

## Editorial

# The Application of Advanced Materials on the Water or Wastewater Treatment

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Water scarcity is being recognized as a present and future threat to human activity, and, as a consequence, water purification technologies are gaining major worldwide attention. Advanced materials have many properties, such as strong adsorption, enhanced redox, and photocatalytic properties, providing unprecedented opportunities to treat surface water, groundwater, and industrial wastewater that are contaminated with toxic metals, organic and inorganic compounds, bacteria, and viruses. Currently, tremendous progress has been made in development of advanced materials for their environmental applications, and knowledge has been accumulated of the effects of these advanced materials on and their applications in the environment security, recycling, and reuse of raw materials and treatment agents, economic benefits, and potential problems to our society. This special issue aims to provide an up-to-date account of advancement in these areas as well as insights gained through field experience.

Specifically, this special issue aims to study (a) advanced materials and advanced composite materials applications in water treatment, industry wastewater treatment, resource reuse of noble metals (e.g., gold, silver) from industry wastewater, environmental analysis, and groundwater remediation; (b) potential toxicity of engineered advanced (composite) materials; (c) transformations of advanced (composite) materials in the environment; and (d) modifications of advanced (composite) materials for enhancing contaminant uptake from aqueous solutions. While the selected six papers may not fully cover the topic of this special issue, they represent

the rich and many-faceted knowledge that we are pleased to share with the readers.

Y. Zhang et al. present an updated review on removing nitrate from groundwater, focusing on innovative ideas as compared to the traditional way. Their work highlights the actual performance of a polyvinyl chloride (PVC) membrane biofilm reactor for removing nitrate from groundwater, with the influences of DO and membrane fouling on the process being assessed.

Offcuts and natural mineral are important materials for removing pollutants due to their low cost. In particular in developing countries, high cost is the main factor that limits the development of environmental protection industry. D. L. Wu et al. demonstrated that iron shavings, a common byproduct of mechanical processing plants, can offer superior reductive dechlorination of hexachloroethane (HCA). While the purity of such Fe metals may be low, these shavings are readily available at low costs and could potentially be used for remediation. "Treating wastes with another waste" is a sustainable approach in environmental engineering fields. F. Zhou et al. prepared and characterized polyaluminium chloride by utilizing fluorine-containing waste with acidic mother liquids from the clay-brine synthetic cryolite process, with detailed processes of the synthesis and characteristics being described.

X. Xu et al. present their work on preparation and application of sustained-release potassium ferrate (VI). They describe a novel encapsulation method using hypochlorite

oxidation to prepare sustained-release  $K_2FeO_4$  during water treatment. Composite materials have gained the unprecedented development in recent years, but they also have many problems, such as the stability, economical efficiency, applicability, and feasibility. The article provides the insight on how to make a composite material have a better performance than the individual materials.

Y. Yang et al. prepared Li(I) doped  $Pr:Y_2SiO_5$  upconversion materials and anatase  $TiO_2$  nanofilm coated  $Li,Pr:Y_2SiO_5$  composite. They tested the luminescence intensities emitted by these composite materials and the photodegradation performances of these materials for treatment of nitrobenzene in wastewater. Their results show that  $Li,Pr:Y_2SiO_5$  has a much better photodegradation performance than  $Pr:Y_2SiO_5$ , indicating that rare earth luminescent materials may have much greater application potential when combined with (or doped by) other materials (e.g., anatase  $TiO_2$  and rare earth ions).

K. Xie et al. evaluated the effect of salinity on membrane fouling characteristics in an intermittently aerated membrane bioreactor (IAMBR). They investigated the system performance and variation of sludge characteristics at different salinities. The membrane fouling may be attributed to the interactions of the variation of sludge characteristics caused by salinity. Therefore, future studies should pay more attention to expand our knowledge of the relationship among the membrane fouling and sludge characteristics in salinity wastewater.

We believe that this special issue can benefit researchers, practitioners, and educators. The readers will find that this special issue not only contains accurate information and updated reviews on some advanced (composite) materials, but also has extensive applications of new materials. We also hope that the special issue will give more inspiration for the development of new or composite advanced materials in the future.

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