

Editorial

# Catalytic Transformation of Renewables (Olefin, Bio-Sourced, et al.)

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The objective of this Special Issue is to provide new diverse contributions that can demonstrate recent applications in biomass transformation using heterogeneous catalysts. In recent decades, a wide variety of biomass-derived chemicals have emerged as key platform chemicals for the production of fine chemicals and liquid fuels using heterogeneous catalysts as the preferred option for most of the developed and proposed catalytic processes. A range of heterogeneous catalysts have been evaluated for effective biomass conversion, such as supported metal nanoparticles, mixed metal oxides and zeolites, where the control of particle size, porosity, acid-basic and redox properties is crucial for providing active, stable and selective heterogeneous catalysts. Moreover, the crucial role of the solvent, choice of reactor design and final chemical processes for controlling activity, selectivity and deactivation phenomena has been demonstrated.

In this Special Issue, 14 articles and 1 review are presented. The article by Thivasasith and co-workers demonstrates the efficient conversion of glucose to hydroxymethylfurfural (HMF) by using Sn-Beta zeolites as heterogeneous multifunctional catalysts and demonstrating the role of Sn and beta zeolite for transforming glucose in an efficient and selective way under relatively mild reaction conditions [1]. Grunwaldt and co-workers showed the influence of the gold nanoparticle size for the catalytic oxidation of 5-hydroxymethylfurfural to produce 2,5-furandicarboxylic acid, by synthesising supported gold colloidal nanoparticles, and by optimising the particle size of Au, the yield to FDCA (2,5-furandicarboxylic acid) was successfully increased up to 92% [2]. In another study, Wojcieszak and co-workers investigated the liquid phase oxidation of HMF and furfural using supported bimetallic AuPd nanoparticles and base free conditions [3]. By tuning the Au-Pd atomic ratio, they succeeded in optimising activity and selectivity towards the desired products. In a following study, the same group reported the liquid phase furfural oxidation in batch and continuous flow conditions using hydrotalcite-supported gold nanoparticles [4]. By tuning Mg:Al molar ratios they succeeded in tuning the acid-base properties of the hydrotalcite-supported nanoparticles and to find the optimum catalyst for transforming furfural to furoic acid with 100% yield and they demonstrated the issues of stability of these catalysts by using continuous flow systems. Villa and co-workers studied the effect of the capping agent of Pd-supported nanoparticles for the hydrogenation of furfural. They demonstrated that by controlling the temperature of the preparation for the preformed Pd colloidal nanoparticles and by altering the stabiliser, the activity and selectivity to the desired products could be controlled. Their studies showed the influence not only of the particle size of Pd but also of the nature of support for affecting the adsorption of the reactant on the Pd active sites [5]. Marinas and co-workers studied the MPV (Meerwein–Ponndorf–Verley) reduction of furfural to furfuryl alcohol using Mg, Zr and Ti mixed systems. Considering the environmentally friendly process of the reduction of a carbonyl compound through hydrogen transfer from a secondary alcohol, the group reported the reduction of furfural to furfuryl alcohol, and it was reported that the presence of Lewis acid sites and especially of acid-base pair sites can favour the MPV reaction [6]. Li and co-workers studied the synthesis of furfuryl alcohol from furfural using a biocatalytic approach. The reduction of furfural was reported in the presence of immobilized



