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Sustainable production of furan-based oxygenated fuel additives from pentose-rich biomass residues

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Abstract

The emission of carbon monoxide, greenhouse gases (e.g., carbon dioxides), hydrocarbon, and particulate matter can be reduced by applying oxygenated additives as a blend to combustible hydrocarbon fuels. However, conventional oxygenates, such as dimethyl ether and methyl t-butyl ether, are sourced from non-renewable feedstocks. This study presents a critical review on the catalytic synthesis of furanic compounds, as an alternative to the conventional oxygenated fuels, from highly abundant lignocellulosic biomass (LCB). This study aims to evaluate the potential of production of furan-based oxygenated fuel additives (e.g., 2-methyl furan , 2-methyl tetrahydrofuran, alkyl levulinates, ethylfurfuryl ether, ethyl tetrahydrofurfuryl ether, tetrahydrofurans) from LCB via the C5-sugars pathway (through furfural); the fuel properties and the performance of furanic fuels in SI or CI engine. The review showed that selecting solvents and catalysts is critical in improving the yield of furanic compounds and reducing the generation of intermediates. The biphasic system for the one-pot conversion of LCB (dehydration and hydrogenation) into furans could facilitate the final product separation and improve final product yield. The combination of Brønsted/Lewis acid catalysts or heterogenous catalysts is promising for effectively converting LCB (alcoholysis) into alkyl levulinates. The use of biomass-based furan fuel additives could potentially have a substantial positive impact on the life cycle analysis of furan / fuel blends due to the availability of lignocellulosic biomass-based feedstocks and improving the sustainability of fuel additives synthesis sourced from LCB waste. © 2022 The Authors

Author keywords

Biorefinery; Fuel additive ; Furan ; Lignocellulosic biomass ; Oil palm empty fruit bunch; Oxygenate

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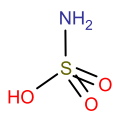

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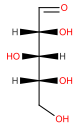

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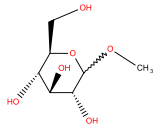

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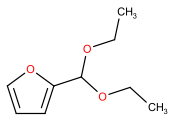

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