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Editorial

Editorial: A Special Issue on "Catalytic Processes in Biofuel Production and Biomass Valorization, 2nd Edition"

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The depletion of fossil fuels, attributable to the rapid increase in the world's population and the growth of industrialization, is estimated to run out in less than ten decades if not replaced by alternative energy sources [1].

The emissions produced by the combustion of fossil fuels, containing carbon dioxide, carbon monoxide, nitrogen and sulfur oxides, organic compounds, and particulate matter, are the main causes of climate change [2].

The discovery of alternative energy resources that can replace conventional fuels has captured the attention of the scientific community. Among them, the production of biofuel and the valorization of biomasses have become the goal of several research studies [3].

Following the success of the first edition of the Special Issue "Catalytic Processes in Biofuel Production and Biomass Valorization" [4], the second edition has based its focus on the recovery of biomass, the identification of alternative sources as raw materials, and the use of new catalysts in biofuel production. The topics of this Special Issue include conceptual and experimental contributions, published in one review article and six original research papers.

Kim et al. (Contribution 1) presented a review describing efficient, economical, and environmentally friendly nanotechnological processes for the production of bioethanol from lignocellulosic biomasses. These magnetic nanoparticles present the advantage of reducing the cost of processes through an easy recovery and reuse of immobilized enzymes. Moreover, they can also be used to control the encapsulation and delivery of nutrients, vitamins, or cofactors for ethanol production in order to optimize fermentation performance and yeast metabolism. Nanofiltration and reverse osmosis membranes can improve the separation and purification of ethanol, enhancing the purity and yield of processes.

Guazzaroni et al. (Contribution 2) isolated a new pyoverdine-producing *Pseudomonas aeruginosa* strain (EL14) from a microbial biofuel cell biofilm to produce organic acids and 1,3-propanediol (1,3-PDO) from glycerol oxidation, with higher yields compared to those obtained in the fermentative system, resulting in a promising biocatalyst for bioelectricity generation.

Pompelli et al. (Contribution 3) showed the chemical composition of the seeds of edible species *Annona squamosa*, *Curcubita maxima*, *Euterpe oleracea*, *Gossypium hirsutum*, *Malpighia glabra*, and *Spondias tuberosa* and non-edible species *Jatropha curcas*, *Moringa oleifera*, *Calotropis procera*, and *Prosopis juliflora* to explore interesting alternatives that can replace soybean or corn oil in biofuel production. Some edible species are grown for their fruit and not for the seed; other non-edible species present a high oil and long-chain polyunsaturated fatty acid content. Thus, their production can be improved with the full use of the fruit, the seed, and the residual of oil extractions, which contain a low ash content and high levels of fibers, proteins, and carbohydrates.

Mateus et al. (Contribution 4) described a comparative study of the use of *Eucalyptus globulus* sawdust and bark as a promising feedstock biomass for bio-oil production with a conversion greater than 90% in laboratory-scale liquefaction experiments. The high-added-value compounds derived from the depolymerization of the biomass, such as furfural,

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lactic acid, and levulinic acid, were identified. Furthermore, the repolymerization reactions mediated by free radicals influenced the properties and quality of the bio-oil.

Shafi et al. (Contribution 5) highlighted the promising potential of mussel shell-derived calcium oxide as a sustainable catalyst for converting *Jatropha curcas* oil into biodiesel. The catalyst exhibited an impressive 99.36% yield of Fatty Acid Methyl Ester (FAME) in transesterification, demonstrating exceptional reusability and surpassing traditional homogeneous catalysts in five cycles.

Ruffo et al. (Contribution 6) demonstrated the potential of a panel of iron(III) complexes containing salophen ligands, with various substituents on the arene rings, in the production of biodiesel from vegetable oils. The unsubstituted species demonstrated to be the most active homogeneous catalysts, even at very low loadings, showing the capability to achieve complete conversion of the oil, under convenient conditions.

Kingkam et al. (Contribution 7) investigated the use of cerium oxide that was extracted from monazite with calcium oxide as a solid catalyst for biodiesel production. The $CaO@CeO_2$ catalyst used for the transesterification reaction of palm oil to produce biodiesel reached an optimum yield of 97%, showing that the high catalytic activity and stability allowed the combined catalyst to be a promising candidate for industrial-scale biodiesel production.

All these topics and original papers have contributed to broadening and improving the vast panorama of research in the field of biofuels and biomass, enabling new perspectives to be revealed in the sustainable energy sector.

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