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Editorial

Special Issue on "Advances in Bioprocess Technology"

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This Special Issue, "Advances in Bioprocess Technology", focuses on the latest advancements in sustainable bioprocess technologies. These technologies encompass a variety of processes such as bioenergy production from lignocellulosic materials, biomass gasification, biofuel and bioproduct generation from agricultural waste, enzymatic bioprocessing, food fermentation, and the optimization, scale-up, and modeling of bioprocesses.

Bioprocess technology involves applying technological advancements to biological processes to produce industrially significant products or to increase the production levels of naturally limited products [1]. It generally combines traditional and modern biotechnology processes, utilizing entire living cells—whether plant, microbial, or mammalian—or their components, such as organelles or enzymes, as biocatalysts. These biocatalysts accelerate the process by inducing physical or chemical changes in biochemical materials derived from carefully designed media, ultimately producing specific, desirable end products [2].

The key stages in bioprocess technology include substrate and media preparation, biocatalyst selection and optimization, large-scale production, downstream processing, purification, and final product formulation.

A bioprocess can commonly be divided into three stages:

- Stage I: Upstream processing, which involves the preparation of the liquid medium, the separation of particulate and inhibitory chemicals from the medium, sterilization, air purification, etc. [3]. Upstream processes include the selection of a microbial strain characterized by the ability to synthesize a specific product having the desired commercial value. This strain then is subjected to improvement protocols to maximize the ability of the strain to synthesize economical amounts of the product [4].
- Stage II: Fermentation, which involves the conversion of substrates to desired product with the help of biological agents such as microorganisms [5]. Techniques for the large-scale production of microbial products must both provide an optimum environment for the microbial synthesis of the desired product and be economically feasible on a large scale [6].
- Stage III: Downstream processing, which involves the separation of cells from the fermentation broth, the purification and concentration of the desired product, and waste disposal or recycling [7,8].

By covering these critical aspects, this Special Issue aims to showcase diverse and cutting-edge research that pushes the boundaries of current bioprocess technologies. The contributions highlight the integration of biological insights with engineering principles to develop efficient, sustainable, and commercially viable processes. In particular, the SI includes original papers on experimental and theoretical studies, with a particular interest in manuscripts that integrate biological and engineering research. Researchers from various areas of bioengineering have contributed innovative approaches and findings that push the boundaries of current bioprocess technologies.

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In conclusion, this Special Issue advances our understanding of bioprocess technology by integrating biological insights with engineering principles to develop efficient, sustainable, and commercially viable processes. The contributions of the authors and the critical assessments by reviewers have ensured the high quality of the presented research. By showcasing the latest developments, this Special Issue fosters knowledge exchange and collaboration, ultimately promoting sustainable industrial practices and inspiring further innovation in the field.

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