Octenylsuccinate quinoa starch granule-stabilized pickering emulsion gels: preparation, microstructure and gelling mechanism

ABSTRACT

The development of emulsion gels has attracted increasing interests due to their potential applications as oil structuring templates and release-controlled carriers for sensitive lipid-soluble bioactive compounds. This work aimed to elucidate the importance of changing the degree of substitution (DS, 0.0072–0.0286) and oil volume fraction (Φ, 10–90%) to achieve octenylsuccinate (OS) quinoa starch granule-based Pickering emulsion gels. The gelation process, droplet size distribution, rheological properties and microstructure of Pickering emulsion gels formed at various DS and Φ values were evaluated. Octenylsuccinylation did not change the morphology or the granule size of quinoa starch but significantly increased the contact angle from 36.2° to 68.7°. OS quinoa starch granule-stabilized Pickering emulsion gels were formed at a DS of 0.0286 with Φ values ranging from 50 to 70%. At the Φ value of 70%, increasing DS progressively increased the apparent viscosity (η) and storage modulus (G′) of the emulsions as a result of the adsorption of more OS quinoa starch granules at the oil/water interface. Both η and G′ showed an increasing trend as a function of Φ (50–70%) at a DS value of 0.0286, and this was closely related to the microstructure of the formed emulsion gels. The network of OS quinoa starch-based Pickering emulsion gels at high Φ values (e.g., 60% and 70%) was mainly composed of compact “aggregated” oil droplets, which was largely attributed to the inter-droplet interactions. These results are of great help in understanding the gelling mechanism and the development of starch granule-based Pickering emulsion gels.

Keyword: Emulsion gels; Quinoa starch; Octenylsuccinic anhydride modification; Microstructure; Gelling mechanism