Structure and mechanical properties of castor oil hybrid Films

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Castor oil has been used as a matrix material to synthesize bio-based films with promising applications in pharmaceutics. Properties of vegetable oils such as biocompatibility, biodegradability and cost-effectiveness make them very good candidates for the production of new bio-friendly films that can replace conventional medical devices in pharmaceutics. Such medical devices include dressings [1] aiming in wound healing and transdermal drug delivery systems [2]. The novelty of the present castor oil hybrid inorganic-organic films was based on their environmentally friendly chemical synthesis that is based on sol-gel reaction preventing the use of organic solvent and curing. The synthesis procedure included, the functionalization of castor oil with an inorganic precursor (isocyanatopropyltriethoxysilane/IPTES) and afterwards the spreading of the functionalized oil onto a water surface (Fig.1A). The whole system was sealed and the control of the humidity during the evaporation of the water induces the cross-linking reaction via hydrolysis and condensation procedure (sol-gel reaction). After one 1 day we observed the formation of solid-like films, transparent with a micrometric thickness and characterized by a steady value of the elastic modulus (Fig.1B). The goal of this work was to characterize the physical properties of castor oil hybrid films and to highlight their pharmaceutical potential. More specifically, our approach aimed to investigate the kinetics of the castor oil cross-linking by means of rheology and Wide angle X-Ray Scattering. The structural and viscoelastic studies of the final state films revealed their solid-like nature. In addition to that, we performed complementary experiments to study their mechanical properties by nanoindentation technique allowing us to measure their Young modulus. Finally, their capacity to entrap model drugs was evaluated as well as their stability in physiological media. Their interaction with cellular elements such as fibroblasts was assessed to confirm their biocompatibility.

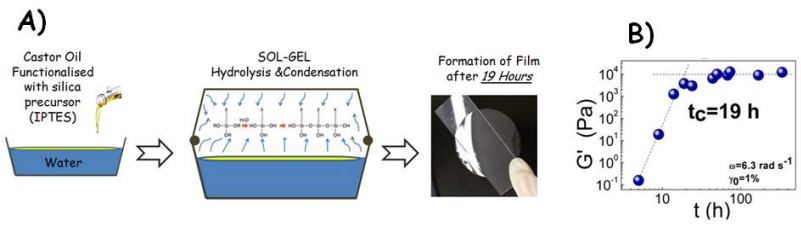

Figure 1 A) Schematic representation of the formation process of the castor oil hybrid films. B) The time evolution of the elastic modulus (G') of the film.

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