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Eco- and Aqua-Friendly Nanocellulose Prepared Under Deep Eutectic Solvent

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Aqua-friendly esterified nanocellulose (ENC) was prepared by using deep eutectic solvent (DES). Phthalic anhydride (PA) and DES made of oxalic acid and choline chlorides (OAC) were mainly used as a reagent and solvent. Results indicated that shape and size of ENC could be varied by preparation methods. Analyses of ENC proposed that oxalic acid participated as both solvent and reactant, resulting in formation of various types of anhydrides with reagent and cellulose. Characterization of ENC was performed by FTIR, TGA, X-ray diffraction, SEM and zeta potential analyzer. FTIR analysis substantiated various types of esters and anhydride groups caused by the presence of PA and oxalic acid within OAC DES. X-ray diffraction analysis confirmed effect of ultrasonic irradiation times on crystalline level of ENC formed. TGA indicated that the ENC showed a unique three-step thermal decomposition unlike pristine cellulose. Results indicated that esterification of nanocellulose affected on solubility in both positive and negative ways. In positive way, reaction of cellulose hydroxyl group by anhydride cleaved intra- and inter-chain hydrogen bonds, consequently increasing solubility of ENC, whereas in negative way introduction of hydrophobic group such as alkyl chain or aromatic ring decreased its solubility. This ENC was anionic in dissolved state and its sorption capacity was studied against heavy metal ions. Results confirmed that sorption of metal ions was influenced by three parameters such as pH and amounts of ENC in the solution and concentration of PA that used in preparing ENC. Therefore, unlike conventional techniques, the current process allowed a rapid preparation of aqua-friendly nanocellullose in much simple steps with eco-friendly ways.

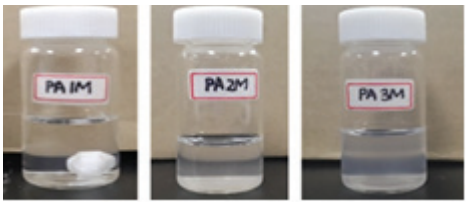

Figure 1. Aqueous ENC solutions prepared at different concentrations of PA

Biography:

Hyung-Min Choi has completed his PhD from University of Maryland, USA. He has been an assistant and associate professor at Louisiana State University and Kansas State University, respectively and has worked for Kimberly-Clark Corp. He has been a professor at Soongsil University since 1995 and has served as Dean of College of Engineering and Provost, Senior Vice President for Research and Academic-Industrial Cooperation. He also has been a visiting professor at Southern Regional Research Center, United States Department of Agriculture, University of Rhode Island and University of Virginia. He is a member of American Association of Textile Chemists and Colorists and Korean Textile Engineering Association. He has published more than 150 papers in world-wide scientific journals.