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Editorial

Current Advanced Technologies in Catalysts/Catalyzed Reactions

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Currently, catalysis represents an exciting research area. Catalysis underpins a diverse array of technologies that define our modern world from fuels that power our vehicles to medicines that improve our lives. This Special Issue delves into the cutting edge of this vibrant field, showcasing current advanced technologies that are revolutionizing the way we design, prepare, and utilize catalysts. The articles present a range of advancements in catalysis across diverse areas, including environmental remediation, energy production, and organic synthesis. This Special Issue provides an important snapshot of the current advancements in various areas of environmental and energy science.

Contribution 1. Wastewater Treatment:

The first contribution details the fabrication of $FeCl_3$-$NaBH_4$-modified mango seed shell (MS)-based hybrid composite ($FeCl_3$-$NaBH_4$/MS) and sodium alginate-modified mango seed shell (MS)-based composite (Na-Alginate/MS) beads for the adsorptive removal of 2,4,6-trichlorophenol from aqueous media.

Contribution 2. Biofuel Production:

The second contribution analyzes the catalytic activity of a commercial catalyst by treating it with oxalic acid, NaOH, and other essential acidic compounds. As the results show, the treated commercial catalyst yielded a better 1,3-butadiene production than the untreated catalyst. In addition, the presence of oxalic acid in combination with NaOH provides a good desilication process and increases the catalyst's acidic properties. This opens the door for new biofuel production routes.

Contribution 3. Pest Control and Drug Discovery:

The third contribution describes the novel one-pot synthesis of benzopyrano-pyrimidine derivatives with nematocidal properties, which was developed using P-toluene sulfonic acid as a catalyst. Molecular docking studies provided insights into their mode of action, potentially paving the way for new pest control strategies.

Contribution 4. Water Purification:

The fourth contribution discusses the preparation of magnetic sugarcane bagasse ash (MBGA) via a simple co-precipitation route. The results indicated that nearly 100% of the tetracycline (TC) concentration (or degradation of 40 mg of TC) could be achieved. This value is far higher than those reported in many studies. Furthermore, the catalyst exhibited a high degradation of TC, even after four cycles, with excellent magnetic properties being retained.

Contribution 5. Bioenergy:

The fifth contribution presents the RSM that was utilized to study the correlation between the power density output and the flow rate of the fuel feed to the anodic chamber, the initial concentration of acetate in the anodic chamber, and the initial concentration of O_2 in the cathodic chamber. This study provides valuable insights into maximizing bioelectricity generation from organic waste.

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Contribution 6. Fuel Synthesis:

The sixth contribution investigates cobalt–manganese bimetallic catalysts synthesized using acid and thermally treated CNT substrates through the SEA process. The efficiency of various percentage formulations of the Co-Mn catalyst supported on CNT was verified by the FTS reaction. The 95Co5Mn/CNT catalyst exhibited high stability for more than 45 h. It was concluded that the reaction variables had a high impact on the catalytic activities and product selectivities during the FTS process.

Contribution 7. Ethanol Production:

The seventh contribution explores recent advancements in ethanol production technologies and catalytic processes, highlighting promising avenues for sustainable and efficient biofuel production. The catalytic hydrogenation of CO_2 is a development direction for the production of ethanol that reduces environmental pollution problems. The limitations of CO_2, a fully oxidized, chemically inert, and thermodynamically stable molecule, should be considered when designing research because its conversion into chemicals requires large amounts of energy and H_2.

Contribution 8. CO_2 Utilization:

The eighth contribution highlights the progress made in the use of three-dimensional (3D) nanomaterials and their compounds and methods for their synthesis in the hydrogenation of CO_2. The development of 3D nanomaterials and metal catalysts supported on 3D nanomaterials is important for CO_2 conversion because of their stability and ability to continuously support catalytic processes, in addition to their ability to reduce CO_2 directly and hydrogenate it into oxygenated hydrocarbons.

Contribution 9. Environmental Remediation:

The ninth contribution focuses on metal oxides used as photocatalysts for the degradation of various types of pollutants. The progress of research on metal oxide nanoparticles and their application as photocatalysts in organic pollutant degradation is highlighted. The application of nano-based materials can be a new horizon for the use of photocatalysts for organic pollutant degradation.

Contribution 10. Plastic Waste Recycling:

The tenth contribution examines recent progress in developing low-cost catalysts for the pyrolysis of plastic waste into fuels. This research contributes to closing the loop on plastic waste management and promoting circular economy approaches. The development of low-cost catalysts is revisited to design better and more effective materials for plastic solid waste (PSW) conversion to oil/bio-oil products.

Overall, this Special Issue reflects a vibrant and diverse field of research that addresses crucial challenges in sustainable development, environmental remediation, and resource utilization. The development of new catalysts, reaction optimization, and material design shows strong potential for future advancements in various sectors. This highlights the potential of novel catalysts and catalytic processes to address pressing environmental and energy challenges while also paving the way for new applications in organic synthesis and other fields. Thus, we embark on this important exploration of current advanced technologies for catalysts/catalyzed reactions. Prepare to be inspired, informed, and empowered by the knowledge contained in these articles. The future of chemistry is catalyzed, and this Special Issue is a guide to its possibilities.

Conflicts of Interest: The authors declare no conflict of interest.

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