Editorial: special issue “Sustainable biorefinery approaches”

Muhammad Aamer Mehmood¹ · Chen-Guang Liu² · Alissara Reungsang³

Published online: 8 March 2021

© Springer-Verlag GmbH Germany, part of Springer Nature 2021

Global demands of biofuels and green products have been skyrocketed due to depleting fossil reserves and raising environmental concerns. Although a considerable progress has been made to develop biofuels and bioprocesses for green products yet these products and processes have several challenges which must be overcome to achieve commercial robustness. Biorefinery is the sustainable progression to facilitate the conversion of biomass to a spectrum of marketable products including fuels, food/feed, nutraceuticals, pharmaceuticals, and bioenergy which leaves almost nothing unconsumed (zero waste approach) at the end of pipeline and ensures the highest profitability [1]. Previous decade has seen a tremendous momentum towards the biorefinery processes with the focus on integrated biorefinery and circular bioeconomy. However, bottlenecks of producing biomass, harvesting-related issues, and its downstreaming have made the commercialization difficult [2]. There is a dire need to address these challenges via refining old processes and developing new robust processes to establish sustainable biorefineries. Developing integrated cascading biorefineries with water-energy-environment nexus included along with the complete valorization of the feedstock and waste may help to achieve the commercial sustainability.

This special issue “Sustainable biorefinery approaches” focuses on the identification of bioprocessing problems along with the possible sustainable solutions, and on the development of new processing techniques involved in the biological, thermochemical transformation of biomass-to-biofuels and biochemicals for the subsequent process improvement in terms of enhanced environmental and economic sustainability. Totally, thirteen original research articles are included in this special issue prepared by the eminent researchers working in the reputed institutions across the globe. Where, Ortiz-Sanchez et al. studied the technical, energy, and economic assessment of the orange peel waste for its utilization as a feedstock in an integrated biorefinery. It was shown that orange peel waste could be a potential feedstock to obtain value-added products such as essential oil, pectin, and biogas in an energy and cost-effective way through establishing small-scale integrated biorefineries. Zhu et al. found that microwave-assisted FeCl_3 pretreatment could be a new and feasible approach to replace H_2SO_4 for biofuel and biomass-derived chemicals production. Fatma et al. effectively employed the use of dual-fungi for the lignocellulosic biomass breakdown and its subsequent applications in bioethanol biorefineries using wheat straw as a feedstock. Vu et al. employed the nanocrystalline and hierarchical ZSM-5-based catalysts for the cracking of triglyceride-rich biomass to improve the quality of biodiesel. Khalekuzzaman et al. proposed the use of colored photobioreactors to enhance the microalgal productivity and quality of biodiesel using anaerobic reactor effluent as a low-cost growth media. Bariani et al. proposed the use of residual solid after furfural production from rice husks through acid hydrolysis and achieved furfural yields higher than those typically achieved at the industrial level with hydroxymethylfurfural and acetic, formic, and levulinic acids as additional products making it a successful valorization-prior-to-combustion approach. Huang et al. studied the impact of fermentation temperatures to upgrade the SCFA production using henna plant biomass as a substrate and it was found that mesophilic conditions were appropriate to improve the acidification process and SCFA production. Rios et al. proposed a multi-purpose flexible industrial configuration to obtain both

✉ Muhammad Aamer Mehmood
draamer@gcu.edu.pk

Chen-Guang Liu
cg.liu@sjtu.edu.cn

Alissara Reungsang
alissara@kku.ac.th

¹ Bioenergy Research Center, Department of Bioinformatics and Biotechnology, Government College University Faisalabad, Faisalabad 38000, Pakistan

² State Key Laboratory of Microbial Metabolism, Joint International Research Laboratory of Metabolic & Developmental Sciences, School of Life Sciences and Biotechnology, Shanghai Jiao Tong University, Shanghai 200240, China

³ Department of Biotechnology, Khon Kaen University, A. Mueang Khon Kaen 40002, Thailand

biodiesel and the biodegradable base stocks for lubricant oils using ricinoleic acid and C₈ alcohols in an existing biodiesel industry. Din et al. developed a cost-effective biorefinery approach for the valorization of coconut husk biomass into value-added products including bioethanol, organic acids, and hydrogen production. Brandão et al. employed hydroprocessing of esters and fatty acids (HEFA) to produce sustainable alternative jet fuels at competitive costs and with relevant environmental and social benefits using coconut oil. Khammee et al. evaluated the potential of *Rhizoclonium* sp. (a freshwater macroalgae) to produce bioethanol through fermentation and demonstrated that its biomass could be a suitable raw material for bioethanol production. Unpaprom et al. employed anaerobic digestion to produce biogas and biofertilizer using water hyacinth combined with swine dung as a feedstock. Reshmy et al. investigated the degradability of nanocellulose films from different environments including water, acidic and alkaline soils, and saltwater and it was found that there is a direct correlation between the moisture retention capacity of soils and the degradation of thin films. This method could be used in biorefineries

and for the production of high-end packaging materials to maintain green environment.

These papers reported the evaluation of new feedstocks, refinement and development of new green processes, and improving the cost-effectiveness to establish sustainable biorefineries achieving environmental and economical sustainability. We are highly thankful to the authors for their valuable contributions and hope that the readers enjoy reading this special issue.

References

1. Costa JAV, de Freitas BCB, Lisboa CR, Santos TD, de Fraga Brusch LR, de Moraes MG (2019) Microalgal biorefinery from CO₂ and the effects under the blue economy. *Renew Sust Energ Rev* 99:58–65
2. Gifuni I, Pollio A, Safi C, Marzocchella A, Olivieri G (2019) Current bottlenecks and challenges of the microalgal biorefinery. *Trends Biotechnol* 37(3):242–252

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.