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Development of pva/chitosan films: structural, thermal, morphological and cytotoxic properties aiming biomedical applications

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Polymer blends are an excellent strategy to overcome the limitations of some polymers and improve their properties in order to expand the field of their applications. Poly(vinyl alcohol) (PVA) is a non-toxic and water-soluble polymer with excellent ability to form transparent films, however its hydrophilic nature restrain its applications. Chitosan (CS) is the second most abundant biopolymer, which exhibits poor solubility in water, high biocompatibility and excellent antimicrobial activity. Blends of PVA/CS are a promisor and multifunctional material since they can be insoluble in water, biocompatible, biodegradable and still have antimicrobial activity. In the present study, PVA/CS blends at different compositions (100/0, 99/01, 95/05, 90/10, 85/15, 80/20 and 0/100) were prepared on the film form by casting method. ATR/FTIR spectra were obtained for PVA/CS films, which exhibit characteristic bands of both polymers. XRD diffractograms obtained from PVA/CS films exhibited a more intense peak at 19.6° corresponding to the (101) crystalline plane of PVA and a halo at 40.0° pertaining to the (111) crystallographic plane, demonstrating that PVA has a semi-crystalline structure. PVA/CS blends showed larger diffraction peaks with deviations for greater and lesser angles, indicating that the crystallinity of PVA was slightly affected by the presence of CS in the blend. TG curves obtained for PVA/CS blends reveal that the thermal degradation of PVA film occurs in three steps due to water evaporation and polymer chain thermal degradation. DSC curves of PVA/CS films showed that 99/01, 95/05 and 90/10 are similar to PVA behaviour, as was also observed in TG curves. However, all the blends presented changes in melting temperature (T_m) compared to pure PVA. For higher contents of CS (85/15 and 80/20), the DSC thermogram profile is a mix of PVA and CS profiles; meantime, the T_m was only shifted to a higher temperature, more similar to the CS T_m . SEM micrographs showed that the surface of the film exhibits uniform morphology without defects characteristic of an apparent phase segregation. Contact angle measurement revealed a tendency to decrease in contact angle with the insertion of CS in the PVA matrix. The cell viability for fibroblast cells in contact with PVA/CS films shows that no PVA/CS blend was non-cytotoxic and in some composition blend the cell viability was greater than to the control. These results indicate that our PVA/CS films are suitable scaffolds to be used in tissue engineering.