Electrohydrodynamic encapsulation of curcumin-cyclodextrin inclusion complexes in chitosan/pectin nanofibrous webs

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There is a growing concern in both the pharmaceutical and food industries for developing encapsulation technologies from renewable sources with the intention of packaging, protection, carrying, and delivery of active compounds. Biopolymers have been concerned as an alternative for fossil fuel-based products owing to their non-toxic, sustainable, biodegradable, and biocompatible properties. Chitosan and pectin are attractive types of polysaccharides that can be industrially produced and have received great attention from the food, pharmaceutical, and cosmetic areas. The electrohydrodynamic atomization method of electrospinning is a rather feasible, flexible, and cost-effective tool to fabricate an encapsulation matrix for various active compounds accompanied by many functional and structural advantages. The major features that make electrospinning attractive are the large surface area, 3D continuous structure, and high porosity of ultimate electrospun nanofibers. Cyclodextrin (CD) is a type of cyclic oligosaccharides having truncated molecular structures and capable of forming inclusion complexes with a variety of compounds that leads to enhanced water solubility/stability and different release profiles for various active compounds. In our study, we have fabricated a curcumin-CD inclusion complex incorporated chitosan/pectin nanofibrous webs using the electrospinning technique. The incorporation of inclusion complex structure has made it possible to generate nanofibrous webs from chitosan and pectin polymers which are normally not possible without using an additional spinnable polymer into the electrospinning solutions. Due to inclusion complexation, the amorphous distribution of curcumin crystals has been provided within the nanofibrous webs which provides an enhanced release profile in an aqueous medium for the insoluble molecule of curcumin. Here, the ultimate nanofibrous webs of chitosan/pectin/curcumin-CD have been thermally crosslinked to obtain stable nanofibrous webs in the liquid environment. The structural characteristics and the stimuli-responsive release profiles of webs have been evaluated in the context of the study.

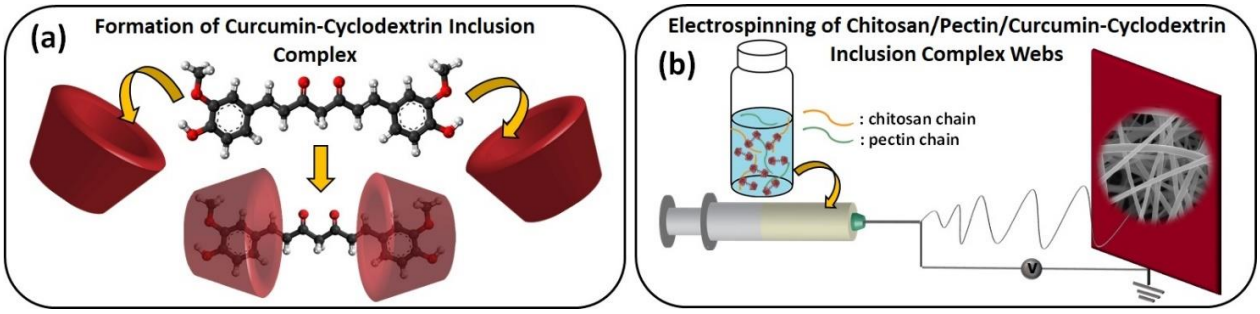

Figure 1. Schematic view of **(a)** the curcumin-cyclodextrin inclusion complex formation and **(b)** the electrospinning of chitosan/pectin/curcumin-cyclodextrin inclusion complex nanofibrous webs.