Search for a harmonized preparation protocol for stabilizing and maintaining the physical properties of cinnamom essential oil nanoemulsions when incorporated into active coatings.

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Size and uniformity of oil droplets in emulsions are directly related to emulsion stability.Nanoemulsions with droplets smaller than 200 nm have high kinetic stability.This study aims to analyze the effect of homogenization method and sequence of preparation steps on the physical properties of coating forming emulsions/nanoemulsions.Four preparation treatments were tested to produce alginate-based coatings incorporated with cinnamon essential oil (CEO) emulsion/nanoemulsion. Primary emulsions containing water, CEO and Tween 80 (PE), or sodium alginate, Tween 80 and CEO (PEA) were prepared using an Ultra-Turrax IKAT25 at 10.000 rpm for 5 minutes. PE and PEA were then homogenized in ultrasound, generating the nanoemulsions NE and NEA, respectively. Finally, a fifth nanoemulsion (NEAT) was prepared by homogenizing NE with a solution of sodium alginate in the Ultra-Turrax at 10.000 rpm for 5 minutes. The components of all emulsions (alginate, CEO and Tween 80) had a final concentration of 1% (w/w). Mean particle size (Z-Average), polidispersity index (PDI) and Zeta potential values measured for each treatment were: PE: 91.32 ± 1.2 nm, 0.59 ± 0.01, and -11.8 mV ± 0.8; PEA: 214 ± 1.8 nm, 0.67 ± 0.02, and -31 mV ± 1.2;NE: 49.21 ± 0.2 nm 0.252 ± 0.00 ,and -10.7 ± 0.0 mV ;NEA: 205.2 ± 4.6 nm, 0.503 ± 0.11, and -48.7 ± 3.2 mV; NEAT: 107.81 ± 0.6 nm, 0.81 ± 0.01, and -37.2 ± 3.0mV. Primary emulsions (PE and PEA) showed Z-Average and PDI values superior to those obtained by the emulsions produced in ultrasound (NE, NEA and NEAT), proving the superiority of ultrasound in producing smaller droplets with greater uniformity. NE showed the lowest PDI and Z-Average results.Emulsions containing sodium alginate (NEA and NEAT) showed different values ??of PDI and Z-Average, indicating that the preparation method affected the physical characteristics of the oil droplets.These emulsions were more negatively charged, probably due to the presence of sodium alginate.Based on these results, droplets size and distribution may be modulated according to preparation protocol. This is an important issue that should be further investigated to obtain a harmonized protocol and ensure the maximum efficiency of essential oils incorporated into active coatings.