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J Fundam Renewable Energy Appl 2016, 6:3(Suppl)
http://dx.doi.org/10.4172/2090-4541.C1.009

World Bioenergy Congress and Expo

June 13-14, 2016 Rome, Italy

Sustainable biomass for energy and chemicals

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Modern bioenergy in the form of liquid biofuels, bioelectricity, biogas, and more efficient heat contributes to about 3.5% of the world's energy matrix. Bioenergy production and use is expected to increase to about 20-25% by 2050 as part of a large global effort to decrease greenhouse gas (GHG) emissions and enable sustainable development. A wide-array of technological pathways using biomass as feedstock has been developed and is maturing with options to substitute petrochemical routes. Additionally, our growing knowledge of plants and microbes can also lead to new biobased chemicals. Bioenergy and biobased chemicals are part of a larger transition to a bioeconomy in which the biomass industry will have an increasingly important role and bioproducts will need to compete on the basis of efficiency and price. A global assessment of bioenergy sustainability recently conducted under the Aegis of SCOPE evaluated the potential expansion of bioenergy and its impacts and benefits. Led by researchers from FAPESP Bioenergy Program (BIOEN) with contributions from 137 experts in 24 countries, the study concluded that there is enough land for bioenergy expansion without competition for food or other needs, and that this expansion is most likely to take place in Latin America and Africa, contributing to social and economic development. Brazil, in its sugarcane ethanol program, has seen an astounding number of new technological developments in the context of sustainability. The speaker will consider environmental security, food security, energy security and improvement of livelihoods and discuss recent scientific findings on biotechnology for bioenergy expansion.

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Kinetic modeling approach for comprehensive understanding of laccase mediated delignification for a non-edible feedstock

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Quest for clean and green energy is a universal need which has been on every country's agenda recently considering the whopping population and diminishing conventional reserves. This demand for clean energy can be sustainably fulfilled by non-edible lignocellulosic biomass owing to its rich sugar content and non-involvement in food, fodder vs. fuel controversy. Production of lignocellulosic biofuels requires an array of steps viz., pretreatment, saccharification and fermentation. Among these steps, pretreatment is one of the crucial one's considering its major involvement in efficiency and cost of the entire process. In this investigation, kinetic modeling approach has been adopted to comprehensively study laccase (produced from *Pleurotus djamor*) mediated delignification of *Ricinus communis*. For accomplishing the task, two systems of coupled models were hypothesized which were subsequently fitted onto the experimental data for deciphering the values of kinetic and thermodynamic constants describing the process. One of the models framed was based on Michaelis Menten (type I) while the other was a modification of Tesseir's equation (type II). After fitting the experimental data onto the models, activation energy of laccase mediated delignification was determined to be 47.65 and 45.52 kJ/mol from type I and II models respectively. Entropy and enthalpy change during delignification was estimated to have positive values which indicate that the process is spontaneous and endothermic in nature. Sensitivity analysis of the models towards the kinetic constants was also conducted and it was observed that the models were most sensitive towards temperature dependent kinetic constants.

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