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De-polymerization of sugarcane bagasse lignin to value added products in sub-critical and super-critical water

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The use of alternative solvents for development of cleaner and renewable processes for industrially useful chemicals is an important area of Green Chemistry. Biomass is a regenerative resource for energy and chemical production. Lignin is abundantly available and has potential to be utilized as a renewable source for industrially useful chemicals. This work is associated with investigation of super-critical water as an alternative solvent in clean technologies. The lignins were de-polymerized at sub-critical and super-critical conditions of water using oxidizing, non-oxidizing and catalytic environment. The effect of various reaction parameters such as pH, temperature, pressure, residence time and catalyst concentration were investigated. It was observed that the lignin on de-polymerization leads to catechol, vanillin, acetovanillone and homovanillic acid as major products while syringic acid and guaicol were found to be minor products. The lignin, on de-polymerization under non-oxidizing conditions, favors the formation of more hydrolyzed products resulting into formation around 15% monomers while under catalytic conditions gives around ~ 50% monomer carbon balance. It has been observed that the lignins on de-polymerization under oxidizing conditions results into enhancement of the carbon balance from 25% to 50% due to formation of more break-down products. The continuous reactor designed in two sections resulted into enhanced de-polymerization of lignin. In the first stage, the lignin polymer undergoes hydrolysis by breaking ether linkages while in the second stage, catalytic oxidization of the oligomers formed occurs, which improved the yields of the break-down monomers significantly.

Biography

Sunil Joshi leads a research group at the National Chemical Laboratory and has been active in the area of catalysis and process development for the last 25 years. He has extensive experience in process intensification, scale up studies and has been responsible for several technology transfers in fine and specialty chemicals. His current research interests involve chemical applications of super-critical fluids, with particular emphasis on conversion of biomass to value added chemicals and carbon dioxide utilization. The focus is mainly on understanding the fundamental chemistry in super-critical fluids and on developing environmentally acceptable processes and materials.

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