

Scaling-up of largescale bioethanol production by fractional hydrolysis and co-fermentation

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Abstract—As conventional sources of energy are dwindling and altering the environment with hazardous impacts on climate and ecosystem, there has been tremendous emphasis in exploiting renewable energy to conventional energy sources. Bioenergy is a form of renewable energy derived from biomass to produce electricity, heat or liquid/solid fuel and has emerged as a potential alternative to fossil fuels and is being promoted as a cleaner source of energy. Energy transformation from biomass to biofuel involves thermochemical and biochemical conversion. The biochemical methods involve fermentation of bio-based substrate involving microorganisms resulting in generation of energy by catabolism of organic compounds. Biofuels have been classified into first, second and third generation based on source of biomass and the microorganism involved.

A novel eco-friendly bioprocess has been developed in our lab for the conversion of lignocellulosic biomass to bioethanol. The cost of production of bioethanol is cheapest of all methods so far developed. The process involves a novel fractional hydrolysis method that gives C5 and C6 sugars directly from the LCB in a single step (no pretreatment is required) without generation of substantial amount of toxic substances in just 1.5 hour time and subsequently fermentation (co-fermentation) of these sugars to ethanol by microorganisms like *Z. mobilis* and *P. stipitis*. The process is able to extract more than 90% (w/w) of available sugars in the LCB and can give around 300 ml of ethanol from 1 kg biomass in most economic way. The process is tested with more than 10 varieties of LCB and studies are complete upto pre-pilot scale level.