Lifecycle GHG emissions for bioethanol production from lignocellulosic biomass: potential of jute and kenaf feedstock from an Indian perspective

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Energy security and the transition to a thriving low-carbon economy are essential for a developing nation like India. We examined the life-cycle greenhouse gas emissions (GHG) and environmental impact of bioethanol production from jute and kenaf feedstock. It was observed that net GHG emissions from crop production and bio-refinery from jute and kenaf ethanol were 3.45 and 5.88 g MJ^{-1} respectively. This result is much lower than any other feedstock like sugarcane bagasse, corn stover, rice straw and wheat straw. Life cycle assessment revealed that ethanol produced from jute and kenaf biomass can reduce GHG emissions by 78–81% when compared with petrol. Bioethanol has the least negative effects (rice straw > sugarcane bagasse > wheat straw > corn stover > jute, kenaf) on the environment and resource depletion. It might deliver 60% of the ethanol requirement annually and may prove to be a workable technology for meeting ethanol-to-petrol blend targets.

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may be another option. However, to meet the demand, additional food grains in the amount of 17 million metric tonnes would be needed. The lignocellulosic biomass of jute (*Corchorus olitorius* L.) and kenaf (*Hibiscus cannabinus* L.) crops may be one option that is acceptable in terms of both sustainability and economics. Biomass production of jute and kenaf plants is about 98 kg day^{-1} ha^{-1}, which is faster than that of other woody plants (28 kg day^{-1} ha^{-1})[6]. Large percentages (40%) of the jute and kenaf plants have woody cores left after the fibre extraction. A total of 4 million metric tonnes of woody biomass are produced annually as agricultural waste[7]. Structurally, jute and kenaf wood sticks have cellulose (40–48%), hemicellulose (18–22%) and lignin (21–24%)[8]. This enriched structural composition makes jute and kenaf suitable materials for bioethanol production[9,10].

GHG emission reductions, one of the main objectives of biofuel policy, have been researched for a variety of feedstocks used in biofuel, such as maize, sugarcane, wheat, rice, etc. No report on GHG emissions covers the production of bioethanol from jute and kenaf biomass. In this study, we examined the life-cycle GHG emissions