Ionic Liquids as a Sustainable Platform for Nanocellulose Processing from Bioresources: Overview and Current Status

By: Haron, GAS (Haron, Gamal Abdalla Suliman) [1];
Mahmood, H (Mahmood, Hamayoun) [2];
Noh, MH (Noh, Mohd Hilmi) [1, 3];
Alam, MZ (Alam, Md Zahangir) [4];
Moniruzzaman, M (Moniruzzaman, Muhammad) [1, 3]

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Abstract
The two-fold threats of the crisis of petrochemical industry-based plastics and serious environmental pollution have triggered the valorization of naturally occurring biopolymers to produce nanocellulose (NC). Nanocellulose has been used extensively in a variety of demanding applications due to its excellent features including biocompatibility, light weight, tunable surface properties, and improved environmental footprint. However, the sustainable production of NC is still confronted with bottlenecks to realize commercial feasibility due to poor solubility and hard processability of biopolymers using conventional hazardous solvents and reagents including concentrated sulfuric acid. The key might rest on the use of ionic liquids (ILs) that have induced a great deal of interest in recent years as powerful "green" solvents for biopolymer processing. ILs can be used as a catalyst and/or reaction medium and/or swelling agent for NC production with an eminent yield of high-quality NC

under mild operating conditions coupled with proficient recoverability and recyclability. This review presents the recent technological developments of ILs-assisted proper valorization strategies of numerous bioresources for NC isolation and modification. The impact of IL cation/anion on structural changes of NC is also covered. The major advances in exploring ILs for NC surface modification reactions such as esterification, silylation, and surface plasticization as well as the microscopic insights of NC interaction with ILs are also reviewed. In view of the dominance of green chemistry principles for high purity of the recovered nanocellulose, close R&D endeavors for cheap and biodegradable ILs conjoined with emerging recycling techniques might boost sustainable commercialization.

Keywords

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Author Information

Corresponding Address : Moniruzzaman, Muhammad (corresponding author)

Univ Teknol PETRONAS, Dept Chem Engn, Bandar Seri Iskandar 32610, Perak, Malaysia

Corresponding Address : Moniruzzaman, Muhammad (corresponding author)

Univ Teknol PETRONAS, Ctr Res Ion Liquids CORIL, Bandar Seri Iskandar 32610, Perak, Malaysia

Affiliation

Universiti Teknologi Petronas

Addresses:

1 Univ Teknol PETRONAS, Dept Chem Engn, Bandar Seri Iskandar 32610, Perak, Malaysia

2 Univ Engn & Technol, Dept Chem Polymer & Composite Mat Engn, Lahore, Pakistan

3 Univ Teknol PETRONAS, Ctr Res Ion Liquids CORIL, Bandar Seri Iskandar 32610, Perak, Malaysia

4 Int Islamic Univ Malaysia, Dept Biotechnol Engn, Fac Engn, Kuala Lumpur 50728, Malaysia

E-mail Addresses: m.moniruzzaman@utp.edu.my

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