi Ghoshal, Ashay Jain, Deepika Thakur, U. S. Shivhare, O. P. Katare

Abstract : The main objectives of this work were the rheological characterization of dispersions, emulsions at different pH used in the microcapsules preparation and the microcapsules obtain from gum arabic (A), guar gum (G), casein (C) and whey protein isolate (W) to keep β-carotene protected from degradation using the complex coacervation microencapsulation technique (CCM). The evaluation of rheological properties of dispersions, emulsions of different pH and so obtained microencapsules manifest the changes occur in the molecular structure of wall materials during the encapsulation process of β-carotene. These dispersions, emulsions of different pH and formulated microencapsules were subjected to go through various conducted experiments (flow curve test, amplitude sweep, and frequency sweep test) using controlled stress dynamic rheometer. Flow properties were evaluated as a function of apparent viscosity under steady shear rate ranging from 0.1 to 100 s-1. The frequency sweep test was conducted to determine the extent of viscosity and elasticity present in the samples at constant strain under changing angular frequency range from 0.1 to 100 rad/s at 25ºC. The dispersions and emulsion exhibited a shear thinning non-Newtonian behavior whereas microencapsules are considered as shear-thickening respectively. The apparent viscosity for dispersion, emulsions were decreased at low shear rates 20 s-1 and for microencapsules, it decreases up to ~50 s-1 besides these value, it has shown constant pattern. Oscillatory shear experiments showed a predominant viscous liquid behavior up to crossover frequencies of dispersions of C, W, A at 49.47 rad/s, 57.60 rad/s and 21.45 rad/s emulsion sample of AW at pH 5.0 it was 17.85 rad/s and GW microencapsules 61.40 rad/s respectively whereas no such crossover was found in G dispersion, emulsion with C and microencapsules still it showed more viscous behavior. Storage and loss modulus decreases with time also a shift of the crossover towards lower frequencies for A, W and C was observed respectively. However, their microencapsules showed more viscous behavior as compared to samples prior to blending.

Keywords : viscosity, gums, proteins, frequency sweep test, apparent viscosity
Conference Title : ICFBC 2016 : International Conference on Food Contamination and Bioactive Constituents
Conference Location : Tokyo, Japan
Conference Dates : September 05-06, 2016