FORMATION OF AN EDIBLE MULTI-LAYER SYSTEM THROUGH LAYER-BY-LAYER DEPOSITION ON β-CAROTENE OIL-IN-WATER NANOEMULSIONS

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An efficient implementation of nanotechnology at the industrial level for food production must consider the development of new tools to improve the performance (e.g. stability, solubility, bioavailability) of functional compounds on a food matrix.

The present work aimed at preparing multi-layer β-carotene nanoemulsions composed of edible materials through layer-by-layer deposition technique (LbL) as potential active ingredients for food formulations.

β-carotene nanoemulsions were prepared by an emulsification-evaporation technique using a high-speed blender. β-carotene was dissolved in n-hexane with Tween 20 dispersed in mili-Q water at a shear rate of 5500 rpm, during 5 min; two homogenization cycles were used. Finally n-hexane was evaporated. In order to improve the stability of β-carotene nanoemulsions, multi-layers were deposited through LbL technique. These multilayers were produced using two polysaccharides with opposite charges, chitosan (Ch) and alginate (Alg), at concentrations of 0.04 % and 0.06 % w/w, respectively. The multi-layers deposited on β-carotene nanoemulsions (NE) were constituted by four polysaccharide layers: NE-Ch-Alg-Ch-Alg.

Z-average diameter of β-carotene nanoemulsions was determined by dynamic light scattering, as well the particle size distributions between layers. The Z-average diameter of the β-carotene nanoemulsions presents a value of 256 ± 19 nm; when layers are deposited that value increases from 297 ± 8 to 421 ± 26 nm. In order to verify the effective deposition of the multilayers the ζ-potential was measured after each layer. The ζ-potential was -21.8 ± 1.3 mV for the nanoemulsions and ranged from +12.5 ± 2.3 to -22 ± 1.0 mV for chitosan and alginate layers, respectively.

The results show that it is possible to prepare multi-layer oil-in-water nanoemulsions through LbL technique using edible materials; this was validated by the characterization of those structures in terms of size, size distribution and surface properties.

This tool should offer the potential to significantly improve the solubility and bioavailability of many functional ingredients.

Keywords: β-carotene; nanoemulsions; multi-layer; Z-average diameter.