Soy protein–gum karaya conjugate: emulsifying activity and rheological behavior in aqueous system and oil in water emulsion

ABSTRACT

The main objective of this study is to investigate the effects of mixing and conjugation of soy protein isolate (SPI) with gum karaya on the characteristics of the hybrid polymer (protein–gum) in both aqueous systems and oil-in-water (O/W) emulsions. It was hypothesized that the covalent linkage of gum karaya with SPI would improve the emulsifying activity and rheological properties of both polymers. Conjugation occurred under controlled conditions (i.e., 60 °C and 75 % relative humidity, 3 days). The conjugated hybrid polymer produced smaller droplet with better uniformity, higher viscosity and stronger emulsifying activity than native gum karaya, suggesting the conjugated polymer provided a bulkier secondary layer with more efficient coverage around oil droplets, thereby inducing stronger resistance against droplet aggregation and flocculation. Emulsions containing the native gum karaya produced the largest droplet size among all prepared emulsions ($D_{3,2}$ = 8.6 μm; $D_{4,3}$ = 22.4 μm); while the emulsion containing protein–gum conjugate (1:1 g/g) had the smallest droplet size ($D_{3,2}$ = 0.2 μm; $D_{4,3}$ = 0.7 μm) with lower polydispersity. The protein–gum conjugate (1:1 g/g) also showed the highest elastic and viscous modulus, the lowest polydispersity (span) and the highest emulsifying activity among all native, mixed and conjugated polymers. Therefore, the percentage of gum karaya used for production of O/W emulsion can be decreased by partially replacing it with the conjugated gum.

Keyword: Gum karaya; Soy protein isolate; Conjugation process; Maillard reaction; SDS-PAGE electropherogram; Scanning electron microscopy (SEM)