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Advances in physicochemical pretreatment strategies for lignocellulose biomass and their effectiveness in bioconversion for biofuel production

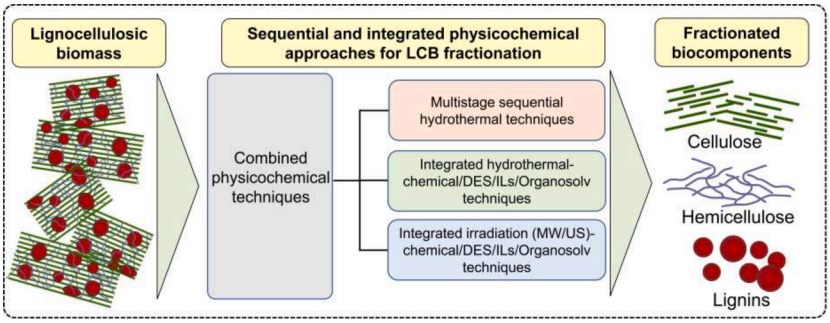
Bikram Basak [a,b], Ramesh Kumar [a], A.V.S.L. Sai Bharadwaj [c], Tae Hyun Kim [c], Jung Rae Kim [d], Min Jang [e], Sang-Eun Oh [f], Hyun-Seog Roh [g], Byong-Hun Jeon [a,*]

[a] Department of Earth Resources & Environmental Engineering, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 04763, Republic of Korea
[b] Petroleum and Mineral Research Institute, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 04763, Republic of Korea
[c] Department of Materials Science and Chemical Engineering, Hanyang University ERICA Campus, Ansan, Gyeonggi-do 15588, Republic of Korea
[d] School of Chemical Engineering, Pusan National University, Busan 46241, Republic of Korea
[e] Department of Environmental Engineering, Kwangwoon University, Seoul 01897, Republic of Korea
[f] Department of Biological Environment, Kangwon National University, 192-1 Hyoja-dong, Gangwon-do, Chuncheon-si 200-701, Republic of Korea
[g] Department of Environmental and Energy Engineering, Yonsei University, 1 Yonseidae-gil, Wonju, Gangwon 26493, Republic of Korea

HIGHLIGHTS

- Emerging physicochemical pretreatments (EPPs) for LCB are discussed.
- Integrated physicochemical techniques favor LCB fractionation at various levels.
- Fractionation and delignification of LCB significantly improve its bioconversion.
- The effects of different EPPs on biofuel production are highlighted.
- Challenges of the EPPs for sustainable biofuel production are highlighted.

GRAPHICAL ABSTRACT



Graphical abstract

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Keywords:
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Lignocellulose fractionation
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ABSTRACT

The inherent recalcitrance of lignocellulosic biomass is a significant barrier to efficient lignocellulosic biorefinery owing to its complex structure and the presence of inhibitory components, primarily lignin. Efficient biomass pretreatment strategies are crucial for fragmentation of lignocellulosic biocomponents, increasing the surface area and solubility of cellulose fibers, and removing or extracting lignin. Conventional pretreatment methods have several disadvantages, such as high operational costs, equipment corrosion, and the generation of toxic byproducts and effluents. In recent years, many emerging single-step, multi-step, and/or combined physicochemical pretreatment regimes have been developed, which are simpler in operation, more economical, and environmentally friendly. Furthermore, many of these combined physicochemical methods improve biomass bioaccessibility and effectively fractionate ~96 % of lignocellulosic biocomponents into cellulose, hemicellulose, and lignin, thereby allowing for highly efficient lignocellulose bioconversion. This review critically discusses the

* Corresponding author.
E-mail address: bhjeon@hanyang.ac.kr (B.-H. Jeon).

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