

Biorefinery-An Emerging Concept

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Abstract

Bio refining is defined as the dispensation of biomass into useful commercial products with high market value. With the growing interest in the use of alternative bio based technologies in the industrial sector, a novel concept of bio-refining began to rise. Bio refinery incorporates numerous biomass based technologies for the fabrications of products including biofuels, biofertilizers, bio feedstock, bio plastics, etc.

Keywords: Thermochemical; Biochemical; Biorefining; Lignin; Cellulose

Introduction

Bio-refinery is an integrated approach that aimed to produce diverse bio-based products with maximum yield using renewable bio-based energy sources [1]. Such bio refinery products include biofuels, biofertilizers, bio-feedstock, bio-plastics, biogas, biopolymers, etc. [2]. Industrial requirement to setup a bio-refinery plant is dependent on factors such as native agricultural technologies, climatic disparities and available feedstock [3]. The most commonly used feedstock is beet sugar, agricultural residues, non-edible cellulosic and lignin content, black liquor sugar cane, wheat, corn, wood, surplus biomass, straw, organic waste, etc. [4].

Routes for Biorefining

Two main routes of bio-refining are given below.

Thermochemical

Process like pyrolysis, gasification, incineration, anaerobic digestion, etc. which causes chemical degradation of the bio-feedstock into its components such as hemicellulose, cellulose, lignin, etc. to be transmuted into commercial products [5].

Biochemical

Conversion process utilizing whole living organism or its bioactive compounds such as enzymes to break down the feedstock into several components e.g., Hydrolysis, fermentation and digestion [6].

Practicability of Technology

- Produce numerous marketable outputs;
- Utilization of diverse feedstock's;
- Easy process optimization;
- Process integration;
- Adaptation of effective aspects such as plant genomics, breeding programs and chemical engineering, etc.;

- High quality feedstock preservation;
- Cost-effective and efficient processing;
- Storage facility [7-11].

Forthcoming Market Potential

- Reduction in the consumption of nonrenewable energy resources such as fossil fuels;
- Decline in the emissions of greenhouse gases;
- Reduced expulsion of process related waste;
- Increased employment rate;
- Positive rural development;
- Positive industrial competitiveness;
- Innovation impact [12-15].

However with inconsistent technological bio-refinery designs or processes, undesirable consequences are expected [16].

The influence of bio-refineries products on the environment depends on:

- The type of feedstock;
- Feedstock land-use impact;
- Efficiency of conversion process;
- Greenhouse gas emission;
- Financial requirements and costs;
- Climate;
- Cost competitive end product;
- Local resources;
- Existing infrastructure;
- Biomass-to-product conversion rates;
- Optimized bio-refinery's product portfolio [17-20].

However bio refining can assist in exploiting the available organic wastes into useful products thereby reducing the issue of waste management and emission of greenhouse gases [21]. Bio based feedstock is transformed through applicable enzymatic and chemical methods, into either vaporous or liquefied biofuels [22]. The pretreatment phase in bio refining produces products like paper-pulp, undigested sugars solvents, activated carbon acetate, laminates,

adhesives, chemicals, resins, etc. which usually remained unused in the outdated pathways [23]. Aptness of this procedure is additional improved from the fact that it can consume different types of plant/animal-derived biomass resources [24].

Conclusion

The notion of bio-refinery is in budding stages. Difficulties like feed stock accessibility; viability in artifact supply chain, operability of the refinery process is impeding its commercial growth. Although bio-refinery is an emerging concept, but it holds great potential to consume undesirable wastes and renewable resources for the fabrication of products for human welfare.

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