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Editorial

Chemicals, Materials, and Catalysts from Natural Renewable Lignocelluloses

Xiaofei Tian,[1] Xuebing Zhao,[2] Zhibin He,[3] and Shanghuan Feng[4]

[1]*School of Biology and Biological Engineering, South China University of Technology, Guangzhou 510006, China*
[2]*Department of Chemical Engineering, Tsinghua University, Beijing 100084, China*
[3]*Limerick Pulp and Paper Centre, University of New Brunswick, Fredericton, Canada E3B 5A3*
[4]*Department of Chemical and Biochemical Engineering, Faculty of Engineering, Western University, London, Canada N6A 3K7*

Correspondence should be addressed to Xiaofei Tian; xtien@scut.edu.cn

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Lignocelluloses consist of the biopolymers of cellulose, hemicellulose, and lignin that form a natural structural matrix. Representing one of the most abundant renewable natural resources, the utilization of lignocelluloses does not necessarily impact the environment and land use. The substitution of traditional fossil resources by the three major biopolymers as sustainable feedstock has been extensively investigated for the manufacture of high value-added products including biofuels, commodity chemicals, biobased functional materials, and heterogeneous catalysts that could be directly applied for promoting the manufacturing processes. Effective separation and conversion techniques would play a significant role in economic viability of manufacturing these products from the lignocellulosic feedstock. Aiming at improving the conversion effectiveness or developing innovative techniques for new value-added products, this special issue was conceived for the collection of studies on state-of-art techniques developed specifically for producing chemicals, materials, and catalysts from the lignocellulosic feedstock.

In the natural source of cell walls, hemicellulose and lignin can be closely linked together in a homogeneous state to form the lignin-carbohydrate complexes (LCC). Recently, the great strength and good biocompatibility of the lignin composition, as well as the stimulation of the animal cell adsorption and growth by the containing galactose composition, were reported. In the study entitled "Lignin-Carbohydrate Complexes Based Spherical Biocarriers: Preparation, Characterization, and Biocompatibility," H. Zhao et al. prepared porous spherical carriers from the natural LCC isolated from the xylem of *Ginkgo biloba* L. with a high physical strength. Because it contains the galactose unit, the carriers are very biocompatible to human hepatocytes. It shows a good promise of the LCC to be introduced as a biomedical supporter in the tissue engineering.

Nanofibrillated celluloses (NFCs) are high value-added cellulosic materials for their high strength, high Young's modulus but low coefficient of thermal expansion and transparency. The NFCs were mechanically prepared from lignocellulosic biomass in the industry. However, the natural cellulose showed a strong resistance against the mechanical fibrillation. The low yield, high degradation, and low energy efficiency always challenge the current mechanical preparation of NFCs. In the study entitled "Ozone Oxidation of Kraft Bamboo Pulp for Preparation of Nanofibrillated Cellulose," M. Liu et al. developed a novel green approach for NFC production from the low-cost Kraft bamboo pulp. Results showed that the NFC product could be efficiently produce through the homogenization method combined with the advanced oxidation technique using ozone. The prepared NFC had a high aspect ratio of length (≥250 nm) versus width (10–20 nm). In the study entitled "Preparation and Characterization of Nanofibrillated Cellulose from Bamboo Fiber via Ultrasonication Assisted by Repulsive Effect," Z. Hu et al. reported an alternative process to efficiently isolate the NFCs from bamboo fiber using ultrasonic homogenization with the assistance of negatively charged entities. As the presence of the carboxyl groups attributed

to the ionic repulsion between the carboxylate groups of the cellulose chains, the number of carboxyl groups that had led to the addition of negative charge played a critical role in the dispersion of NFCs. Ultrasonic homogenization could contribute to a further augmentation of the surface charge by destroying the crystal structure of the cellulose composition.

Carbonaceous adsorbents derived from lignocellulosic biomass could be applied in removal of heavy metals from aqueous environments. In the study entitled "Valorizing Rice Straw and Its Anaerobically Digested Residues for Biochar to Remove Pb(II) from Aqueous Solution," both the rice straw and its anaerobically digested residues (ADR) were valorized to biochar through the pyrolysis approach. Results showed that the Pb(II) absorption capacities of biochar produced from the rice straw and its ADR at 500°C were 276.3 and 90.5 $mg \cdot g^{-1}$, respectively. Different adsorption mechanisms acted between the biochar produced from the two biomass resources. The biochar from the rice straw promised an efficient adsorbent for removal of the Pb(II) from aqueous solutions, in which the existence of the carbonates and carboxylates was considered to be responsible for the promoted adsorption efficiency.

