New Insight into the Photocatalytic Degradation of Persistent Organic Pollutants (POPs) over Highly Integrated Reduced Graphene Oxide(rGO)/Bismuth Ferrite (BiFeO3)

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Due to their potential for long-distance transit, environmental persistence, and considerable detrimental effects on both human health and the environment, persistent organic pollutants (POPs) are chemicals that warrant worldwide attention. POPs are organic substances that exhibit variable resistance to photolytic, biological, and chemical destruction. It would be ideal to develop cutting-edge water treatment methods that are both affordable and highly effective for treating wastewater contaminated with POPs. Due to its effectiveness in quickly deteriorating and mineralizing resistant organic compounds, the photodegradation process of POPs has garnered increased interest. A heterogeneous photocatalyst like $BiFeO_3$ (BFO), which has a strong oxidising power and chemical inertness with low band gap energy, performs better than other types. Despite its benefits, BFO has been constrained by the quick transfer of produced electrons from semiconductors to metal particles, which causes a high photogenerated electron-hole recombination rate. In order to reduce electron-hole recombination and significantly increase the life of the excited carriers with improved interfacial interactions and efficient charge transferring processes in the materials, one strategy in light absorption modification for photocatalyst is the integration of electronically active materials, such as carbon-based materials. The equivalent mechanism of photodegradation of POPs by rGO/BFO, which can facilitate pollutant transfer and boost photocatalytic efficiency, has not been thoroughly studied. Determining the photodegradation mechanism and its kinetic impact will therefore be the main goals of this study, which will also clarify how rGO/BFO is made. There is speculation that it will result in a decrease in the rate of electron-hole recombination and enable efficient electron transfer migration. It is thought that highly integrated rGO/BFO is more catalytically active than a single system of polycrystalline BFO and could increase the formation of reactive oxygen species or extend the lifespan of electrons. Additionally, the hydroxyl, carbonyl, or epoxy groups of rGO will aid in anchoring BFO on its surface, increasing the dispersibility of BFO and creating a synergistic effect between BFO and rGO that is anticipated to improve the photocatalytic activity of targeted pollutants and solve the secondary pollutants problem. It is anticipated that the performance of these newly developed hybrid materials will have a significant impact on their ability to photo catalytically degrade highly concentrated persistent organic pollutants under visible light. Overall, the results of this study can be used to construct photodegradation models for POP effluent and, as a result, raise awareness about the need for industrial and agricultural sectors to share technology for improved environmental protection.