Mechanics of composite scaffolds for bone tissue engineering

Devendra Verma, Kalpana Katti*, Dinesh Katti, Bedabibhas Mohanty

Department of Civil Engineering
North Dakota State University
Fargo, ND 58105, USA

* contact: Kalpana.Katti@Ndsu.Edu

ABSTRACT

Tissue engineering: an interdisciplinary field that combines cells, engineering materials and suitable growth factors to develop biological substitutes, has tremendous potential for bone regenration. From the materials point of view, mechanical behavior, biocompatibility, and bioactivity are the three important properties of the scaffold materials. The ability of scaffolds to attach and promote cell growth, controlled resorption while maintaining adequate mechanical strength is the big challenge. Specifically for bone tissue engineering, low mechanical strength of scaffolds has been the biggest challenge. Various biodegradable polymers poly(lactic acid), poly(glycolic acid) and poly(caprolactone) have been extensively studied for scaffold application. Scaffolds made from composites of these polymers with hydroxyapatite (natural bone mineral), tricalcium phosphate and bioactive glass have also been explored. We have investigated blends of a biological macromolecule, chitosan, and polygalacturonic acid for their applicability for tissue engineering. Fourier transform infrared spectroscopy has been performed to study the interaction between these biopolymers. Optical microscope image indicate that chitosan and polygalacturonic acid form fiber-like structure. Nanomechanical properties of such composite scaffold have shown significant improvement.