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Semiconductor gellan gum based composite hydrogels for tissue engineering applications

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Semiconductor hydrogels can be developed by combining the intrinsic electrical properties of semiconductors with the specific characteristics of hydrogels. These hydrogels have recently attracted much attention for applications in tissue engineering, especially formulations incorporating pyrrole and excellent biocompatibility. Several studies have reported that electrical stimulation influences the migration, proliferation and differentiation of stem cells and other cell lines [1]. The goal of this work is to use *in situ* chemical polymerization of polypyrrole (PPy) with gellan gum (GG) in order to obtain a new generation of semiconductor composite hydrogels. For the synthesis of GG/PPy composites, GG at 1.25% (w/v) final concentration was prepared in distilled water at room temperature. The solution was then heated under stirring at 90°C for 20 min. Temperature was decreased to 65°C and Py was added under vigorous agitation. The crosslinker solution ($CaCl_2$, 0.18%) was added at 50°C. After 2 h, GG/Py composite hydrogels were obtained. In a further step, GG/Py samples were immersed in a solution of oxidizing agent in PBS and the reaction was carried out for 18 h under agitation at room temperature. Finally, the samples were frozen at -80°C for 48 h and lyophilized. The characterization of GG, GG/PPy and PPy samples was performed by scanning electron microscopy (SEM). The incorporation of PPy in the gellan gum was confirmed by SEM analysis. The coating with PPy increases the thickness of each sheet in 3 fold when compared with GG samples. Conductivity tests were also performed. For cytotoxicity assay, the samples were rehydrated with complete culture medium. MTS and DNA quantification assays were performed to evaluate the metabolic activity and proliferation of L929 fibroblast cells after 1, 3 and 7 days in culture with GG, GG/PPy and PPy samples. MTS assays clearly indicate a proportional relation between the cell viability and the PPy concentration: higher concentrations of PPy resulted in lower cell viability. These results show that lower concentration of PPy incorporated in the GG hydrogels can provide an adequate electrical stimulus to improve cell behavior. In conclusion, semiconductor hydrogels can be an excellent platform for tissue engineering and electrochemical therapy applications.

References:

1. McCaig, C.D., et al., *Controlling cell behavior electrically: Current views and future potential.* Physiological Reviews, 2005. 85(3): p. 943-978.

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