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Nanostructured films developed through layer-by-layer assembly of κ-carrageenan-chitosan

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Nanotechnology holds a great potential to generate very innovative solutions and to provide food technologists with instruments to meet the ever-growing consumer demands in very diverse aspects related with the foods they eat: safety, quality, health-promotion and novelty. Layer-by-layer assembly, which is performed by the simple alternating immersion of substrates into aqueous solutions of oppositely charged polyelectrolytes, can be applied to produce multilayers of nanometer thickness on various surfaces. Multilayered coatings can be specially engineered to incorporate and allow the controlled release of bioactive compounds and can be used to coat food systems such as fresh-cut fruits and vegetables.

The aim of the present work was to develop a multilayer coating through layer-by-layer assembly technique using two oppositely charged polysaccharides, κ-carrageenan (zeta potential of -57 mV) and chitosan (zeta potencial=+46 mV), onto aminolyzed/charged polyethylene terephthalate (PET) and to characterize the film in terms of its permeabilities and surface properties. The □-carrageenan/chitosan system was chosen for this study due to their water barrier and antimicrobial properties, respectively.

The adsorption of the polyelectrolytes on PET surfaces was monitored by UV-VIS spectroscopy, quartz crystal microbalance and contact angle measurements and analysed by scanning electron microscopy (SEM). The nanolaminates, composed by three κ-carrageenan and two chitosan layers, has been successfully assembled on PET substrate, as confirmed by the increase of absorbance and the decrease of frequency after each polyelectrolyte deposition, by changes in the contact angle and SEM (nanolayers total thickness of 171.1 nm). The κ-carrageenan/chitosan multilayers exhibits good gas barrier properties and offer great potential to be used to coat food systems.

These results will contribute to the establishment of an approach to produce edible multilayers with improved characteristics to coat e.g. fresh and minimally processed fruits, aiming at a higher benefit for the product/consumer.