J Biotechnol Biomater 2017, 7:2 (Suppl)
http://dx.doi.org/10.4172/2155-952X.C1.074

Quantitative accurate mechanical measurements with atomic force microscopy new techniques for studying biomaterials

Irene Revenko
Asylum Research, USA

Atomic Force Microscopy (AFM) is a powerful imaging technique that has also emerged as an indispensible technique for measuring mechanical properties of biomaterials and biological samples. It provides high spatial resolution and force sensitivity within physiologically relevant environments in the kPa to GPa elastic modulus range. To respond to the large diversity of material properties a variety of AFM techniques can provide the most relevant or accurate data for every application. Here we are reviewing a large number of available techniques and how they apply to different types of biomaterials, as well as different stages of fabrication, quality control and testing. In particular we will review and compare the following techniques: Force Curve Measurements, Fast Force Mapping, Phase Imaging, Loss Tangent Imaging and AM-FM (Amplitude Modulation-Frequency Modulation). AM-FM mode, for example, delivers high-resolution topographical images and simultaneously measures quantitative contact stiffness data, from which elastic modulus can be calculated with appropriate models for the tip-sample contact mechanics. With the growing demand for mechanical characterization of materials at the nanoscale, the AM-FM technique provides quantitative nanomechanical information, while simultaneously offering all the familiar advantages of tapping mode. Together all these AFM different techniques can be used on any biomaterial and measure a wide range of properties including elastic stiffness, loss and storage modulus, viscous damping, adhesion, and hardness. This short review should help determining which technique to choose based on the research goals and the samples.

Irene.Revenko@oxinst.com

Structure and properties of nanocrystalline chitosan

Pighinelli L[1],Guimarães M F[1], Becker C M[2], Zehetmeyer G[2], Rasia M G[2] , Corrêa D S[1], Paz R L[1], Zannin B G[1], Kmiec M[1], Tedesco M F[1], Reis V[1], Silva M M[1], Feij[6] C T[1] and **Feistel C C[1]**
[1]Lutheran University of Brazil, Brazil
[2]SENAI Institute for Innovation, Brazil

Chitosan and its derivatives are polymers with excellent properties to be used in regenerative medicine because they guarantee efficiency in the healing process. This polymer has a great potential for the development of a new generation of biomaterials that can be used in regenerative medicine and tissue engineering. The nanocrystalline chitosan (nCh) is a modified form of chitosan prepared by the method of obtaining chitosan salts. It is characterized by having the same special properties of the precursor chitosan as biocompatibility, bioactivity, be non-toxic and biodegradable. The aim of this study was to develop a new method of obtaining nanocrystalline chitosan according to their chemical and physical characterization. The material was characterized by Absorption Spectroscopy in the Infrared Region - with the Fourier transform (FTIR - ATR), scanning electron microscopy, SEM, Nuclear Magnetic Resonance, NMR, Diffraction of X-rays, particle size analysis and the potential Zeta. The results indicated that the process of obtaining nanocrystalline chitosan, did not change the structure of the precursor chitosan. The analysis in the FTIR showed the same functional groups of the precursor chitosan. The 1H-NMR spectroscopy was helpful in the analysis of the chitosan samples in a wide range of values to determine the degree of deacetylation (GD). The morphology indicates the homogeneity of the structure and the surface. The X-ray diffraction shows the reduction of crystallinity of QNC, which corresponds to the amorphous structure thereof. The value of the zeta potential of the chitosan acetate (AQ) in acid media (pH 4.43) was 43.6 mV, while the value of QNC (pH 7.3) was 15.4 mV due to its high polydispersity. The variation in particle size of samples, and AQ using QNC 0.450 uM mesh filter, indicated the average particle size of 55.52 and 266.0 nm, respectively.

pighinelli@gmail.com