Abstract

Development of cellulose based bionanocomposites scaffold by using zirconia and magnetite nanoparticles for bone tissue engineering

Bone defects due to various diseases such as osteoporosis, congenital malformations, traffic accident, trauma, fracture nonunion, and bone cancer are the biggest challenge for the clinical sector. So, to solve this problem many researchers have been using scaffold made by polymer, ceramic or metallic. But by using a single material it is very difficult to achieve the required properties for the bone tissue engineering. So, in this project the main objective is an attempt to develop a scaffold with a appropriate pore size, and very good thermal, mechanical, and biocompatibility properties for the tissue regeneration. Solvent casting and particulate leaching method have been used to synthesize a scaffold by using cellulose as a polymer matrix, and zirconia & magnetite nanoparticles. The main function of the cellulose matrix is to achieve biocompatibility property in the scaffold while zirconia and magnetite helps to increase mechanical strength and tissue regeneration property of the scaffold. Various characterizations were performed to ensure the properties and characteristics of the scaffolds. SEM analysis ensures the pore size, shape, and their interconnectivity to transport the minerals and nutrients. EDS analysis confirms the presence of zirconia and magnetite nanoparticles in the scaffold and it did not get leach out. TGA analysis informed about the thermal stability of the composite scaffold. Compression testing measures the young's modulus of the scaffold. From these analyses it was observed that the nanoparticles are contributed to improve the thermal and mechanical properties of the scaffold. Cells MC3T3 and L929 are seeded on the scaffold and the attachment of these cells on the scaffold were observed to investigate the biocompatibility property of the scaffold and the effect of nanoparticles on the cell the cells attachment was also reported.

Keywords: Tissue engineering, scaffold, biocompatibility, nanoparticles, bionanocomposites.