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Short Article

Physics Congress 2020: Sulphur free high speed production of hollow Nano spheres and Nano fibrils of cellulose for application in 3D-bioprinter ink- Mandeep Singh- Dolphin PG College of Science & Agriculture, India Punjab University, India

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Abstract

Statement of the Problem: The present work provides method of quick production of highly porous Nano cellulose with uniformly spherical (CNS) and fibrous (NFCs) morphology from a waste biomass. The conventional methods used for synthesis of cellulose nano spheres (especially) are so far time consuming and utilize a main hydrolysis treatment of fibrous macro and microstructures in which high concentration H2SO4, H2SO4/HCl acid or enzymatic process is followed that utilize acids with concentration up to 64%. Due to which different factors from environment to characteristic properties of individual Nano cellulose remain affected. But in this study synthesis of hollow Nano spheres involves sulphur free method along with mechanical treatment to produce CNS and NFCs directly from defibrillated MFCs of waste biomass. Methodology & Theoretical Orientation: In place of conventional methods involving high concentration acid hydrolysis (mostly mediated by sulphuric acid), a combination of physico-chemical methods was used that in addition with intrinsic properties of the raw material helped producing speedy release of nanospheres from MFCs during high shear mechanical treatment.

Findings: Homogenization of MFCs was done in different passes rendering CNS and NFCs with diameter ranging between 40-90nm and 20-45nm as depicted by HRTEM/STEM and FESEM analysis (as shown below). WAXRD, FTIR and CHNO elemental analysis were also done to draw structural and compositional analysis of the nanocellulose. Conclusion & Significance: A high content of leftover sulphur causes poor thermal stability and low crystallinity in resultant nanomaterials. A non-uniform size distribution, irregular spherical morphology and low yields add to the factors that limit the use of CNS for potential application in supercapacitance and drug delivery and their explorations in advanced applications. In the present study, the produced CNS/NFCs are further be explored for application as stable 3D-bioprinter ink.

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