Assessing environmental impacts through innovative solutions

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The present editorial introduces to a special issue in *Environmental Science and Pollution Research* journal, focusing upon selected papers presented at the Sixth International Symposium on Green Chemistry, Sustainable Development and Circular Economy that took place in Thessaloniki, Greece, in September 2020 (GreenChem6).

The main symposium goal was to bring scientists, professionals, and researchers from various areas together, to present and discuss topics related to Green Chemistry, sustainable development, and circular economy for a better environment and a healthier life. Considering the transition to circular economy, the European Green Deal strategy as well as the 17 SDG that UN has announced, innovative solutions on proposed strategies are imperative. Environmental impact can be estimated through evidence and should not be made on assumptions, and these need to be based on a robust understanding of the socio-economic effects of public and industrial intervention. Innovation is expected to diminish amounts of waste, air pollution, and material resource exhaustion and to increase the reuse of other materials, in order to facilitate in the successful transition to circular economy.

Research and innovation policy supports a range of research activities to offer direct and indirect provisions to technology diffusion. Limited consideration of the environment or creation of negative environmental impacts jeopardizes the entire sustainability level. When the system underperforms and the innovation potential cannot counterbalance environmental deterioration, then the long-term sustainability also fails. This is what Green Chemistry solutions strive to avoid.

As such, scientists, researchers, professionals, environmentalists, and policy makers had the opportunity to present their valuable input to the related conference. They were also able to discuss current issues related to environmental toxicity, risk assessment, environmental protection, and conservation.

The 12 selected articles embody the purposes of the scientific approach of the conference and are briefly discussed here.

The importance of maintaining the marine environment in a healthy state is self-evident. The research carried out by Squadrone et al. (2021) shows that the microplastics can be vectors of metal ions leading to contamination in Mediterranean Sea. It is well known that microplastics are contaminants of great environmental concern as they can increase the enrichment capability of other pollutants, causing their entry in the marine food web.

The heterotrophic cultivation of *Chlorella vulgaris* grown with glycerol was investigated by Gougoulas et al. (2021). The investigation of the kinetics of the heterotrophic growth of *Chlorella vulgaris* as a means of producing bio-oil for biodiesel is the main aim of the research. Anaerobic digestion was found to be of potential use in the formulation of bioreactor culture media, reducing the use of potassium, phosphorus, and micronutrients from natural resources.

Furthermore, Meng et al. (2021) created an evolutionary game theory-based analysis for the dynamic reward and penalty strategies of green building construction incentive. It is stressed therein that the contractors should actively introduce

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and learn new construction technology, adopt reasonable green technology in combination with local conditions, and comprehensively consider adaptability and economy.

Li et al. (2021) investigated how environmental values impact green product purchase intention regarding green trust. The results revealed that, when green trust was high, environmental concern enhanced the promotion effect of green product purchase intention. It is imperative to establish consumers' green trust in green marketing, as such enterprises should further enhance their certification systems of environmental labels and green products, standardize the certification systems, and strictly control the issuance of green certification marks.

Golia and Diakouloukas (2021) used a robust quadratic regression approach of soil pollution prediction after a 5-year-long field research. They investigated the soil parameters that affect the levels of potentially harmful metals (PHM) in Thessaly area, Greece. Soil reaction, electrical conductivity, organic matter, clay and sand content, exchangeable cations, and metals oxides have been assumed to influence the pseudo-total concentrations of metals in soils of different soil orders. Based on new data collections in the future, the proposed prediction equations could be verified, further optimized, and proved to be accurate enough to serve as a useful tool for PHM's contamination monitoring.

Conversion of brewers' spent grain (BSG) into proteinaceous animal feed using solid state fermentation had been investigated by Eliopoulos et al. (2021). The study highlighted the grain's potential for augmented commercial price which is in the line/related with the protein's content increase achieved by solid state fermentation bioprocess. Thus, the BSG is strongly recommended for animal nutrition for its physicochemical properties as well as for reducing its environmental impact in the context of the circular economy.

Fluopyram removal from rinsing water of agricultural equipment with the use of horizontal subsurface flow pilot-scale constructed wetlands was investigated by Parlakidis et al. (2021). Five pilot-scale constructed wetlands, with different characteristics, were employed in the removal of fluopyram from aqueous solution. Based on the findings of the present study, fluopyram removal was mainly achieved through microbial biodegradation, adsorption on porous media, and bioaccumulation processes. Furthermore, the addition of zeolite as a substrate material caused an enormous increase of fluopyram absorption on porous media.

Charitopoulou et al. (2021) studied the effect of brominated flame retardant on the pyrolysis products of polymers originating in waste of electric and electronic equipment (WEEE). During the solvent casting method, there were obtained two peaks giving a chlorinated compound (2-chlorobiphenyl), due to incomplete evaporation of chlorobenzene (solvent) during the preparation. According to this observation, the melt-mixing method (in an extruder)

may be considered a more advantageous method than the solvent casting, considering that during the former method pyrolysis, products were not affected.

Mavriou et al. (2021) investigated the bioprocess performance, along with the transformation pathway, and the bacterial community dynamics in an immobilized cell bioreactor treating fludioxonil-contaminated wastewater under microaerophilic conditions. The developed immobilized cell bioreactor operating under microaerophilic conditions was proven to be an efficient and cost-effective method for the depuration of fungicide-rich wastewaters generated by the fruit packaging industry.

The production of hydroxytyrosol-rich extract from *Olea europaea* leaf with enhanced biological activity using immobilized enzyme reactors was investigated by Chatzikonstantinou et al. (2021). The proposed bioprocess was economically viable as it employs low-priced enzyme and immobilization matrices while at the same time it demonstrated good productivity. Finally, the proposed process could also be applied for the valorization of olive mill wastewaters, which are also rich in oleuropein and other phenolic compounds that could be exploited by the pharmaceutical and food industry.

Zhao et al. (2021) studied the fabrication of a novel bio-adsorbent (alginate-based composite beads) and its application for the removal of Cu(II) from aqueous solution. The stable surface structure of the adsorbent was confirmed by further characterization analysis. The adsorption performance was evaluated by using batch adsorption experiment, and the maximum adsorption capacity of the beads for Cu(II) was calculated by Langmuir model. The adsorption kinetics studies showed that the adsorption process for Cu(II) was mainly controlled by chemical adsorption, and Langmuir model indeed fitted the adsorption parameter.

Zhang et al. (2022) investigation was concerning the degradation of oxytetracycline by a magnetic MOFs heterojunction photocatalyst with persulfate. The magnetic type was accomplished by a hydrothermal method, which demonstrated excellent degradation performance against the antibiotic in the presence of coupled persulfate. The $\text{Fe}_3\text{O}_4/\text{MIL-101}$ photocatalyst coupled with persulfate is an effective method for the degradation of organic pollutants in water bodies.

The above-mentioned scientific papers mirror the broad and multidisciplinary research presented and promoted in GreenChem6. This joint effort came into fruition due to the dedication and the punctuality of the authors, the professionalism and the commitment of the *ESPR* journal, and the experience and the enthusiasm of the guest editors. We believe that the journal's distinguished readers will find this special issue of particular interest to them.

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