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Editorial

Innovative Materials and Processes for Removal of Biopersistent Pollutants

Andrea Petrella [1,*], Marco Race [2] and Danilo Spasiano [1,*]

1 Dipartimento di Ingegneria Civile, Ambientale, Edile, Del Territorio e di Chimica, Politecnico di Bari, Via E. Orabona 4, 70125 Bari, Italy
2 Dipartimento di Ingegneria Civile e Meccanica, Università degli Studi di Cassino e del Lazio Meridionale, Via di Biasio 43, 03043 Cassino, Italy
* Correspondence: andrea.petrella@poliba.it (A.P.); danilo.spasiano@poliba.it (D.S.)

1. Introduction

The aim of this Special Issue "Innovative Materials and Processes for Removal of Biopersistent Pollutants" (https://www.mdpi.com/journal/processes/special_issues/biopersistent_removal; accessed on 12 January 2023) was to collect researches devoted to the recent progress and new perspectives in the processes of treatment and removal of hazardous artificial contaminants in air, soil, and water supply.

For this purpose, the Guest Editors share some comments. Fifteen papers were submitted, ten of which were published, and the publication times reflected those of the journal.

A range of different but complementary topics were addressed, from environmental regulation [1] to the development of applications that can be useful in supporting decisions [2–4]. Furthermore, many studies analyzed how the modification of some materials can be effective for the reduction in pollutant dispersions [5–9] and the application of an innovative plant configuration [10].

As evidence of the high interest in the topics covered, to date, all the papers have been cited in other works, reaching 18 citations [5], 6 citations [6,7], 5 citations [3,10], 4 citations [4], 2 citations [1,8,9], and 1 citation [2].

The Guest Editors want to thank all the authors for the appreciation received for this Special Issue, and believe that these topics can be a starting point for future research. They also thank the Editors in Chief for the opportunity to coordinate this SI.

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2. Innovative Materials for Removal of Biopersistent Pollutants

In the paper by Lin et al. [8], a mesoporous activated carbon (AC) was prepared from water caltrop husk at 750 °C for 90 min. This material could be used as an excellent adsorbent for the removal of methylene blue from the liquid phase due to its fast adsorption rate and maximal adsorption capacity (126.6 mg/g), and the process could be represented by a pseudo-second-order model.

In the paper by Loffredo et al. [9], a solid by-product named digestate, obtained through anaerobic digestion, was used as a biosorbent of organic and inorganic pollutants in wastewater treatment and soil remediation. The characterization of this material, the qualitative and quantitative aspects of the adsorption/desorption of pesticides and xenoestrogens, and data modeling were examined.

In the paper by Huong at al. [7], Fe-Cu materials were synthesized using the chemical plating method and tested for the removal of phenol from aqueous solution through internal microelectrolysis. Various parameters such as pH, time, Fe-Cu material weight, phenol concentration, and shaking speed were investigated. An evaluation of the optimal process was carried out in real coking wastewater from a coal factory, and resulted in treated wastewater with favorable water indicators.

In the study by Wang et al. [6], TiO_2 nanoparticles were synthesized, characterized, and combined with aged waste reactors to treat landfill leachate. The optimal process conditions were determined, such as the effects of the ultraviolet irradiation time, amount of the catalyst, and pH on the removal efficiency for COD and color in the leachate. The photocatalytic/biological combined treatment of landfill leachate was shown, together with excellent recyclability of the catalyst.

Zhang et al. [5] studied how to modify biochar to cover landfills and simultaneously oxidize methane, in order to reduce emissions into the atmosphere. The biochar was modified in order to increase its hydrophobicity and excellent results were achieved by coupling the silane agent KH-570.

3. Processes for Removal of Biopersistent Pollutants

Through legislation, it is possible to incentivize the progress of green industrial technology. For this reason, Shi et al. [1], took China as a case study and evaluated the effects of environmental regulation on human activities.

In the paper by Petrella et al. [10], an innovative unit was employed for the study of the UV/TiO_2 photo-catalytic degradation of biopersistent textile azo-dyes. The chemical, physical, and hydraulic/hydrodynamic parameters of the system influenced the degradation kinetics. A comparison of the removal efficiencies between dyes such as methyl red and methylene blue was carried out in consideration of the pH of the solution.

Innovative processes for the removal of heavy metals from aqueous solutions were also analyzed in consideration of the sanitary risks and environmental hazards of these toxic compounds [11,12]. In this context, parametric mathematical modelling techniques, such as response surface methodology (RSM) and artificial neural networks (ANNs), have been chosen as a tool for the optimization of operating conditions [13]. In the first paper by Fertu et al. [3], experimental laboratory data on the biosorption of Pb(II), Cd(II), and Zn(II) from aqueous media using soybean and soybean waste biomasses were exploited through modeling and optimization. For this purpose, RSM was used as a model, followed by optimization based on numerical methods. The solutions confirmed the efficiency of the sorbents in the removal of heavy metals and the results were validated experimentally.

In the second paper by Fertu et al. [4], the results of the previous research based on heavy metal retention in soybean and soybean waste biomasses were capitalized. The data were processed by applying a methodology based on ANNs and evolutionary algorithms (EAs), the latter represented by the differential evolution (DE) algorithm. A simultaneous training and determination of the topology was performed, and the hSADE-NN hybrid algorithm was applied to obtain optimal models for the heavy metal retention process.

Finally, a platform to support the drafting of strategic plans aimed at safeguarding water resources was created by Liang et al. [2]. This tool can be used to prevent water pollution and manage emergencies.

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