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Editorial: Insights in environmental engineering

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Editorial on the Research Topic
Insights in environmental engineering

The Research Topic "*Insights in Environmental Engineering*," cross-listed with the Environmental Catalysis and the Water, Waste, and Wastewater Engineering sections, was initiated on 6 November 2023, and completed on 23 April 2024. Seven papers were published in this Research Topic during its lifespan of less than half a year, including one review, four research, and two perspective articles. A total of 27 authors contributed from nine countries across five continents, including Australia, China, Ethiopia, Germany, India, Spain, Malawi, the United Kingdom, and the United States. This Research Topic, although small, reflects what was intended to solicit in the Research Topic call: forward-looking contributions focused on new insights, novel developments, current challenges, latest discoveries, significant accomplishments, and future perspectives in the field. As of 2 May 2024, it generated 1,018 total downloads and 4,946 total views. Many editors and reviewers have contributed greatly to ensure this Research Topic's timely and quality publications. Their advice and critique have greatly improved the Research Topic's quality through the effective Frontiers interactive review process, which is reflected in the final products.

Two perspective papers in this Research Topic identify the grand challenges and research opportunities in Environmental Catalysis and Water, Waste, and Wastewater Engineering. In "*Grand Challenges Present Great Opportunities in Environmental Catalysis*," Dr. Qingguo (Jack) Huang, Specialty Chief Editor, discusses how more efficient and sustainable catalysis applicable to pollution control, cleaner production, and greener processes provide tools to address the vast challenges that we are facing today, the scarcity of water and the pollution by wastewater, solid wastes, and air/gas emissions (Huang). Furthermore, in his perspective paper titled "*The Grand Challenge of Water, Waste, Wastewater and Emissions Engineering and Valorization*," Specialty Chief Editor Dr. Christian Kennes argues that pollution sources can be considered valuable resources by their reuse, resource recovery, and pollutants valorization. This is a trend in Water, Waste and Wastewater Engineering, in which Environmental Catalysis plays a pivotal role (Kennes).

Through catalytic processes, harmful pollutants can be converted into less toxic substances or even into valuable products, thereby reducing environmental impact and

enhancing resource efficiency. Environmental catalysis is thus essential for addressing pressing environmental concerns and advancing towards a cleaner, more sustainable future. In this context, the study reported in "*Heterogeneous Catalytic Oxidation Regeneration of Desulfurization-Rich Liquor with Fe^{3+} Modified Chitosan*" targets the catalytic remediation of hydrogen sulfide (H_2S) present in industrial streams. The catalyst is based on chitosan, a broadly available biopolymer forming stable hydrogel beads, and coordinated iron (III) cations. Notably, not only does the material efficiently oxidize H_2S, but its activity can be fully recovered in the presence of bubbling oxygen (Liu et al.).

Catalysts may be used as a downstream solution to degrade harmful compounds but also have great potential in shifting towards more sustainable processes, including clean and renewable energy. In line with this, the comprehensive review article "*Biomass-Derived Carbon Nanostructures and Their Applications as Electrocatalysts for Hydrogen Evolution and Oxygen Reduction/Evolution*" explores the potential of biomass-derived carbon nanostructures (CN) and their great potential in electrochemical technologies crucial for energy production, conversion, and storage. Emphasis is given to a better comprehension of the relationships between the physicochemical properties of the CN, and hence their preparation protocol, and their catalytic activity in hydrogen evolution reaction, and the oxygen reduction and evolution reactions (Maliutina et al.).

As reported in the paper "*Major Contributing Factors to the Lower Level of Connection to the Existing Sewer Network in Addis Ababa: the Case of the Kality Catchment*," in some regions of the world, e.g., Addis Ababa, households are still not connected to a sewer network, despite its proximity (Ali and Robele). In this study, an efficient survey allowed the identification of the main factors contributing to this situation, which appeared to be lack of awareness, connection fee, topography, customers' preference for onsite sanitation over sewers, customers' unwillingness to reinstate fences or pavements in their compound, and the unreliability of the water utility service. The lack of regulations for monitoring wastewater management appeared to be another critical Research Topic.

Another paper highlights that the management of sewage sludge is a current key research topic, while its utilization as fertilizer in the European Union is restricted by stringent European environmental regulations. The research "*Acid Leaching of Hydrothermally Carbonized Sewage Sludge: Phosphorus Recovery and Hydrochar Characteristics*" studied different ways to acid leach hydrochar produced by hydrothermal carbonization of sewage sludges, and compared phosphorus recovery and effects on the hydrochar properties (Shettigondahalli Ekanthalu et al.).

The 5-day biochemical oxygen demand (BOD_5) is a commonly used key indicator of water quality in wastewater treatment facilities. However, BOD_5 estimation is a time-consuming and expensive procedure. The research reported on the "*Comparative Study for the Performance of Pure Artificial Intelligence Software Sensor and Selforganizing Map Assisted Software for Predicting 5-Day Biochemical Oxygen Demand for Kauma Sewage Treatment Plant Effluent in Malawi*" outscores the possibility to partly overcome such drawbacks based on the efficient implementation of an Adaptive Fuzzy Inference System, a kind of artificial intelligence algorithm that integrates both neural networks and fuzzy logic principles, to predict BOD_5 (Mng'ombe et al.).

This Research Topic, via a mix of perspective, review and research articles, provides a relatively thorough overview of the environmental engineering field, and some insights into the progress towards more accessible and sustainable waste treatment practices. We look forward to more of this kind forthcoming to serve our communities and our world at large.

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