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Feasibility assessment of bioethanol production from humic acid-assisted alkaline pretreated Kentucky bluegrass (*Poa pratensis L.*) followed by downstream enrichment using direct contact membrane distillation

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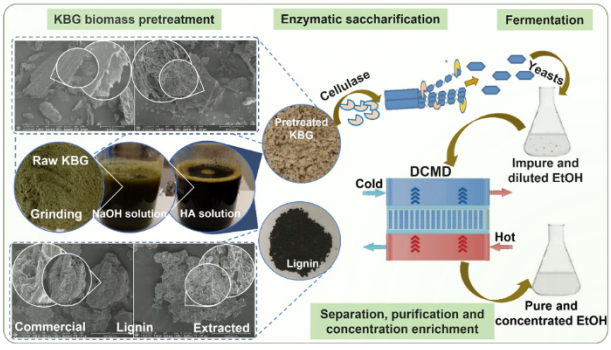
HIGHLIGHTS

- Prospective KBG biomass was evaluated for sustainable biofuel production.
- HA-assisted alkaline pretreatment delignified KBG biomass up to 70%.
- Pretreated biomass was efficiently saccharified to yield 0.55 g/g reducing sugars.
- Ethanol yield of 76.6% could be downstream purified and enriched with DCMD.
- The new hybrid system enables cellulosic ethanol production at a commercial scale.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Kentucky bluegrass
Humic acid
Cellulosic ethanol
Membrane distillation
Downstream purification

ABSTRACT

The effective fractionation of structural components of abundantly available lignocellulosic biomass is essential to unlock its full biorefinery potential. In this study, the feasibility of humic acid on the pretreatment of Kentucky bluegrass biomass in alkaline condition was assessed to separate 70.1% lignin and hydrolyzable biocomponents. The humic acid-assisted delignification followed by enzymatic saccharification yielded 0.55 g/g of reducing sugars from 7.5% (w/v) pretreated biomass loading and 16 FPU/g of cellulase. Yeast fermentation of the biomass hydrolysate produced 76.6% (w/w) ethanol, which was subsequently separated and concentrated using direct contact membrane distillation. The hydrophobic microporous flat-sheet membrane housed in a rectangular-shaped crossflow module and counter-current mode of flow of the feed (hot) and distillate (cold) streams yielded a flux of 11.6 kg EtOH/m^2/24 h. A modular, compact, flexible, and eco-friendly membrane-integrated hybrid

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