Soybean straw is a renewable resource in agricultural byproducts. In the study entitled "Evaluation of Alkali-Pretreated Soybean Straw for Lignocellulosic Bioethanol Production," S. Kim tested the potential of the soybean straw to be used as the raw material for lignocellulosic bioethanol production. The results showed that the alkali-pretreatment with sodium hydroxide could remove the lignin and hemicellulose from the soybean straw effectively. The enzyme digestibility of the raw material was promoted leading an over 90% of the cellulose composition converted to fermentable sugars catalyzed by the commercial Cellic CTec2 enzyme cocktail. The ethanol yield was 0.305 g ethanol/g dry soybean straw through the simultaneous hydrolysis and fermentation process under the optimal condition. The ethanol productivity from soybean straw was greatly enhanced by the pretreatment using sodium hydroxide.

We hope all the work above in this special issue could provide useful information and shall technically contribute to further development of the biorefinery field.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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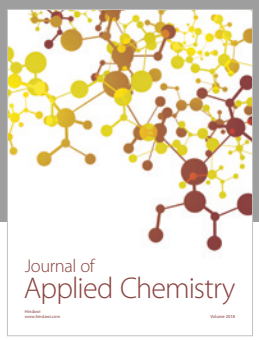
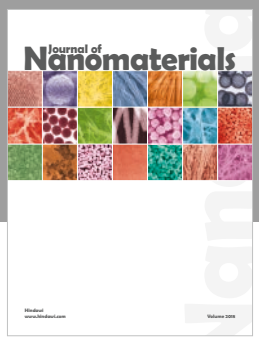
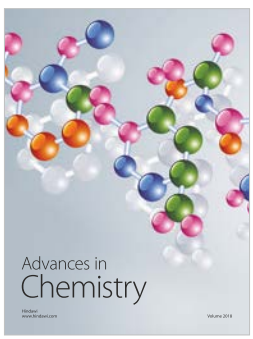
Xiaofei Tian
Xuebing Zhao
Zhibin He
Shanghuan Feng







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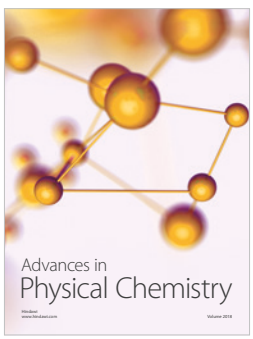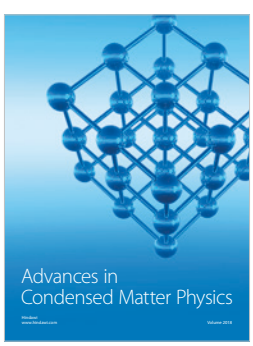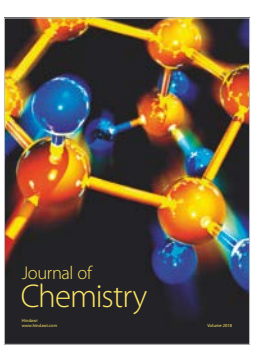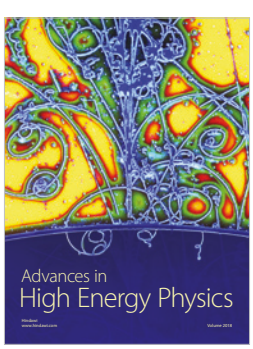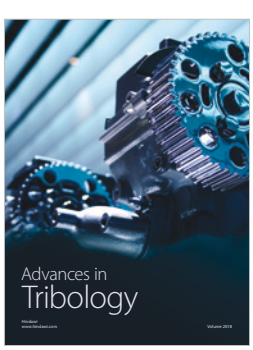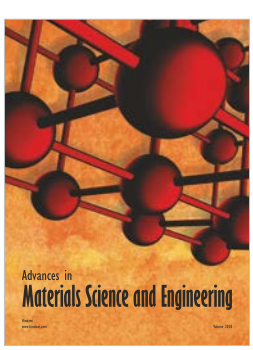
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