ELECTROFABRICATION AND CHARACTERIZATION OF MULTIFUNCTIONAL, ASYMMETRIC BILAYER FILMS BASED ON CHITOSAN-GELATIN-MESOPOROUS BIOACTIVE GLASS NANOPARTICLES FOR GUIDED BONE REGENERATION

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Guided bone regeneration is a common approach to tackle periodontal bone defects. Bilayer films having a compact barrier layer and porous osteogenic layer for better tissue regeneration is a common approach to deal with this issue. In this work asymmetric bilayer films were fabricated, that were composed of a dense chitosan-mesoporous bioactive glass nanoparticle (MBGNs) layer with and without the phytotherapeutic agent naringin. Two different types of the porous layer were fabricated, 1) chitosan and gelatin with MBGNs, 2) copper (Cu^{2+}) chitosan complex and gelatin with MBGNs. These films were produced by electrophoretic deposition (EPD). EPD was done on stainless steel 316 L substrate with the interelectrode distance of 1 cm. The deposition was done by using a constant current of 3 mA/cm². Primarily, EPD was conducted for 15 min to deposit a dense layer. After that, the suspension was changed and EPD was carried out again for 15 min to deposit the porous layer. For the dense layer, chitosan (1% w/v) were dissolved in HCL solution having pH 4.5 at 40°C and after that 0.2 % (w/v) MBGNs were dispersed in the solution. On the other hand, chitosan and gelatin (1% w/v), MBGNs 0.05 % (w/v) and 2.5 mM di-sodium hydrogen phosphate were dissolved in HCL solution having pH 4.5 at 40°C for the porous layer fabrication. After successful fabrication, bilayer films were removed from the substrate and characterized by using different physicochemical techniques. The morphology of the dense and porous layers was evaluated by using scanning electron microscopy (SEM) and it was also observed that MBGNs were uniformly distributed on the surface as well as embedded within the chitosan matrix. Additionally, the presence of chitosan, gelatin and MBGNs was confirmed by Fourier transform infrared spectroscopy (FTIR). The films exhibited a high swelling behavior. Furthermore, degradation studies revealed a controlled degradation rate. *In vitro* bioactivity was also carried out and it was observed that films exhibited hydroxy carbonated apatite formation after seven days. The release behavior of naringin was also analyzed by using UV-visible spectroscopy. The release behavior showed an initial burst release followed by a subsequent sustain release. Finally, cell studies of the films were conducted by using a human osteoblast-like MG-63 cell line and found that all films exhibited cytocompatibility. These results suggest the potential of EPD for the fabrication of free-standing films that can be used for different biomedical applications.