Impact of emulsification time on the stability of Pickering emulsions stabilized by modified starch nanoparticles

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The use of green techniques to modify native starches by heat moisture treatment (HMT) and by nanoprecipitation are attractive methods in the production of stabilizers for Pickering emulsions, aiming to produce highly stable emulsions and clean label products. The objective of this work was to evaluate the influence of emulsification time (3, 6 and 9 min) and concentration of starch nanoparticles (SNP) (0.8, 2.4, 3 and 4%) in the stability of Pickering emulsions using 20% oil phase. Starch was modified by heat-moisture method (20% moisture content, 140 ºC for 4h) and precipitated with ethanol to obtain nanoparticles. The physical stability of emulsions was investigated by cremation index for up to 14 days. The flow curves of emulsions were obtained with a rotational rheometer (TA Instruments) in the cone-plate configuration, at 25 °C in the range from 0 to 200 s-1. The cremation index showed that emulsions with 4% SNPs, regardless homogenization time and those produced with 3% of SNPs for times greater than 3 min were stable for up to 14 days. Microscopy was also performed to evaluate the behavior of the drops during storage All emulsions produced with lower SNP concentrations (0.8 and 2.4%) destabilized up to the 7th day of storage. The stable emulsions showed shear thinning behavior with R2?0.995 to Power Law model. The pseudoplasticity and consistency index increased as concentration of SNP increased and the homogenization time decreased. Micrographs showed that the emulsions with longer emulsification times (6 and 9 min) and higher concentration (4%) presented more heterogeneous droplets than those that were emulsified for only 3 min and formulated with lower concentrations of SNPs. Therefore, it can be concluded that SNPs produced by HMT and nanoprecipitation successfully stabilized Pickering emulsions against coalescence. These results show the potential of using only physical modifications to obtain nanoparticles that can produce stable emulsions by environmental friendly processes.