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Editorial: Environmental micropollutants and stressors: environmental impacts, ecotoxicology, risk assessment, and remediation

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Editorial on the Research Topic
Environmental micropollutants and stressors: environmental impacts, ecotoxicology, risk assessment, and remediation

Environmental micropollutants and stressors (EMPS) are emerging environmental issues due to their presence in trace amounts within various environmental matrices and living organisms (Yang et al., 2022). The origin of EMPS is diverse, including pharmaceuticals, pesticides, trace metals, persistent organic pollutants, micro- and nano-plastics, which makes them difficult to regulate, and raises concerns about their potential threats to ecosystems (Narwal et al., 2023). It is thus of great necessity to assess the impacts and ecotoxicological effects of EMPS, and to develop efficient methods for the remediation of polluted environment.

Before developing efficient methods for EMPS remediation, accurate detection and characterization of EMPS should be the priority. Microplastics (MPs) is one of the emerging EMPS, receiving lots of attention on its potential risk for human and aquatic ecosystems. In this Research Topic, Hossain et al. systematically characterized microplastics and assessed the potential risk in bottled drinking water from a developing country (Bangladesh) and in fish culture ponds (Hossain et al.). As bottled water is ubiquitous, MPs in bottled water with different shapes and sizes, as revealed in this study, could pose great threat to human health, which requires close monitoring by the regulatory agencies during manufacturing and packaging. MPs are also widely discovered in various aquatic systems and living organisms. Hossain et al. investigated the sediment and water samples collected from five types of fishponds, to identify, characterize, and assess the contamination risk of MPs. High pollution load index was reported, indicating the high contamination of MPs in aquatic ecosystems.

Long-term cage farming was also reported for its potential soil contamination with EMPS, which requires vertical distribution assessment. Zhen-Zhen et al. investigated the total nitrogen, organic carbon and phosphorus along with sediment depth and discovered the adverse impacts of these environmental stressors after long-term cage farming. Hence, alternating the farming and fallowing period is suggested to mitigate EMPS. To further explore the environmental impacts of EMPS on aquacultural systems, Menon et al. provide an interesting review including aquatic physicochemical factors and oxidative stress physiology in fish. Improved understanding of the roles that living organisms, EMPS and physicochemical factors paly is advised to reduce risks to human health and environmental quality.

Following EMPS detection and characterization, efficient removal techniques are needed. Among these, catalytic degradation of EMPS using various micro- and/or nanomaterials have been widely reported (Narwal et al., 2023). In this Research Topic, Zhang et al. (2023) developed a simple hydrothermal process for the synthesis of cerium and nitrogen co-doped TiO_2 photocatalyst loaded on modified oyster shell powder, which served as an efficient photocatalyst for the glyphosate degradation. With improved specific surface area and photocatalytic property, a glyphosate degradation efficiency of more than 80% could be achieved within 3 h, which shed light on the potential application of this type of efficient and cost-effective photocatalysts for the EMPS removal. Apart from photocatalytic degradation, advanced oxidation processes (AOPs) induced by various catalysts are also commonly employed for the removal of EMPS. Guo et al. provide an example of catalytic ozonation process by developing a magnetic recoverable CeO_2/Fe_3O_4/natural zeolite catalyst for the efficient removal of sulfamethazine. Both studies reported successful implementation of the prepared catalysts for EMPS removal under a wide pH range with excellent reusability, which are major challenges for current environmental catalysts. In addition to catalytic degradation, adsorption using highly porous materials represents another strategy for EMPS removal. Biochar, a cost-effective porous material for adsorption, was decorated with MgO and Fe_3O_4 nanoparticles to boost 7–9 times higher adsorption efficiencies of cadmium in polluted soils (Ding et al.). The exploration of biochar adsorption mechanism and assessment for alleviating Cd stress in real plants marks one step further in terms of the practical implementation of biochar for EMPS removal.

Collectively, the work presented in this Research Topic reveals the impacts of multiple EMPSs on living organisms and ecosystems, and explores several techniques for the EMPS removal. Given the fact that more EMPSs are being discovered with the social and industrial activities, it becomes progressively more important to assess the environmental impacts, ecotoxicology, and risk. The Research Topic provides a glimpse of EMPS work and points out promising new research avenues that will continue to enhance our understanding of the interactions between human activities and ecosystems.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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