

## EDITORIAL

# MICROENCAPSULATION: A TECHNOLOGICAL ALTERNATIVE TO PRESERVE ACTIVE INGREDIENTS IN FUNCTIONAL FOODS

## MICROENCAPSULACIÓN: UNA ALTERNATIVA TECNOLÓGICA PARA PRESERVAR INGREDIENTES ACTIVOS EN ALIMENTOS FUNCIONALES

In the late 80's started the rise of researches related to the obtainment of food capable of supplying the energetic demand, promoting growth and encompassing better properties and benefits for the human being (1-4). Due to their nutritional and pharmacological features, these foods were called nutraceutical or functional foods as they comprise one or more components, not necessarily nutrients, that promote health, prevent diseases and strengthen the immune system or exhibit medical properties (1, 2). Regardless such researches increase and despite the approval for use and commercialization of these foods, in most countries there is neither a statutory definition nor any specific legislation that governs them (3, 4).

The components responsible of the activity in nutraceutical food are nutrients (vitamins, fatty acids, polysaccharides or peptides, among others), standardized extracts (secondary metabolites as flavonoids, phenols or alkaloids, etc.) with pharmacological activity, obtained from different sources or microorganisms as bacteria that are beneficial to the organism, even if the effectiveness of these functional foods, or their possible undesired effects, is not always well supported (1-4). Moreover, it has been found that some of the possible causes of the activity lost or diminution of such products are a consequence of the sensibility or lability of their components at ambient conditions, of industrial processes (temperature, pressure, oxygen, light, humidity, among others), or of the physiological conditions. Consequently, the usage of protection, preservation, storage and transportation methods for active components is essential so its bioavailability and minimum effective concentration is assured (1-4).

The most used technology for protection, storage and transportation of labile or sensible components is the microencapsulation. This method consists in completely covering or surrounding an active component (solid, liquid or gaseous), that presents physiochemical disadvantages or biological lability, with a protector die, that is resistant and biocompatible, resulting in a particle between 0,2 and 5000  $\mu\text{m}$ , with transportation and release capacity. This technology permits to control the particles morphology, regulate their porosity and texture, which alters the mechanisms and times of release (4-6) and allows the encapsulation of great quantities without affecting excessively the food desired physicochemical properties, such as: consistency texture and color, among others. This technique can also be employed to mask the strong or unpleasant flavor or smell of some active components (5, 6).

The morphology of microparticles depends on the nature of the nucleus, the protector die and the microencapsulation technique involved. The most common morphologies are: a) microcapsules or reservoir systems, wherein the nucleus is covered or surrounded by an external film, and b) microspheres or die type, in which the nucleus is homogeneously fused with the protector wall (5-7). Less common morphologies comprise mononuclears of multiple walls and clusters of microparticles. The current release mechanisms of the capsuled component or nucleus are a combination of different types or systems, as nucleus diffusion through the cover, wall of external film degradation, solvation and pH effects, as well as morphological and medium porosity changes due to temperature and pressure (6-8).

There is a large variety of chemical and physical processes applied for microencapsulation. The first are referred to: a) microemulsions formation (O/W or W/O) in which their stability and the size of the drops

depend on the nature of the organic phase and the surfactant/organic phase relation, although it presents disadvantages as low encapsulation and the use of large quantities of surfactants; b) liposomes incorporation or mono and multilaminar phospholipids vesicles, previously synthesized or in the component's presence that are biodegradable and biocompatible, but the common usage of organic solvents makes necessary the usage of alternative techniques; and c) the coacervation or coverage of disperse particles by a polymeric material, solved in the die, presenting high efficiency and size control of said particle, but it is a highly expensive technique (5-7). Most employed physical processes are: a) spray drying, where a fine spray is formed from the emulsion or dispersion (atomization), which later contacts with a hot gas draft to evaporate the solvent which results on a high efficiency encapsulation and a better stability of the product, even though the parameters optimization may be tiresome, it is crucial to morphology; and b) the extrusion, wherein an active material and wall emulsion pass at high pressure to a pore defined die (7, 8).

Nowadays, researches in nutraceutical foods and microencapsulation of active component fields are directed to demonstrate or maintain their effectiveness and safety, as well as broadening their usage and commercialization in other matrixes and active components.

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## REFERENCES

1. Santini A, Tenore GC, Novellino E. Nutraceuticals: A paradigm of proactive medicine. *Eur J Pharm Sci.* 2017; 96: 53-61.
2. Ye Q, Georges N, Selomulya C. Microencapsulation of active ingredients in functional foods: From research stage to commercial food products. *Trends Food Sci Technol.* 2018; 78: 167-179
3. De Prisco A, Mauriello G. Probiotication of foods: A focus on microencapsulation tool. *Trends Food Sci Technol.* 2016; 48: 27-39.
4. Gonçalves R, Martins JT, Duarte C, Vicente AA, Pinheiro AC. Advances in nutraceutical delivery systems: From formulation design for bioavailability enhancement to efficacy and safety evaluation. *Trends Food Sci Technol.* 2018; 78: 270-291.
5. Akhavan S, Assadpour E, Katouzian I, Jafari SM. Lipid nano scale cargos for the protection and delivery of food bioactive ingredients and nutraceuticals. *Trends Food Sci Technol.* 2018; 74: 132-146.
6. Khorasani S, Danaei M, Mozafari MR. Nanoliposome technology for the food and nutraceutical industries. *Trends Food Sci Technol.* 2018; 79: 106-115.
7. Aguiar J, Estevinho JB, Santos L. Microencapsulation of natural antioxidants for food application & the specific case of coffee antioxidants - A review. *Trends Food Sci Technol.* 2016; 58: 21-39.
8. Parra Huertas RA. Revisión: Microencapsulación de Alimentos. *Rev. Fac. Nac. Agron.* 2010; 63 (2): 5669-5684.