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Editorial

Photosynthetic Microorganisms: Cultivation and Application

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Photosynthetic microorganisms such as microalgae, cyanobacteria, and purple bacteria have attracted much interest as promising platforms for the sustainable production of high-value products and bioenergy. They are fast-growing organisms that can achieve high biomass productivity and primarily use sunlight as an energy source. Commercialization of photosynthetic microorganisms as feedstock for natural products and biofuels requires the use of efficient cultivation systems. Photobioreactors are closed systems that operate either outdoors or indoors and provide good process control. They must be designed to provide symmetrical light distribution and efficient mixing to ensure homogeneous illumination of the culture. This Special Issue brings together articles dealing with the application of photosynthetic microorganisms in environmental biotechnology.

Four papers were selected for publication. Three are original studies [1–3] proposing the biotechnological application of photosynthetic microorganisms and one is a literature review [4].

Touloupakis et al., in the paper "Poly-β-Hydroxybutyrate Production by *Rhodopseudomonas* sp. Grown in Semi-Continuous Mode in a 4 L Photobioreactor", investigated the effect of acetate on *Rhodopseudomonas* sp. growth and poly-β-hydroxybutyrate production in a 4 L photobioreactor [1]. The use of the photobioreactor allowed optimal cell growth under well-controlled culture conditions. The cultivation process was divided into a symmetrical growth phase and a poly-β-hydroxybutyrate accumulation phase separated temporally.

Faraloni et al., in the paper "Impact of Light Stress on the Synthesis of Both Antioxidants Polyphenols and Carotenoids, as Fast Photoprotective Response in *Chlamydomonas reinhardtii:* New Prospective for Biotechnological Potential of This Microalga", studied the induction of synthesis of carotenoids and polyphenols in *Chlamydomonas reinhardtii* under high light [2]. In *Chlamydomonas reinhardtii,* increasing light intensity symmetrically led to increasing accumulation of carotenoids and phenolic compounds.

Mountourakis et al., in the paper "The Microalga *Chlorella vulgaris* as a Natural Bioenergetic System for Effective CO_2 Mitigation—New Perspectives against Global Warming", studied the metabolic and functional differentiation of *Chlorella vulgaris* under different light intensities and CO_2 concentrations [3]. Asymmetries arising from different light intensities and CO_2 concentrations induce metabolic and functional changes. The results demonstrate the ability of *Chlorella vulgaris* to modify hostile CO_2 atmospheres by photosynthetically utilizing solar radiation to convert CO_2 to O_2, which benefits the organism and produces a microalgal biomass rich in carbohydrates and lipids.

Sepúlveda-Muñoz et al., in the literature review "Wastewater Treatment Using Photosynthetic Microorganisms", investigated the fundamentals, symmetry and asymmetry of wastewater treatment with photosynthetic microorganisms [4]. The main photobioreactor configurations as well as the potential of photosynthetic microorganism biomass valorisation strategies are also discussed.

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

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