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Pickering emulsifiers based on hydrophobically modified small granular starches- effect of the degree of modification on the emulsification capacity and stability

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A great portion of food, pharmaceutical and cosmetic products are emulsions. Traditional emulsions are stabilized by amphiphilic emulsifiers which act by lowering the interfacial tension, increase the steric hindrances and/or electrostatic repulsion between the droplets. It is possible to used solid particles with partial dual wettability to produce stable emulsions known as Pickering emulsions. The irreversible adsorption and larger size of particles compared to conventional emulsifiers, decrease the risk of coalescence, giving Pickering emulsions higher stability as well as other merits including more robust formulation, reduced foaming problems and lower toxicity.

Recently starch granules have shown to have potential in producing Pickering emulsions. Starch is attractive source since it is natural and abundant. Moreover, using starch granules as emulsifier can result in removal of health and environmental concerns associating with chemically synthesized conventional emulsifiers. The physicochemical properties of starch granules are highly dependent on the botanical origin. Small granular starches have shown to have superior properties when used as emulsifying agents.

Small granular starches from quinoa, amaranth and rice were hydrophobically modified with octenyl succinic anhydride (OSA) in alkaline slurry to different degrees i.e. 0.6, 1.2, 1.8, 2.4, and 3.0%. The native and modified starch granules were used to stabilize emulsions. The physico-chemical properties of these Pickering emulsifiers were characterized by light scattering, light microscopy, scanning electron microscopy, proximate analysis and differential scanning calorimetry. The emulsification capacity was investigated by particle size analysis and the stability was investigated by accelerated environmental stress using centrifugation and Turbiscan.

The results showed that both initial stability and stability towards accelerated stress is directly related to modification degree, granule size, and starch amount. Furthermore it appears that a certain degree of trace protein does not interfere with the OSA modification and has a better emulsification result at lower degrees of modification.