

Editorial

Conversion of Lignocellulosic Biomass and Derivatives into Value-Added Heteroatom-Containing Compounds

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Lignocellulosic biomass has been developed as a sustainable and promising feedstock for production of various value-added chemicals and biofuels [1–3]. Due to the oxygen-rich features of biomass sources, the yielded products are typically functionalized with oxygen-containing species, remarkably enriching the product variety [4–7]. Moreover, functionalization of biomass derivatives with nitrogen, sulphur, phosphorus, and silicon atoms can also be achieved via specific reaction routes or catalytic pathways [8, 9]. Those heteroatom-containing compounds are crucial core scaffolds or key intermediates in a wide range of bioactive molecules and functional materials and can also be directly used as solvents, surfactants, and so on [10–12].

This special issue intends to highlight current advances in the development and optimization of catalytic systems and processes for the selective transformation of lignocellulosic biomass and derivatives to value-added products, especially heteroatom-containing compounds. The papers selected are on the development of green technologies to upgrade biomass and waste resources, and those with topics on the design of appropriate catalytic materials/molecules with controllable functionalities or the establishment of fitting catalytic processes to boost conversion processes are also considered. Hereby, we are pleased to share six exciting papers on biomass valorization with the readers.

In the paper entitled “Hydrothermal Catalytic Conversion of Glucose to Lactic Acid with Acidic MIL-101(Fe),” X. Liu et al. explore MIL-101(Fe) as a heterogeneous acid catalyst for direct conversion of glucose to lactic acid, with a moderate yield of 25.4% in water at a reaction temperature of

190°C after 2 h. The unique catalyst structure properties and appropriate acid strength are demonstrated to be responsible for the superior activity of MIL-101(Fe) in the synthesis of lactic acid from glucose. After four consecutive recycles, glucose conversion decreases from 70.8% to 54.9%, and LA yield is dropped from an initial value of 25.4% to 18.5%, possibly due to the partial deposition of oligomeric byproducts in the catalyst pores that lead to the blocking of the active sites and partial ingredient changes in the catalyst.

In the paper entitled “Highly Selective Reduction of Bio-Based Furfural to Furfuryl Alcohol Catalyzed by Supported KF with Polymethylhydrosiloxane (PMHS),” Z. Yu et al. present an economical and benign catalytic system, containing an easily prepared and reusable catalyst 5 wt.% KF/ZrO₂ and a low-cost hydrogen source PMHS, which is efficient for hydrogenation of furfural (FUR) to high-value furfuryl alcohol (FFA) under mild reaction conditions. A high FFA yield (97%) and FUR conversion (99%) can be obtained over KF/ZrO₂ at 25°C in just 0.5 h, which is superior to those attained with other tested catalysts. It is found that the performance of KF/ZrO₂ is remarkably affected by acid-base properties of the ZrO₂ support and KF loading dose. In addition, the KF/ZrO₂ catalyst can be recycled at least five times, with the FFA yield decreasing from 97% to 71%, which is attributed to the catalyst pores covered by the PMHS-based resin.

In the paper entitled “Formaldehyde Use and Alternative Biobased Binders for Particleboard Formulation: A Review,” S. W. Kariuki et al. overview the application of starch as an alternative binder to formaldehyde in formulation of

particleboard. The use of the modified starch is illustrated to show increased particleboard performance. The authors point out that mechanical strength, such as modulus of rupture, modulus of elasticity, and internal bonding in particleboards, however, remains to be a challenge.

In the paper entitled “Solid-Phase Preparation of Al-TiO₂ for Efficient Separation of Bioderived Product Danshensu,” F. Chang et al. prepare four Al-TiO₂ solid samples with different Ti/Al ratios of 1:0.1, 1:0.09, 1:0.07, and 1:0.05 synthesized by a solid-phase synthesis method, which are characterized by XRD, SEM, EDS, BET, and other techniques. These Al-TiO₂ samples were tested to have good adsorption and desorption ability, in which the solid Al-TiO₂ with a Ti/Al ratio of 1:0.05 is more suitable for the separation of Danshensu. A high adsorption of 77.70% is attained after 2 h adsorption time with a pH value of 3, and a high desorption rate of 70.29% was received at the sample concentration of 3.0 mg/mL with 80% ethanol eluent.

In the paper entitled “Kinetic Study of Biodangerous Methylmercury Degradation under Various Light Conditions,” Y. Zhang et al. investigate the kinetics and mechanism of methylmercury (MeHg) degradation under UVB, UVA, natural light, and dark and disclose that light radiation can enhance MeHg degradation but has no significant influence on the final balance between MeHg and inorganic Mercury (Hg²⁺) in pure water. This balance can be used as a key fundamental to estimate MeHg cycling in other complicated aquatic environments.

In the paper entitled “High CO₂ Adsorption Enthalpy Enabled by Uncoordinated N-Heteroatom Sites of a 3D Metal-Organic Framework,” Y. Zhao et al. examine the CO₂ adsorption properties of a prepared 3D metal-organic framework, Mn₂L₂(H₂O)₂·(DMF), with uncoordinated N-heteroatom sites. The uncoordinated nitrogen heteroatom sites are uncovered to markedly increase the reciprocity between host frame and CO₂ at room temperature, therefore showing high adsorption enthalpy of CO₂.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this Special Issue.

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