Synthesis of starch nanoparticles from quinoa starch by rapid nanoprecipitation: Characterization and application in Pickering emulsion

Fan Jiang[1], Lei Chang[1], Yangjin Liu[1], Shuang-kui Du[1]

([18]Northwest A & F University, Yangling 712000, China)

Abstract: 【 **Objective** 】 In order to evaluate the effects of morphology and rheology of starch nanoparticles (SNPs) on emulsifying ability and to reveal the stability mechanism of SNPs-based Pickering emulsion, explore the feasibility of using starch as a emulsifier to construct food-grade Pickering emulsion and its application in production of oil containing hydrocolloid-based powders.【**Method**】Quinoa SNPs were prepared by rapid nanoprecipitation method. The molecular characteristics and rheological properties of the SNPs were investigated to reveal the nucleation mechanism of regenerated starch in nanoprecipitation. The effects of SNPs concentration, oil fraction, pH and ionic strength on the storage stability, emulsification stability, oxidation stability and rheological properties of the emulsion were investigated to explore the stabilization mechanism of SNPs-based stabilized Pickering emulsions. The effects of freezing methods and re-hydration on the properties of the emulsions were analyzed.【**Result**】The particle size of SNPs ranged from 190.35 nm to 310.25 nm and ultrasonic pretreatment reduced the particle size. Quinoa SNPs swelled to flocculent and did not completely nucleate after nanoprecipitation. Quinoa SNPs formed a stable network in water, showing great viscoelastic behavior. The quinoa SNPs-based Pickering emulsion was the smallest and most uniform with great stability. The SNPs concentration of 2.0% to 2.5% and oil fraction of 33% to 67% provided the better stability for the emulsions. Compared with corn oil, the larger starch concentration (2.0%-2.5%) and ionic strength (100-200mM) in the emulsions could effectively inhibit oil oxidation and reduce the production of primary and secondary oxidation products. The results of scanning electron microscopy showed that the final structure of the lyophilized powder was compact and uniform, and the surface was smooth.【**Conclusion**】Efficient emulsifiers for stabilizing Pickering emulsions could be selected in accordance with the molecular and rheological properties of starch. Quinoa SNPs suspension with a stable network could be used as an efficient emulsifier for stabilizing Pickering emulsions. Quinoa SNPs stabilized Pickering emulsion was demonstrated the feasibility of the production of oil containing hydrocolloid-based powders.

Acknowledgements：Shaanxi Province Key Research and Development Program Project (No.2021NY-155)
Fan Jiang, E-mail：jiangfan9592@163.com