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An overview of biodiesel production via calcium oxide based catalysts: Current state and perspective

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Abstract

Biodiesel is a clean, renewable, liquid fuel that can be used in existing diesel engines without modification as pure or blend. Transesterification (the primary process for biodiesel generation) via heterogeneous catalysis using low-cost waste feedstocks for catalyst synthesis improves the economics of biodiesel production. Heterogeneous catalysts are preferred for the industrial generation of biodiesel due to their robustness and low costs due to the easy separation and relatively higher reusability. Calcium oxides found in abundance in nature, e.g., in seashells and eggshells, are promising candidates for the synthesis of heterogeneous catalysts. However, process improvements are required to design productive calcium oxide-based catalysts at an industrial scale. The current work presents an overview of the biodiesel production advancements using calcium oxide-based catalysts (e.g., pure, supported, and mixed with metal oxides). The review discusses different factors involved in the synthesis of calcium oxide-based catalysts, and the effect of reaction parameters on the biodiesel yield of calcium oxide-based catalysis are studied. Further, the common reactor designs used for the heterogeneous catalysis using calcium oxide-based catalysts are explained. Moreover, the catalytic activity mechanism, challenges and prospects of the application of calcium oxide-based catalysts in biodiesel generation are discussed. The study of calcium oxide-based catalyst should continue to be evaluated for the potential of their application in the commercial sector as they remain the pivotal goal of these studies. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Author Keywords

Alkaline metal oxides; Alternative fuel; Biodiesel production; Heterogeneous catalyst; Renewable energy

Index Keywords

Calcium oxide, Catalysis, Catalyst activity, Costs, Lime, Reusability, Synthetic fuels; Biodiesel production, Catalyst synthesis, Commercial sector, Heterogeneous catalyst, Industrial scale, Process Improvement, Reaction parameters, Reactor designs; Biodiesel

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