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EDITORIAL

NANOENCAPSULATION OF BIOACTIVE INGREDIENTS: TRENDS IN PHARMACEUTICAL INDUSTRY AND FUNCTIONAL FOODS

NANOENCAPSULACIÓN DE INGREDIENTES BIOACTIVOS: TENDENCIAS EN LA INDUSTRIA FARMACÉUTICA Y EN ALIMENTOS FUNCIONALES

Multiple researches have allowed the development of nanoencapsulation techniques that ease the controlled or targeted release of bioactive components and favor their incorporation in different foods and medication formulations to improve their bioavailability (1, 2). Recent studies have facilitated the development of nanoencapsulation systems of different active ingredients for functional foods, comprising phenolic compounds, antioxidants, essential oils, minerals, flavors, fish oils, essential fatty acids, vitamins, antimicrobials, soluble fiber, peptides, lycopene, lutein, β-carotene, phytosterols, iron, calcium, among others (3, 4), as well as bioactive compounds for therapeutic applications as polyphenols, curcumin, quercetin, resveratrol and epigallocatechin-3-gallate (5).

It is considered that a nano sized system is the one constituted by particles with a size lesser than 1000 nm (3), despite some researchers consider that this concept is suitable when the particles size is lesser than 500 nm (6), while others that said concept is appropriate when 50% of the particles have a size lesser than 100 nm (7). Nanoencapsulation technologies use nano-vehicles, named nanocarriers, that facilitate the transportation of bioactive ingredients.

These nanocarriers present the following advantages: a) they improve the bioavailability of active components due to the increase of surface-to-volume ratio; b) they ease the interaction with metabolism and enzyme factors; c) they enhance of solubility of hydrophobic components in the site of action; d) allow the pass through cell walls; f) they favor the muco-adhesiveness of the small intestine and; e) they do not interfere with the appearance of the final product (8, 9).

There is great diversity of nanocarriers in the medium, which can be classified according to their composition or according to the method of obtainment, as follows (3):

1) Nanocarriers based on biopolymer particles obtained from: a) simple systems (protein nanoparticles obtained from desolvation of proteins, as lactoglubin, or polysaccharide nanoparticles obtained from precipitation, as chitosan and cellulose); b) nanogels in which are comprised nanohydrogels, nano-organogels/oleogels and mixtures of gels obtained from chitosan, whey and soy proteins, and alginates; c) complex systems of biopolymer nanoparticles, as nanostructures of polysaccharide-polysaccharide, protein-protein and protein-polysaccharide and; d) nanotubes and nanofibers, which include nanotubes made with α-lactoalbumin and nanofibers made with β-lactoalbumin (10-13).
2) Nanocarriers based on lipids, in which are fats or oils. Examples of these systems are: a) nanoemulsions (O/W or W/O) or double nanoemulsions (O/W/O or W/O/W); b) nanoliposomes prepared from oils, phospholipids and different solvents, suitable to incorporate hydrophilic and hydrophobic ingredients, given the features of their components; and c) the carriers of nanolipids, which are assumed to have better control of size and release process of the bioactive ingredients (6, 14).
3) Nanocarriers obtained through high technology equipment as electro-spinning and electro-spraying, nanofluidic systems and nano spray dryer (15-17).
4) Nanocarriers of natural origin, which are nanovehicles that exist in nature and have been used in encapsulating systems as amylose, casein and cyclodextrin nanostructures (18-20).

5) Other types of nanocarriers comprise: a) nanocrystals (bioactive components with cellulose or starch nanocrystals, or bioactive crystals with other type of nanocarriers); b) nanostructured surfactants (microemulsions, niosomes, cubosomes); c) polymer nanoparticles (dendrimers, poly-capro-lactone (PCA); poly-gamma-glutamic (PGA) or poly-delta-L-lactide (PLA); d) inorganic nanocarriers (gold, silica or magnetic nanoparticles, carbon nanotubes, or quantic point). These types of nanocarriers have been used mostly in the pharmaceutical area (3).

With the arise of nanotechnology, it has been evidenced a range of possibilities related to design, formulation and development of products and medications with an innovator component. The usage of different nanoencapsulation techniques is an opportunity at disposal of foods and pharmaceutical industries to lead their efforts towards goods or medications with added value respect to other products offered in the market, given the improvements that these techniques provide to their features. This is, products with better properties that allow increasing the bioavailability and effectiveness of bioactive ingredients, as well as their sensorial quality.

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