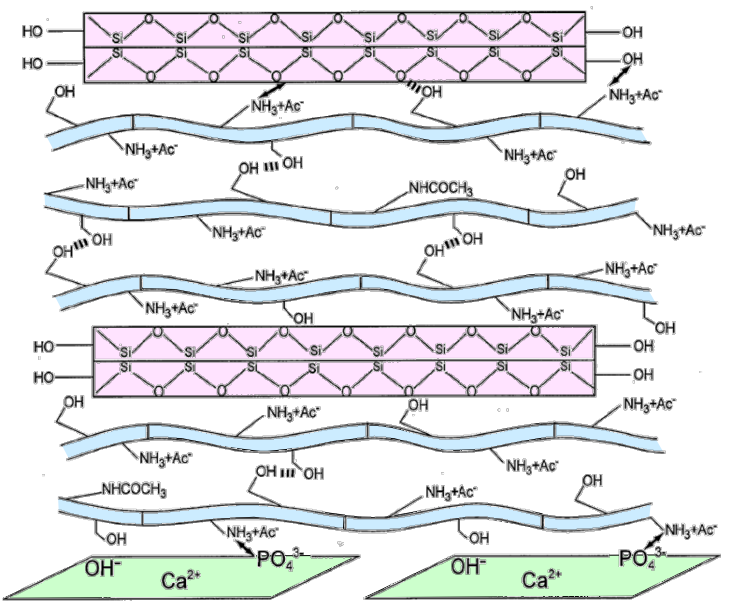
Non-Confidential Description

Novel Clay Based Nanocomposite for Bone Tissue Engineering

Technology Case: RFT-244

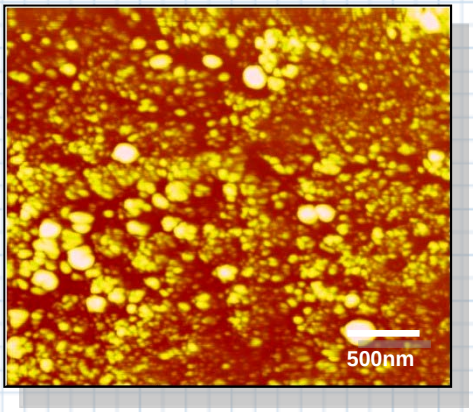


Invention Summary

Recently, nanocomposites based on biopolymers are replacing synthetic polymer composites for various biomedical applications, because of the biocompatible and biodegradable behavior of natural polymers.

Scientists at North Dakota State University have recently synthesized a biopolymer-based novel nanocomposite chitosan/montmorillonite (MMT)/hydroxyapatite (HAP) material that exhibits superior nanomechanical properties and shows promising prospects for use in tissue engineering applications.

Above: *Schematic diagram of possible interactions in chi/MMT/HAP composite.*



Right: *Atomic force microscope phase images of chi/MMT/HAP composites.*

Benefits

- **GREEN TECHNOLOGY!**
  Highly biocompatible as exhibited from cell culture experiments
- Superior nano-mechanical properties
- Intercalated structure formed with an increase in d-spacing
- Well distributed nanoparticles in the chitosan matrix

Invention Premise

The composite was prepared from chitosan, unmodified MMT, and HAP precipitate in aqueous media. The properties of the composites were analyzed using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), atomic force microscopy (AFM), thermo-gravimetric analysis (TGA), and nano-indentation.

The biocompatibility of MMT/HAP mix materials was analyzed by seeding samples with osteoblasts. XRD results reveal that an intercalated structure was formed with an increase in d-spacing. FTIR studies provide the evidence of molecular interaction among the three different constituents of the composite. AFM images (see image above) indicate a microstructure with well distributed nanoparticles in the chitosan matrix.

The composites also exhibit a significant enhancement in nanomechanical property as compared to pure chitosan. TGA results indicate that an intercalated nanocomposite was formed with improved thermal properties. The cell culture experiments show MMT/HAP mix as highly biocompatible.

Patents

This technology is patent pending with fully preserved U.S. patent rights and is available for licensing/partnering opportunities.

The Inventors

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Kalpana Katti received her undergraduate degree in Physics at the University of Delhi, India. She went on to get an M.S. in Solid State Physics in Kanpur, India, and received her Ph.D. in Material Science and Engineering at the University of Washington, Seattle. Her research areas include bone tissue engineering, biomimetics, nanotechnology, biomedical engineering, biomaterials, vibrational microspectroscopy, and multiscale modeling in bio-nano composite systems.

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Dinesh Katti received his undergraduate degree in Civil Engineering from the National Institute of Technology in Srinagar, India. He went on to get an M.S. in Civil Engineering from Indian Institute of Technology in Bombay, and a Ph.D. in Civil Engineering from the University of Arizona at Tucson. His research areas include Geotechnical Engineering, Constitutive Modeling of Materials, Expansive Soils, Multiscale Modeling of Material Response, Bio-Nanocomposites, and Finite Element Method.

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