Neeru Anand et al., J Fundam Renewable Energy Appl 2018, Volume 8
DOI: 10.4172/2090-4541-C3-056

Conversion of cellulose to 5-HMF in ionic liquid catalysed by solid acid catalyst

Neeru Anand, Uplabdhi Tyagi, and **Dinesh Kumar**
Guru Gobind Singh Indraprastha University, India

In recent years, area of renewable energy is gaining importance due to challenges associated with non-renewability of fossil fuels. Lignocellulosic biomass provides an alternative source for green and renewable energy. 5-Hydroxymethyl furfural which is the most important intermediate derived from lignocellulosic biomass is gaining importance because of its potential in various industrial applications. Efficient conversion of biomass can be directly processed via hydrolysis process under milder reaction conditions using solid acid catalyst. In the present work, three different kinds of modified activated carbon (catalysts) i.e. H_2SO_4-AC, H_3PO_4-AC and HCl-AC were synthsized in order to investigate the effect on the yield of 5-HMF via degradation of cellulose in [C4mim] Cl. Characterization studies were performed to examine some changes in morphology and functional groups of the activated carbon through SEM and FTIR including BET surface area of before and after modification of activated carbon. Results showed that all the three modified catalysts were promising and showed appreciable catalytic activity with the maximum yield in 60 min. The percentage yield was 36.33±0.24% using H_2SO_4-AC, 32.27±0.3% using HCl-AC and 33.03±0.99% using H_3PO_4-AC as catalysts respectively. These appreciable yields obtained by chemically modified activated carbon using [Bmim] Cl as green solvent may be due to the presence of C_2 hydrogen of imidazolium ion which is acidic in nature and hence may promote the reaction at faster rate. On the other hand, imidazolium molecule helps to stabilize the end products through hydrogen bonding interaction. In addition, effect of several metal ions on modified activated carbon was studied after impregnation of metals including Cr^{+3}, Al^{+3}, Cu^{+2}, Zn^{+2}, K^{+} and Fe^{+3} on the hydrolysis of cellulose using H_2SO_4-AC as catalyst under same conditions. The catalysis effect of Cr^{3+} exhibited significant effect on accelerating the hydrolysis rate and improving the yield of 5-HMF as compared to other metal ions. The yield was increased to 49.02±0.98% for Cr^{3+} metal ion respectively at 120°C with the reaction time of 1 hr. Also, the recovery of sugars and ionic liquid from the catalysis system makes the process economically feasible at large scale. Catalyst recyclability was also studied and it was observed that catalyst was reusable for 3 runs with minimal loss in activity. In addition, ionic liquid was recovered by using appropriate amount of salt solution. These modified and immobilised solid acid catalyst with ionic liquid as green solvent proved to be promising to facilitate cost effective and eco-friendly conversion of cellulose to value added products.

Biography

Neeru Anand is working as Associate Professor in University School of Chemical Technology, GGS Indraprastha University, New Delhi, India. She has done BE (Chemical Engineering) and PhD (Chemical Engineering). She has 15 years of teaching experience. Prior to teaching she has worked for 9 years as a Process Safety Consultant and has participated in a number of safety studies for refineries, petrochemicals, oil and gas installations in India. She has published papers in reputed international journals.

Neeruanand@ipu.ac.in

Notes: