

# Sustainable and Green Technologies for Industrial Chemical Engineering

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## 1. Introduction

The aim of this *Eng* Special Issue is to collect experimental and theoretical research relating engineering science and technology to the general topics of *Eng*. In this Special Issue, many of these general topics have been selected with the idea of contributing to the discourse on Sustainable and Green Technologies. Therefore, these aspects are being addressed from various points of view and have the support of this fascinating field of engineering and its applications.

In recent years, there has been a paradigm shift towards greener processes/products, with a particular emphasis on sustainability. Manufacturing processes require reworking and adapting new methods to ensure they are more efficient, cleaner, less polluting and ideally cost effective. There are multiple sectors of the bio-based and chemical market that can be adapted towards greener initiatives, for example, bio-based chemicals, biofuels and biomaterials and the concept of waste-to-energy [1]. This Special Issue focuses on greener and more sustainable processes for chemical and feedstock substitutes, with a focus on where bio-based products can be introduced into the petroleum-driven market as a drop-in replacement or functional replacement and/or through novel products.

For many years, environmental problems were considered to be caused by the economic system and the rapid use of natural resources [2]. It has taken many years to establish the use of materials (raw materials), the initial design of chemical processes, hazardous properties of products, energy consumption and other parameters involved in the manufacture of products, such as life cycle, recycling, etc.

The rapid development of new chemical technologies and the huge amounts of innovative chemical products available have forced attention to focus on corrective actions for harmful impacts. However, the most efficient way to reduce negative impacts is to design and innovate manufacturing processes, taking into account, for example, energy, materials, the use and generation of secondary materials that are hazardous and, finally, the life cycles of products and their recycling into new materials [1].

Green chemistry involves other synthetic routes that are more environmentally friendly. Green technologies investigate alternative reaction conditions, alternative media (solvent-free) and even alternative energy sources [3]. Designing chemical products and processes that reduce or eliminate the use and generation of hazardous substances is the most fundamental approach to pollution prevention. Green chemistry addresses the need to produce the goods and services that society depends on in a more environmentally friendly manner. Pharmaceuticals can be produced while minimizing the amount of waste generated, biodegradable plastics can be synthesized from plants and reactions can be performed in water instead of traditional organic solvents by applying the principles of green chemistry to chemical products and processes.



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The principles of green engineering are based on the principles of green chemistry, established by Paul Anastas and Julie Zimmerman [2,3]. These principles recommend a basis for researchers and technologists to apply in the design of new materials, products, processes and systems. Products, processes and systems can be made more intrinsically benign by changing the inherent nature of the system or the circumstances/conditions of the system to reduce the problem of toxins and associated exposure to harmful effects (or both).

These are some of the aspects that have been covered in this Special Issue and that may allow for greater discussion among potential readers of it. For more information, please see the List of Contributions.

## 2. Overview of the Published Articles

This Special Issue contains up to 10 papers, including 1 *Review*, published by several authors interested in new cutting-edge developments in the field of engineering. The submitted papers are from authors from 10 countries, namely Brazil, Germany, Greece, Iraq, Morocco, Romania, Russia, Spain, Ukraine and USA.

## 3. Conclusions

The articles published in this Special Issue present important advancements in the topics of our journal. I would like to express my sincere gratitude to all the authors, who have professionally and enthusiastically wanted to contribute to this Special Issue, and I would also like to thank the Managing Editors and reviewers who helped to improve the papers and made important contributions to this Special Issue. I hope that the articles showcased in this Special Issue are interesting and inspiring for its readers, especially young scholars who are eager to learn about recent advances and contribute future research in the field.

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