Emulsifying Properties of a Novel Polysaccharide Extracted from the Seeds Of Basil (*Ocimum basilicum L.*)

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Abstract

The present study investigated the emulsifying properties of a novel polysaccharide extracted from the seeds of Basil (*Ocimum bacilicum*, L.). Emulsifying properties of basil seed gum (BSG) were evaluated in terms of emulsion droplet size distribution (d_{32} and d_{43}), rheological properties (apparent viscosity and viscoelasticity), droplet charge (zeta potential), visual phase separation (at 20^{o}C for 1 month period), and adsorption properties (surface/interfacial tensions). Soya oil-in-water emulsions (30% wt/wt) were formulated and stabilised by BSG containing <1.2% (wt/wt) protein and a major glucomannan fraction. Different BSG concentrations (0.1-1% wt/wt) were tested, as well as the effect of pH (1-12), salt (5-70 mM NaCl), heating (80^{o}C, 30 mins) and purification (removal of proteins from gum) on 0.3% (wt/wt) BSG-stabilised oil-in-water emulsions.

Emulsions with monomodal droplet distributions and with oil droplet size below 1.0 µm (d_{32}) were formed with as little as 0.3% (wt/wt) BSG. The emulsifying properties of BSG were sensitive to changes in pH and salt. Generally, small emulsion droplets were formed at pH above 6.0 and low ionic strength. However, larger droplets were formed and zeta potential values decreased at low pH and high ionic strength. Microstructures confirmed the occurrence of coalescence over time. BSG appeared to exhibit strong hydrophobic character as fluorescing dye (usually for proteins) was detected at the interface, as well as polysaccharide inclusions were trapped within coalescing droplets after homogenisation, suggesting its strong adsorption. Heating and purification reduced the emulsifying properties of BSG. Nevertheless, the emulsions remained stable against phase separation.

The rheological properties of BSG emulsions appeared to be dependent on gum concentration and purification, but independent on pH, salt, and heating, which suggests the resistance of BSG to processing conditions, and thereby it could provide strong emulsion stability. Surface/interfacial tension measurements confirmed the adsorption of BSG at the oil-water interfaces. All gum preparations (crude, purified and protein-free) exhibited an ability to lower the tensions at the interface. However, purification of the gum reduced its adsorption activity, indicating that (i) protein plays an important role in gum adsorption, but it is not an absolute driving force for adsorption and (ii) gum itself becomes altered by the purification process.

BSG (0.17 % wt/wt carbohydrate purity) demonstrated excellent emulsifying and stabilising properties when compared to some other polysaccharides. Protein-free BSG produced larger droplets than crude BSG, but still it produced stable emulsions, comparable to other gums, such as sugar beet pectin. This suggests that the emulsifying and stabilising mechanism of the gum is not only ascribed to the surface-active protein moiety, but could also be attributed to the hydrophobic character of the polysaccharide itself. Overall, BSG is a promising gum, which can be considered as a novel hydrocolloid emulsifier.

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