

## Nanostructures for food applications

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There are three primary structures at nanoscale suitable to be used in foods, namely: nanoparticles/nanocapsules, nanolaminates and nanofibres /nanotubes. All these structures can be obtained using food grade biopolymers such as carbohydrates, lipids or proteins. As the consequence of their properties, each structure can be used for different applications. Thus, nanoparticles/nanocapsules are useful for controlled delivery of bioactive and functional compounds or to protect against degradation during processing or storage of labile food components. The main application for nanolaminates is to develop edible coatings for active packaging of fresh and perishable foods. Finally, nanofibres and self-assembling nanotubes can be used for nanoencapsulation but also to modify or create new macroscopic rheological properties. Several examples of these applications will be discussed: On demand and smart delivery of encapsulated antimicrobials on temperature and pH sensitive pNIPAA nanohydrogels will be showed (Fuciños et al., 2015). In the same way, casein nanocapsules are suitable for calcium and iron fortification of biscuits without modification of their organoleptic properties. Nanoemulsions of candelilla wax incorporating a polyphenol extract can be used to obtain an edible nanocoating able to prevent apple spoilage and extend their shelf life (De León-Zapata et al., 2015). Finally, self-assembling nanotubes can be used to encapsulate caffeine and also to modify the rheological properties of  $\beta$ -lactoglobulin solutions (Ramos et al., 2015).

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