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Fabrication of Drug-Loaded Halloysite Nanotubes Containing Sodium Alginate/Gelatin Composite Scaffolds

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Abstract : Bone defects are mentioned as one of the most challenging clinical conditions, affecting millions of people each year. A fracture, osteoporosis, tumor, or infection usually causes these defects. At present, autologous and allogeneic grafts are used to correct bone defects, but these grafts have some difficulties, such as limited access, infection, disease transmission, and immune rejection. Bone tissue engineering is considered a new strategy for repairing bone defects. However, problems with scaffolds' design with unique structures limit their clinical applications. In addition, numerous in-vitro studies have been performed on the behavior of bone cells in two-dimensional environments. Still, cells grow in physiological situations in the human body in a three-dimensional environment. As a result, the controlled design of porous structures with high structural complexity and providing the necessary flexibility to meet specific needs in bone tissue repair is beneficial. For this purpose, a three-dimensional composite scaffold based on gelatin and sodium alginate hydrogels is used in this research. In addition, the antibacterial drug-loaded halloysite nanotubes were introduced into the hydrogel scaffold structure to provide a suitable substrate for controlled drug release. The presence of halloysite nanotubes improved hydrogel's properties, while the drug eliminated infection and disease transmission. Finally, it can be acknowledged that the composite scaffold prepared in this study for bone tissue engineering seems promising.

Keywords : halloysite nanotubes, bone tissue engineering, composite scaffold, controlled drug release
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