Advanced floating photocatalysts for water treatment

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Abstract

Water is life. Every day huge amounts of wastewater are produced, most of which are never treated before disposal and are almost never reused, resulting in a huge environmental effect. This issue is exacerbated by the fact that water scarcity is a major public health concern. Poor hygiene conditions frequently expose the population to disease transmission.

Although numerous technological approaches to wastewater purification and reuse have been developed, some of them fail to successfully remove persistent organic pollutants (POPs), such as drugs, cosmetics, flame retardants, and so on. Researchers have worked on the development of novel efficient techniques, among which advanced oxidation processes (AOPs), particularly photocatalysis, have arisen.

However, most photocatalytic devices are in powder form. This remains a practical barrier that must be overcome, as the challenging photocatalyst recovery from the reaction mixture for reuse can result in incomplete recovery, producing contamination and increased expenditures. Floating photocatalysts have recently emerged as a viable alternative to standard materials, as they maximize light usage and surface aeration, improving pollutants abatement efficacy and lowering post-treatment costs.

If properly developed to be sustainable and efficient, they have the potential to transform future wastewater treatment systems.

Herein, we present our findings on the development of sustainable floating photoactive materials resulting from the immobilization of TiO_2-free innovative photocatalysts (graphitic carbon nitride and bismuth oxyhalides) on eco-friendly floating supports (alginate spheres, natural sponges, and lightweight expanded clay aggregates).

All these materials were tested for the removal of various organic contaminants (drugs, dyes, and polyphenols) in different water matrices using solar light, and the potential and limitations of each system will be discussed.