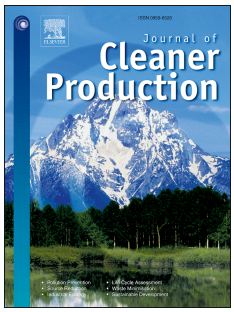
Accepted Manuscript



Environmental screening of potential biomass for green biorefinery conversion

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Environmental screening of potential biomass for green biorefinery conversion

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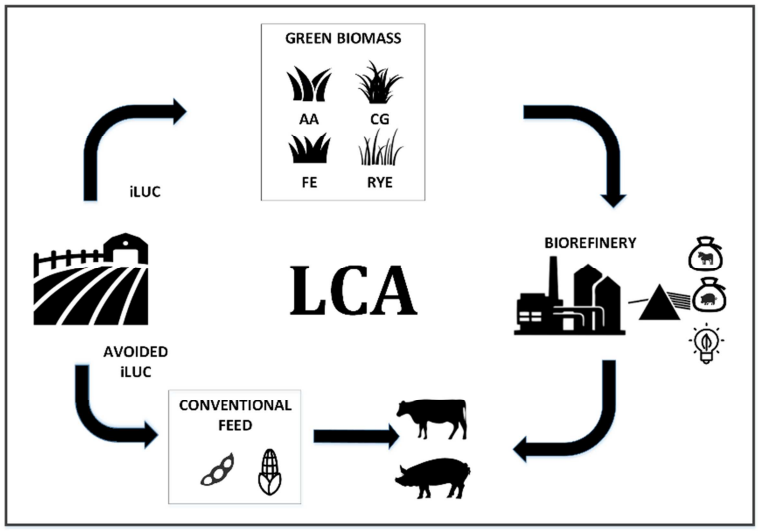
GRAPHICAL ABSTRACT



ASTRACT

Green biorefinery (GBR) is a new biorefinery technology for the conversion of fresh biomass to value added products. In the present study, we combined a Process Flowsheet Simulation (PFS) and Life Cycle Assessment (LCA) of a small scale decentralized GBR to screen environmental impact profiles for potential biomass feedstocks for GBR conversion. Furthermore, we carried out hotspot and sensitivity analysis to identify where the largest impacts arise in the biorefining stage in order to provide recommendations and focus points for GBR technology developers. The GBR considered in this study produces a protein-rich feed for monogastric animals and an energy-rich feed from the press pulp and biogas from the GBR residues. The included biomass feedstocks are: alfalfa, grass-clover, festulolium and ryegrass. These biomasses were selected to accommodate variations in central biomass characteristics like: crop yields, rate of fertilizer application, chemical biomass compositions and related potential environmental implications. Among the studied crops, alfalfa provides the best overall environmental performance due to its high yield and low agricultural input demands. Results of the hotspot analysis further identified the coagulation and the drying as the processes that induce most of the environmental impacts in the biorefining stage. Conversion of green biomass for the production of feed and energy could provide environmental benefits compared to the production of conventional feed. However, the GBR technology have still room for optimization in order to further reduce the environmental impacts, across all impact categories, by decreasing energy consumption and increasing conversion efficiency.

Keywords: *Life Cycle Assessment, biorefineries, biobased products, green biomass, Process Flowsheet Simulation*