

Spectroscopic Investigation of Chitosan Phosphoralation during Hydroxyapatite-Chitosan Hybrid Synthesis

JASON ANDERSON



ABSTRACT

Chitosan is the deacylated product of chitin, which is found in the exoskeleton of crustacean organisms. Chitosan's reactivity is pH dependent and at high pH it has the ability to react with other functional moieties such as carboxylates, hydroxyls, thiols and orthophosphates.

Hydroxyapatite (HA) is the main mineral component of bone ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$). Sixty-five percent of bone material is made up of this mineral. Because of hydroxyapatite's bioactive, biodegradable and osteo-conductive properties, it is used extensively for biomedical implant applications.

Recently, Kumar Ganesan, et al., have synthesized a hybrid material consisting of HA and chitosan in which the latter modulates the growth kinetics and assembly of the former. This also results in a nanostructured hybrid film that seems to hold much promise in bone-tissue engineering and oral-drug delivery devices. However, little is known about the mechanisms by which chitosan modulates growth behavior for HA. It has been hypothesized that a possible mechanism could be through phosphorylation of the amines on chitosan at the high pH encountered during the hybrid reaction.

Little is known about the mechanism(s) by which chitosan phosphorylates and modulates calcium phosphate growth. Investigating previous research efforts has shown through infrared (IR) spectra and nuclear magnetic resonance spectroscopy (NMR) that phosphorylation does indeed occur. This research will shed light on the possible phosphorylation mechanisms given these reaction conditions and hence, the details of HA-chitosan nano-hybrid formation.

BIOGRAPHY

I am originally from Billings, Montana and graduated from Senior High in 2002. After high school, I was unsure about my future and decided to attend Montana State University of Billings. After three years of only part-time attendance, I discovered my love for chemistry and biology. Now I am a senior biology student and will graduate in the fall of 2008 with a Degree in Biology and Minors in Chemistry and Math. I plan to attend Montana Tech after graduation and obtain my Masters in Environmental Engineering.