National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Valorisation of lignocellulosic food wastes using green solvent system to recover lignin as a value added product and its application in pollutant remediation
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Venue	: BM Seminar Room
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Abstract	: Food waste, a lignocellulosic biomass is a potential feedstock for recovering value-added products like lignin through valorisation thereby minimizing its detrimental impact to the environment. The present study explores potential food wastes like onion skin, potato peel, banana peel, pomegranate peel, and tea residue as bioresources for isolating lignin, to investigate the efficiency of the green deep eutectic solvent (DES) method for lignin extraction from these wastes and to characterize the extracted lignin comprehensively. The extraction was carried out at 100 °C for 6 hr using choline chloride-oxalic acid (CC-OA) DES with a solid-to-liquid ratio of 1:10 (w/v). The yield and purity of the extracted lignin from different biowastes were determined. A varied yield and purity of lignin was obtained depending on the food waste sources. However, the highest lignin yield of 22.439±4.38% and purity of 77±1.95% was obtained with pomegranate peel. A comparable lignin yield (21.348±2.40%) and purity (75±1.26%) was also achieved with banana peel. UV-Visible and FTIR analyses revealed the existence of aromatic and major functional groups of lignin. XRD analysis confirmed its amorphous nature and its spherical or ellipsoidal morphology revealed by FESEM image analysis. The presence of hydroxyl ions, phenols, and carboxylic acids, and protons in methoxy group, aliphatic and aromatic moieties in the lignin were identified by negative zeta potential values and 1H NMR spectra analysis respectively. The quantity of major linkages like β-O-4′, β−5′ and β−β′ in the lignin was determined by 2D-HSQC NMR. The extracted lignin exhibited effective antimicrobial activity. The elemental composition and higher heating values were determined by CHNSO analysis. Overall, pomegranate and banana peels are found to be the most prospective food wastes for extracting lignin. The study demonstrates the potentiality of the green CC-OA DES to extract lignin from food wastes. The yield of lignin from pomegranate peel was further improved by optimising extraction parameters, such as time, temperature, stirring speed, CC:OA ratio and biomass:solvent ratio by response surface methodology. The extracted lignin was used to develop lignin/PVA polymeric nanofibrous mat by electrospinning technique for further use as an adsorbent in pollutant remediation.