Wheat Straw Lignin for Value Added By-products: A Biofuel for Future

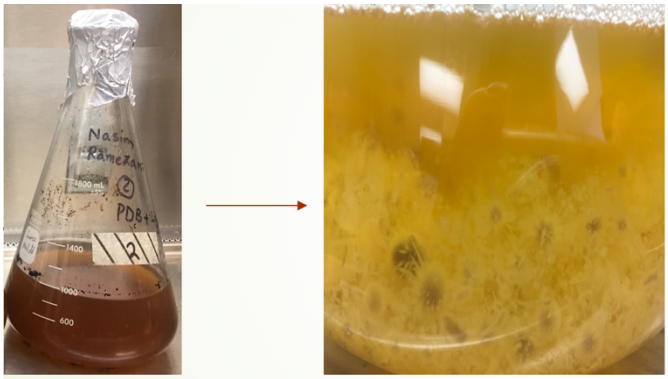
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Abstract

It is predicted that the world population will be increased to 9 billion by 2050. Therefore, the next energy goals of the 21st century must be to provide reasonable energy services for the comfort of all human beings. Among all sources of energies, renewable energies are anticipated to change the future of energy flows (Balakshin et al., 2014). Each year, half of produced world biomass is lignocellulosic biomass, which has a weight around 10-20 billion dry tons (Zhao et al, 2009). While lignin can be efficiently used in pharma and food sector, it is burnt to produce heat and recover pulping chemicals in paper mills industry (Holladay et al, 2007). In this study, high purified lignin was extracted by Organosolv method from wheat straw. In extraction process, no catalysts were applied, Therefore, the carbohydrates impurities caused by acids were the least. On the other hand, all the ethanol applied in the process was recovered. So, the extraction was done with the minimum amount of solvent and energy. The extracted lignin was characterized by NMR, and FTIR. Moreover, the extraction was done in the bigger facility (20L Parr reactor) for mass production. Furthermore, the biodegradation of lignin by *Bjerkandera adusta* was investigated. In the FTIR spectrum existence of different lignin bonds including C-C, C=O, C=C, and aromatic rings were confirmed. Same groups were observed in the C NMR spectrum. Furthermore, the presence of carboxylic acid, aldehyde, phenolic hydroxyl, aromatic rings syringyl, and guaiacyl units were determined. The growth of *Bjerkandera adusta* on PDA culture media consist of 2% extracted lignin, makes this fungus a good candidate for lignin biodegradation (Negrão et al., 2015). These characteristics give the wheat straw lignin a good opportunity to be applied as a renewable polymer (W.J.J. Huijgen et al., 2014).

Image





Lignin Biodegradation by *Bjerkandera adusta*
lignin on PDB (left), growth of fungus and lignin biodegradation after 7 days- change in color (right)

Recent Publications

1. Balakshin, M., E. Capanema and A. Berlin. 2014. Isolation and Analysis of Lignin–Carbohydrate Complexes Preparations with Traditional and Advanced Methods-Chapter 4: A Review. .
2. Holladay, J., J. Bozell, J. White and D. Johnson. 2007. Top value-added chemicals from biomass. DOE Report PNNL. 16983.
3. Huijgen, W., G. Telysheva, A. Arshanitsa, R. Gosselink and P. De Wild. 2014. Characteristics of wheat straw lignins from ethanol-based organosolv treatment. Industrial Crops and Products. 59:85-95.
4. Negrão, D.R., M. Sain, Leão, Alcides Lopes Leão Lopes, J. Sameni, R. Jeng, de Jesus, João Paulo Furlan and R.T.R. Monteiro. 2015. Fragmentation of lignin from organosolv black liquor by white rot fungi. BioResources. 10(1):1553-1573.
5. Zhao, C., X. Chen and C. Zhao. 2009. Effect of crystal structure on CO 2 capture characteristics of dry potassium-based sorbents. Chemosphere. 75(10):1401-1404.



Nasim Ramezani mainly focuses on biofuels production from different biomasses by biochemical methods. In her PhD project, she has extracted high purified lignin from wheat straw biomass and has developed her method in large scale. She also has applied white rot fungi to degrade the extracted lignin. Her goal is to produce different by-products from the lignin

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