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Synthesis and Characterization of Reinforced Chitosan Hydrogels for Bone Tissue Regeneration

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Synthesis and Characterization of Reinforced Chitosan Hydrogels for Bone Tissue Regeneration*

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Abstract

Chitosan is the second most abundant natural polymer; it is biodegradable, biocompatible and bioactive. Even though chitosan has been used in various biomedical studies due these characteristics, its mechanical properties are the subject of investigations, as they still need to be improved. Therefore, a hydrogel prepared from composites of chitosan, polycaprolactone and nanodiamonds may offer enhanced mechanical properties compared to pure chitosan. We hypothesize that the mechanical properties of the hydrogel composites will be superior to the unaltered chitosan, while preserving the advantages of the material. The solutions were prepared using chitosan 1.5 wt%, PCL 5 wt% and nanodiamonds 0.016% suspended solutions. Triton X-100 was used as an emulsifier. The solutions were left in the -20 °C overnight prior lyophilization. The microemulsion technique was used in order to fabricate a porous hydrogel. Further analysis will be made, to characterize the hydrogels. Preliminary results suggest the successful formation of an aerogel based on their physical appearance. Additional studies are needed to fully understand the desired properties of the composite.

KEYWORDS: Chitosan; Hydrogels; PCL; Nanodiamonds; Bone Regeneration

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Chitosan is the second most abundant natural polymer; it is biodegradable, biocompatible and bioactive. Even though chitosan has been used in various biomedical studies due these characteristics, its mechanical properties are the subject of investigations, as they still need to be improved. Therefore, a hydrogel prepared from composites of chitosan, polycaprolactone and nanodiamonds may offer enhanced mechanical properties compared to pure chitosan. We hypothesize that the mechanical properties of the hydrogel composites will be superior to the unaltered chitosan, while preserving the advantages of the material. The solutions were prepared using chitosan 1.5 wt%, PCL 5 wt% and nanodiamonds 0.016% suspended solutions. Triton X-100 was used as an emulsifier. The solutions were left in the -20 °C overnight prior lyophilization. The microemulsion technique was used in order to fabricate a porous hydrogel. Further analysis will be made, to characterize the hydrogels. Preliminary results suggest the successful formation of an aerogel based on their physical appearance. Additional studies are needed to fully understand the desired properties of the composite.

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