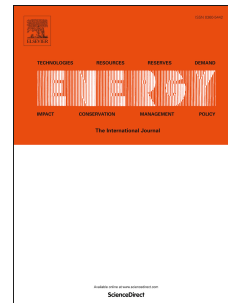


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Fischer-Tropsch route for the conversion of biomass to liquid fuels - Technical and economic analysis

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Abstract

The techno-economics of biomass gasification systems for the production of Fischer-Tropsch (FT) based liquid fuels are analysed by estimating the overall mass and energy conversion of biomass to liquid (BTL) fuel. The investigation of BTL systems for 1000 kg/h biomass gasification system and an expected liquid hydrocarbon output of 1500 tonnes are estimated. The cost analysis, based on the annualized life cycle of the systems, includes a steam-oxygen based biomass gasification plant paired with the FT unit. The gasifier considered in this analysis is the downdraft reactor design, operating on oxygen-steam gasifying medium at an equivalence ratio of 0.1 and a steam-to-biomass ratio in the range of 0.8 - 1.2 to generate syngas with H₂/CO ratio of 2.1:1, ideally suitable for the cobalt based fixed bed FT reactor. The mass and energy balance reveal that for a once-through FT reactor configuration, substantial energy exists in the gas phase, which includes C1-C5 hydrocarbons and unconverted syngas. The study suggests that the product gas be utilized in an IC engine and converted to electricity, for in-house power demands and for the sale of excess electricity to the grid. The analysis indicates a market competitive liquid fuel production with CO conversion greater than 60%, at a cost ranging from INR 35 - 40 /liter (0.5 - 0.6 USD/litre) alongside electricity as a major co-product in the BTL system. This study examines the economics of building economically affordable and environmentally favourable BTL systems of smaller throughputs with particular reference to India.

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