

Influence of cosolvents and in situ forming hydroxyapatite on the mechanical characteristics of collagen films

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Abstract

Collagen was processed into films in mixtures containing various ratios of water, propylene glycol, and ethanol. An experimental mixture design was applied to characterize the effects of individual solvents and their interactions on the mechanical properties of collagen films. Scanning electron microscopy (SEM) was used to examine the surface properties of collagen films. The ultimate tensile strength (UTS) and related characteristics of collagen films were also evaluated with dynamic mechanical analysis. The effect of in situ forming hydroxyapatite (HAP) within collagen films at a concentration of 10 mM on the physical characteristics of these films was evaluated by the same methods. With X-ray and SEM examinations, it was confirmed that HAP was formed inside the collagen film. However, the UTS of collagen films without HAP was 4-5 times higher than that with HAP. This was probably due to the discontinuity of the film structure caused by HAP in the collagen films. The results of a statistical analysis of the experimental design revealed the influence of the solvent mixtures on the mechanical properties of the collagen films with and without HAP, showing similar responses for the UTS and modulus of elasticity. Both parameters showed a maximal response in the solvent range containing a lower percentage of ethanol with the desired percentage of propylene glycol to plasticize the collagen films.