



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

Name of the Student : **Arbind Prasad**

Roll Number : **136103034**

Programme of Study : **Ph.D.**

Thesis Title: Development and Characterization of nano-Hydroxyapatite based Bioabsorbable Polymeric Internal Fixation Devices

Name of Thesis Supervisor(s) : **Dr. M. Ravi Sankar and Prof. Vimal Katiyar**

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Traditional metallic internal fixation devices (IFDs) have many limitations. To overcome the limitations, bioabsorbable polymer PLA was melt mixed with lab synthesized nano Hydroxyapatite powders (nHAp) through twin screw extruder cum injection molding process. The widely used IFDs such as cortical screw, cancellous screw, bone plate, steinmann pins and staples has been fabricated with PLA and nHAp in various combinations. The developed bioabsorbable IFDs has been mechanically tested as per ISO/ASTM standards. The biocompatibility test conducted in simulated body fluid confirms about biocompatibility of the composites. The rate of degradation was conducted as per ASTM standards and observed 30%-40% reduction in mass after 90 days. Parametric optimization of process parameters of extrusion cum injection molding process of all IFDs were successfully done and optimized. It was observed that in cortical screws, axial pull out strength of 10 % nHAp gives 38% increment, 30% torsional strength, 12% double shear strength enhancement. In cancellous screws, axial pull out strength of 10% nHAp gives 39%, 48% torsional strength, 8% double shear strength enhancement. In case of bone plates, 19% torsional strength (5% nHAp), 3% Single plate pull out test (3% nHAp) and double plate pull out test (7% nHAp) enhancement was observed. In case of Steinmann pins, 11% double shear strength (10% nHAp) enhancement was observed. While in case of bone staples, torsional strength of 3% nHAp gives 5% increment. Thus it gives a path breaking approach to manufacture cost effective bioabsorbable internal fixation devices so that output of this research reach to every needy persons.