**Encapsulation of Blackberry Extract by Basil Seed Gum- Whey Protein Concentrate Nanoemulsion**

Samin Sadeghi, Seyed Mohammad Ali Razavi and Maryam Nadi

*Center of Excellence in Native Natural Hydrocolloids of Iran, Ferdowsi University of Mashhad, PO Box: 91775-1163, Mashhad, Iran*

**Abstract**

Blackberries are rich in anthocyanins and polyphenols and have important antioxidant and therapeutic properties, but their use is limited due to their instability under various conditions1. Encapsulating anthocyanins through nanoencapsulation and using biodegradable carriers such as basil seed gum and whey protein can reduce these limitations and help improve their stability and bioavailability2. In this study, an oil-in-water (O/W) nanoemulsion containing basil seed gum (BSG) and whey protein concentrate (WPC) was used to encapsulate phenolic compounds and anthocyanins from blackberry extract. First, blackberry extract was extracted by solvent-ultrasound method and introduced into the emulsion. BSG and WPC solution was formulated in a ratio of 50:50 (w/w) and used as a nanoemulsion coating. To produce nanoemulsions, the emulsions were homogenized at two speeds (8000 and 12000 rpm) and the effect of homogenizer speed was investigated in terms of physicochemical properties such as particle size, zeta potential and PDI (polydispersity index), creaming and encapsulation efficiency. When the homogenization speed increased from 8000 to 12000 rpm, an increase in zeta potential (from -27.12 to -19.14 mV) and in particle size (from 946.08 to 1029.20 nm) were observed. Higher zeta potential creates stronger electrostatic repulsion, which leads to better stability of nanoparticles (less aggregation) and prevents coalescence of emulsion droplets, leading to system stability3. Moreover, increasing the homogenizer speed had reducing effect on the PDI of O/W emulsions (13.84%) that shows a more homogeneous particle size distribution4. The creaming measurement confirmed the stability of the nanoemulsions at 4 oC for 28 days. The encapsulation efficiency of the nanoemulsion produced at 12000 rpm was higher (89%) than that of the nanoemulsion produced at 8000 rpm (80%). High encapsulation efficiency in nanocarriers leads to better efficacy and bioavailability, and also less nanocarrier is required to deliver a given amount of an active ingredient5. Our findings represent that homogenization speed was an effective factor in increasing the encapsulation efficiency and improving the stability of blackberry extract.

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