Gelatin-hydroxyapatite hybrid hydrogels as composite scaffolds for bone tissue engineering applications

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Nowadays, demands for artificial biomimetic materials in medical field are becoming more frequent. Researchers have evaluated various biomaterials to mimic the specifically organized nanoscale structure of the bone. Among those, composite materials of hydroxyapatite crystals and natural polymers (collagen and gelatin) have received a great deal of attention [1-4].

In this work, the design and the preparation of a gelatin-hydroxyapatite (Gel-HAp) hybrid hydrogel, as a macroporous scaffold for hard tissue engineering applications, is reported. Microbial transglutaminase (mTGase) has been used to form biocompatible and thermally stable hydrogels from gelatin. An experimental design was carried out to explore the effects of gelatin and transglutaminase concentrations on hydrogel properties. Subsequently, hydroxyapatite (HAp) powder was synthesized by a sol-gel technique. Microstructure of the calcined hydroxyapatite was examined by means of scanning electron microscopy (SEM), and the material was characterized by X-ray diffraction and Fourier transformed infrared spectroscopy (FTIR) before incorporating it on cross-linked gelatin hydrogels. Rheological, morphological and physicochemical properties of the Gel-HAp composite hydrogels were examined, as well as their absorption equilibrium values, in order to evaluate the effects of HAp incorporation.

The results revealed that both elastic modulus and absorption ratio depend on gelatin and enzyme concentrations. The incorporation of HAp into gelatin hydrogels induced an increase of their elastic modulus. Thereby, these findings suggested that the synthesized composite materials might be potentially useful in hard tissue regeneration and tissue engineering fields.

References

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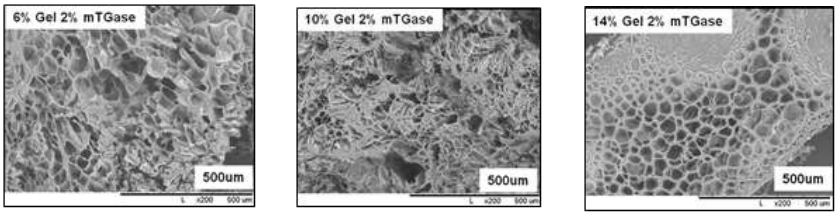

Figure 1: SEM morphologies of gelatin-HAp composite foam at different gelatin concentrations.