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*Meyerozyma guilliermondii* SC1103 cells. The biocatalytic process was optimised, and 98% conversion of furfural with selectivity over 985 was achieved. Moreover, the scale up process demonstrated that the furfuryl alcohol productivity can be increased significantly and is among the highest values reported for the biocatalytic synthesis of furfuryl alcohol [7]. Albonetti and co-workers investigated the hydrodeoxygenation of furfural over Fe-containing MgO catalysts using methanol as a hydrogen donor and continuous flow conditions [8]. They reported the production of 2-methylfuran with 92% selectivity, by tuning the content of Fe and, therefore, the content of Lewis acid sites on the basic support. FTIR (Fourier Transform Infrared Spectroscopy) has been used to study the reaction mechanism and especially under which reaction conditions hydrogen transfer reduction or methanol dehydrogenation and/or methanol disproportionation happens during the process. The oxidative condensation of furfural with ethanol and using Pd-based catalysts was studied by Maireles-Torres and co-workers [9]. Particularly, they focused on studying the influence of the support using acidic and basic materials. They concluded that the presence of basic sites can lead to a beneficial effect on the catalytic activity, and the best activity was reported when MgO was the chosen support with 70% yield to furan-2-acrolein. The combination of PdO particles with the high basicity of the MgO was responsible for the improved catalytic behaviour observed. Tungasmita and co-workers synthesised nickel phosphides supported on MCM-41-based materials, and they demonstrated the one pot catalytic conversion of cellobiose to sorbitol, which is one important product from the biomass family [10]. By varying the Ni to P atomic ratio, they optimised the conversion and yield to sorbitol, and by characterisation studies, they reported that the most active phase is in the presence of Ni<sub>12</sub>P<sub>5</sub>. The autocatalytic fractionation of wood hemicellulose was reported by Parajo and co-workers [11]. *Eucalyptus globulus* wood samples were treated with hot, compressed water (autohydrolysis) in consecutive stages under non-isothermal conditions in order to convert the hemicellulose fraction into soluble compounds through reactions catalysed by in situ generated acids. The concentration profiles determined for the soluble saccharides, acids, and furans present in the liquid phases from the diverse crossflow stages were employed for kinetic modelling, based on pseudohomogeneous reactions and Arrhenius-type dependence of the kinetic coefficients on temperature. Galvita and co-workers reported the design and optimization of an industrial ethanol dehydration by employing a multiscale model ranging from nano- and micro-, to macroscale [12]. The intrinsic kinetics of the elementary steps was quantified through ab initio obtained rate and equilibrium coefficients. Heat and mass transfer limitations for the industrial design case were assessed via literature correlations. The developed industrial reactor model indicated that it is not advantageous to utilize feeds with high concentrations of ethanol, since a lower ethanol conversion and ethene yield were observed. Li and co-workers reported the synthesis, characterisation and catalytic performance of MFI zeolite derived from different silica sources [13]. The dry gel conversion (DGC) method was used to synthesize silicalite-1 and ZSM-5 with MFI structures. From the characterization results, it was reported that the high-quality coffin-like silicalite-1 was synthesized using silica spheres with a particle size of 300 nm as a silica source. The performance of aqueous phase eugenol hydrodeoxygenation over the Pd/C-ZSM-5 catalyst was evaluated, and it was shown that high hydrocarbon selectivity up to 74% could be achieved with eugenol conversion of 97%. Yu and co-workers showed the influence of the Co/SBA-15 catalyst texture, such as pore size and pore length, on Fischer-Tropsch (FT) synthesis [14]. The authors reported that the increase in pore size could improve the activity of the Co/SBA-15 catalyst until a certain value. Moreover, it was also found that the pore length of the Co/SBA-15 catalyst played a key role in the catalytic activity. CO<sub>2</sub> and C<sub>4</sub>+ selectivity was 2.0% and 74%, respectively, during the simulated syngas (64% H<sub>2</sub>: 32% CO: balanced N<sub>2</sub>) FT over the Co/SBA-15 catalysts, and CO conversion rate and CH<sub>4</sub> selectivity were 10.8% and 15.7%, respectively, after 100 h time on stream. Finally, one review is presented in this Special Issue, focusing on the usage of zeolites as acid/basic solid catalysts and on recent synthetic developments. De Luca and co-workers present, in this review, the key properties of zeolites as acid, both

Lewis and Brønsted, and basic solid support [15]. Moreover, their application as catalysts is discussed by reviewing published works, and their still unexplored potential as a green, mild and selective catalyst is also reported.

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