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The Strength characteristics of Chitosan- and Titanium- Poly (L-lactic) Acid Based Composites

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Abstract

The problem of bone fracture and the need to avoid revision surgery in osteosynthesis are the critical reasons for the gradual shift from the use of metallic fixations to the polymeric scaffold in the orthopaedic applications. However, the mechanical properties of polymers that have become a substitute for metals need to be improved upon. An attempt was made to improve the mechanical properties of poly(L-lactic) acid (PLLA), a biopolymer, by loading it with 1.04, 2.08, 4.17, 8.33 and 16.67 wt.% of chitosan (an organic filler) and Ti-6Al-2Sn-2Mo-2Cr-0.25Si (an inorganic particle). Melt blend technique was the processing technique. Hardness, compressive modulus and fracture toughness of virgin PLLA improved significantly while the resulting composites were found to be less ductile than unreinforced PLLA. Titanium reinforced PLLA displayed superior mechanical properties over the neat and chitin reinforced PLLA. Compressive modulus values of the developed composites were much lower than the modulus of cortical bone, they were, however, mechanically compatible with the properties of cancellous bone. Optical microscopy images also show the formation of pores which are a catalyst for cell proliferation and cell differentiation.

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