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Editorial: Environmental remediation strategies of new and emerging chemical contaminants

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Editorial on the Research Topic
Environmental remediation strategies of new and emerging chemical contaminants

The industrial development of the 21st century has led to anthropogenic impacts on Earth. Through the rapid growth of pharmaceuticals, electronics, agrochemicals, and biotech industries which have transformed healthcare, enhanced agriculture, and improved technological innovations, these developments have also led to unprecedented pollution. One of the most severe challenges has been the emergence and proliferation of new and emerging pollutants (NEPs), including antibiotics, antidepressants, microplastics, microbeads, specialty chemicals, etc. These xenobiotic compounds can persist in the environment and exhibit complex behaviors with long-term ecological and health impacts. As the global community increasingly recognizes the hazards associated with NEPs, the need for advanced, sustainable remediation strategies has never been more urgent. This Research Topic, Environmental Remediation Strategies for New and Emerging Chemical Contaminants, aims to address the critical challenges posed by NEPs through innovative research and reviews. It seeks to provide new perspectives on the environmental and health risks associated with NEPs while highlighting novel, sustainable solutions for their remediation. The issue combines the recent advancements in sustainable technologies to tackle these challenges.

Among the NEPs, microplastics have become a serious pollutant affecting terrestrial and aquatic ecosystems. The study Nakei et al. provides a promising solution for tackling plastic pollution in terrestrial and aquatic environments. The study reveals that bioprospecting of agricultural soils, water bodies, and landfills containing plastic wastes can provide highly efficient microbial species for breaking down polyethylene polymers. The ever-increasing use of agrochemicals has led to widespread environmental pollution, demanding urgent measures for restoration and remediation. The paper, Hu et al. examines the enhanced biodegradation capabilities of the microorganisms for more efficient

breakdown of complex agrochemical NEPs as a promising approach for managing the agrochemical pollution. Further, the review Zhou et al. explores the toxicity and bioremediation options for the treatment of carbendazim contaminated residues in agroecosystems. Apart from agrochemicals, another insightful study, Li et al., is particularly helpful in dealing with soil pollution with explosive munition 2,4,6-trinitrotoluene (TNT) and its metabolites.

In recent times, the nano-revolution has also caused the release of nanoparticles (NPs) as an emerging contaminant into the environment, with its remediation remaining an important environmental issue and a global challenge. Carbon nanotubes (CNTs) are a group of NPs that severely impact human health and ecosystems due to their widespread use. In this regard, a study, Takahashi et al., explores applying green chemistry principles to synthesize environmentally friendly catalysts for the degradation of persistent organic pollutants like CNTs. Further, long-term stability and continuity of the CNTs degradation is explored in another study, Takahashi and Hori which provides another innovative approach for bioremediation of NEPs like CNTs. Taking the microbial degradation further, the study, Deng et al. provides three novel species of *Mycobacterium* isolated from polluted soil samples, characterized and evaluated for biodegradation of polycyclic aromatic hydrocarbons (PAHs), which are considered as priority pollutants. Apart from microbial remediation, the issue also explores physicochemical and organic amendments-based solutions for tackling the challenge of NEP remediation (Zha et al.; Zouari et al.).

Researchers have developed a combined waste water treatment approach addressing the challenge of NEP contamination in wastewater Kokilaramani et al. This study reports that photoelectrochemical oxidation offers an excellent solution for wastewater treatment, inhibiting the growth of harmful microbes responsible for biocorrosion and degrading the pollutants in the wastewater stream. Teymoorian et al.

While remediation technologies are of immense importance, understanding the ecological risks posed by NEPs is equally essential. The review, Ferreira et al., provides important insight into how the application of these drugs has increased in time, particularly during the Covid pandemic, and has led to worldwide pollution of biologically active micropollutants. The article emphasizes the microbial degradation of such pharmaceutical compounds through pure isolates and microbial consortia via *in vitro*, *in situ*, and *ex-situ* processes.

With the ever-growing challenge of NEP pollution, the 12 articles published in this Research Topic provide a comprehensive view of challenges, toxicity, and recent advancements in the remediation of NEPs. The present issue addresses the challenges regarding the sources and impacts of NEPs and their remediation. The contributions in this issue pave the way for sustainable pollution control strategies, ensuring cleaner ecosystems and healthier communities. This issue highlights the urgent need for continued innovation and multidisciplinary collaboration to provide effective solutions for the mitigation of NEPs. The Research Topic will be valuable for researchers, policymakers, industry persons, and environmental engineers. This issue's contribution will provide the foundation for future research offering solutions for a clean, green, and safer environment through the mitigation of NEPs.

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