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Microfibrillated cellulose nanofibers from eucalypt wood: Mechanical extraction and application in starch films

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The effects of addition of eucalyptus microfibrillated cellulose nanofibers on the optical, mechanical, and microstructural properties of corn starch (plasticized with glycerol) films were studied. The microfibrillated cellulose nanofibers were obtained in a grinder by mechanical defibrillation. Starch films with 0%, 1%, 2% and 3% (by wt%) content of microfibrillated cellulose nanofiber were prepared. The starch/nanofiber films exhibited higher transmittance and lower ultraviolet absorption and reflexion. The presence of nanofibers has not showed influence in the transparency and color parameters of the plain starch films. The presence of nanofibers in the starch films increased the puncture strength. The morphology of the fracture surface of the films produced was investigated by SEM. Agglomerates of ghost granules of starch were observedon the cross section of the starch/nanofiber films. These structures are envelopes of gelatinized starch granules remaining after majority of internal starch polymers have been released. Films with 1% and 2% (by wt%) of cellulose nanofibers presented the higher rate of water vapor transmission (WVTR) compared to plain starch film and films with 3% of nanofibers. The lower WVTR for films with 3% of nanofibers is probably consequence of the closed net formed by the nanofibers into the starch film, which turn difficult the permeability of the film. The starch/nanofiber films obtained in this work presents potential to a wide range of applications such as optical instruments, flexible polymer substrates for flexible OLEDs (organic light-emitting diodes), architecture of engineered composites, agricultural uses and food packaging with antimicrobial properties. These studies have been conducted by our research group as well as by other research Brazilian teams.

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Novel therapeutic and diagnostic advancements using nanomaterials for developing critical care and orthopedic applications

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Nanomedicine is an exploding field within the biotechnology industry using cutting edge nanomaterials to enable novel advances in biomedical research. Clearly, the development of a minimally invasive, cheap, robust, accurate and fast system for the measurement of multi-analytes is required. NanoAxis, a company based on pioneering the establishment of nanomedicine products presents the development of medical devices using quantum dot-based sensors as examples of our platform technology. We specifically address detecting key diabetic ketoacidosis monitoring parameters (i.e. glucose, urea, pH, sodium, potassium, calcium, bicarbonate), and key cytokine biomarkers important in peri-prosthetic joint infections. Nanotechnology in combination with diagnostic antibodies offers a novel contemporary approach to next generation sensors. Nanoparticles have been favorably established as potential transducers in enzyme based biosensing systems due to their large surface-to-volume ratio, high catalytic efficiency and high surface reaction activity. Among nanoparticles, quantum dots are preferable due to their size dependent optical and physical properties. Our data suggest that our sensor technology can be adapted to host of medical devices to enable devices that are automated, miniaturized, and portable for wide accessibility to clinicians worldwide, while providing robust, accurate and highly sensitive clinical data at the point-of-care level.

Biography

Krishnan Chakravarthy, MD, PhD is Founding President and CEO of NanoAxis. He holds a BA degree in Biology from the University of Chicago. He completed his MD, PhD Program at State University of New York at Buffalo School of Medicine. He has also served as a contractor at the US Centers for Disease Control and Prevention (CDC). He has published several major papers in the field of nanomedicine, presented at both national and international conferences, and authored numerous patents in the field. He intends to guide NanoAxis to becoming a global leader in nanomedicine technologies.

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