HYBRID MEMBRANE CONTAINING CYCLODEXTRIN NANOSPONGES FOR INNOVATIVE SMART PACKAGING

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Food packaging has multiple scopes i.e.: protection, communication, containement etc. but more recently other performances were requires such as to reduce preservatives and increase food safety. Actually active packaging can be intended as an innovative packaging that allows the extention of the shelf life of the products ameliorating or preserving their original qualities. Organic polymers are often the material of choice for these applications. Nevertheless, their properties not always meet the requirement of the industries. More recently, the incorporation of certain components in the packaging films can favour the release or the adsorption of the desired substances from or into the packaged food so prolong the shelf life and sustain the quality, the safety and sensory characteristics of the food.

Cyclodextrins [1] are cyclic oligosaccharides produced by enzymatic degradation of starch and are formed by 6,7 or 8 glucose units linked by 1 → α4 glucosidic bonds and are namend α,β and γ cyclodextrin, respectively. The structure of cyclodextrins resemble a truncated cone a have the peculiarity to position They are able to form stable inclusion compounds with a large set of organic molecules and present high interest as agent to retain or release various substances including odor, bitter compounds, cholesterol, aromas, colors etc. They were already used in the field of food packaging. For instance, β-cyclodextrin was entrapped ethylene-vinyl alcohol copolymers to increase the permeability of water vapour, oxygen and carbon dioxide [2], to include essential oil and to improve antimicrobial properties of the films [3], to include ethylene in α-cyclodextrin and to modulate the ripening of fruits [4] etc.

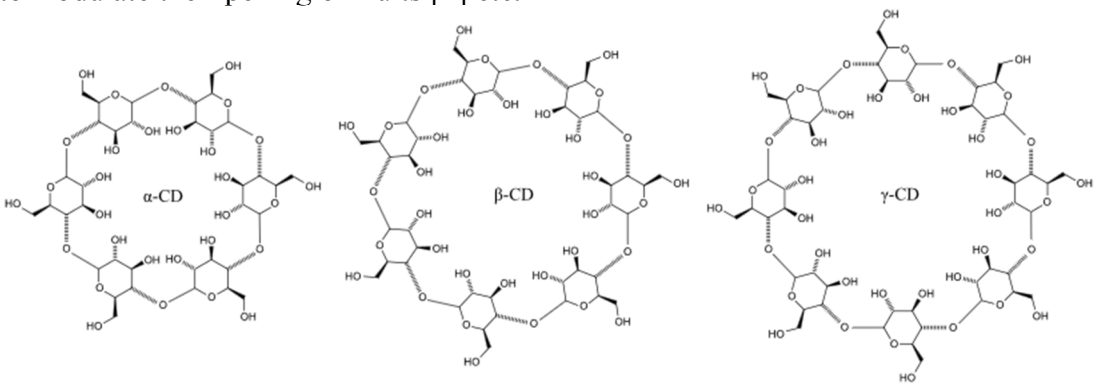

Figure 1. Molecular structure of natural cyclodextrins

In the last decade it was reported by several authors the uses of cyclodextrin nanosponges [5] as superior nano-container able to encapsulate a great deals of organic molecules in order to obtain a prolonged and controlled release in the environment or, on the contrary, to remove them from the environment. They were demonstrated effective drug delivery systems and several other application comprising the ability to easily form hybrid membrane greatly influencing the permeability towards water and gases. In this work, we have used dextrins or β-cyclodextrin nanosponges to form hybrid membranes of PEEK-WC and PVDF by means of phase inversion technique and evaluated their performances towards the permeability of water, oxygen.

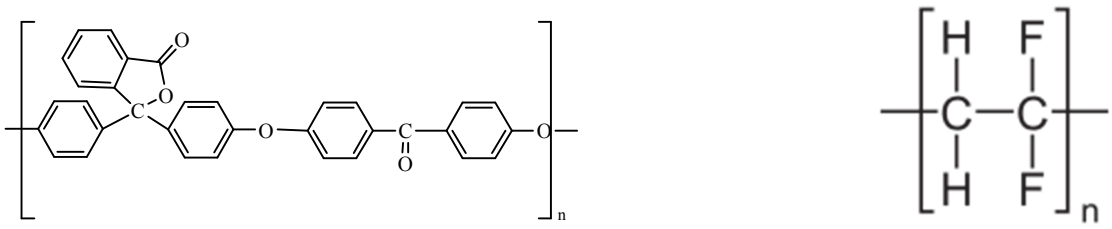

Figure 2. Molecular structure of PEEK-WC (left) and PVDF (right) polymers

In addition some membranes containing flavours encapsulated in nanosponges were prepared. Beside the good performances observed, it should be pointed out that nanosponges are insoluble in water and all organic solvents and being nanosized particles they do not migrate out the film avoiding the contamination of the products.

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