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Commentary on Biorefinery

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Description

A biorefinery is a type of refinery that uses biomass to produce electricity and other useful byproducts (such as chemicals). Bio refining is described as "the sustainable processing of biomass into a spectrum of bio-based goods (food, feed, chemicals, and materials) and bioenergy (biofuels, electricity, and/or heat)" by the International Energy Agency's Bioenergy Task 42. By fractionating an initial raw material (biomass) into numerous intermediates (carbohydrates, proteins, and triglycerides) that may be further turned into value-added products, bio refineries can supply multiple chemicals. A "cascading phase" is a term used to describe each refining step [1-5].

This study used three simulated algal biorefinery plants (Biorefineries A, B, and C) with a biomass processing capacity of 2,105 tonnes per year. Biorefinery A is expected to generate 49.1 million litres of biodiesel per year in addition to AM and glycerin as coproducts. With high-value recombinant protein treatments, Biorefinery B is expected to generate the same biodiesel and coproducts as Biorefinery A, whereas Biorefinery C is expected to produce the same biodiesel and coproducts as Biorefinery A with a low-value recombinant protein.

The fundamental processing for a unit of biomass (1000 kg), as well as the processing phases and efficiencies for each of the three Biorefineries. The Biorefinery A processing strategy is based on the present level of biodiesel production technology as determined by published literature and industrial processing. Processing and isolation of recombinant proteins from culture water is a disruptive technology for Biorefineries B and C, and it necessitates the creation of novel algal strains and unique process engineering approaches.

Biorefinery systems' financial viability

The approach of techno-economic evaluation (TEA) is used to determine if a technology or process is economically viable. The goal of TEA research is to give data on the effectiveness of the biorefinery idea in a variety of production systems, including sugarcane mills, biodiesel production, pulp and paper mills, and the treatment of industrial and municipal solid waste.

Because sugarcane bagasse is a viable feedstock for producing fuels and chemicals, bioethanol plants and sugarcane mills are well-established processes where the biorefinery idea may be used. In Brazil, two facilities with capacities of 40 and 84 Ml/y generate lignocellulosic bioethanol (2G) (about 0.4 percent of the production capacity in Brazil). The TEA of ethanol production utilising moderate bagasse liquefaction, simultaneous saccharification, and co-fermentation yields a minimum selling price of 50.38 to 62.72 US cents/L, which is equivalent to market prices. The generation of xylitol, citric acid, and glutamic acid from sugarcane lignocellulose (bagasse and harvesting wastes) has been studied using electricity.

The three biorefinery systems were designed to be annexed to a South African sugar mill. The manufacture of xylitol and glutamic acid has proven economic viability, with IRRs of 12.3 percent and 31.5 percent, respectively, above the base case IRR (10.3 percent). Similarly, the production of ethanol, lactic acid or methanol, and ethanol-lactic acid from sugarcane bagasse has been investigated; lactic acid was found to be the most economically attractive, with a net present value of M$476–1278; similarly, the production of ethanol and lactic acid as a co-product was found to be a favourable scenario (net present value of M$165–718) because this acid has applications in the pharmaceutical, cosmetic, chemical, and food industries.

Conflict of Interest

None.

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