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Advanced hydrogel films of alginate/carbon nanofibers for biomedical applications

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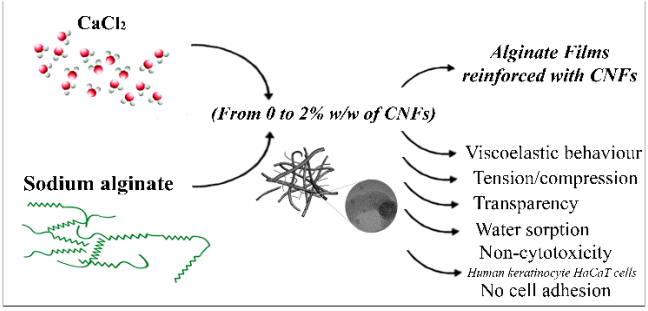
Graphical Abstract



Abstract

Alginates are outstanding biomaterials due to their excellent biocompatibility, renewability, biodegradability and cost-effectiveness in comparison with other biopolymers. Nevertheless, in general, these hydrogels have poor mechanical performance that limit their potential applications in biomedical areas such as skin tissue engineering and wound healing. In this regard, the study follows an enhanced engineering route to synthesized alginate-based films reinforced with different amounts (0, 0.1, 0.5, 1 and 2% w/w) of carbon nanofibers (CNFs) and characterize their physical and biological behavior. The results of this study showed that these composite materials possess similar biological properties to neat alginate hydrogels. Thus, none of the synthesized composite materials showed any cytotoxic effect and no cell adhesion was observed on the films. Water sorption at the human temperature (about 37°C) did not suffer substantial changes with the addition of CNFs into the polymer matrix. The dynamic mechanical and tensile/compressive performance of calcium alginate were significantly enhanced with the incorporation of even a very low amount of CNFs. Thus, the tensile and compression modulus of the calcium alginate films in the dry and hydrated state increases up to three and six times, respectively, with the load of 2% w/w CNFs. Furthermore, the composite biomaterials reinforced with the lowest CNFs amount have the advantage of possessing more transparency and lower production costs. (Read complete study in detail in reference [14])

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