

Growing populations and industrialization have increased water demand, leaving 36% of the global population with inadequate water supplies. Contaminated water is a major problem, especially in low- and middle-income countries. Advanced Oxidation Processes (AOPs), particularly photocatalysis using TiO₂, offer a solution by oxidizing organic pollutants. While TiO₂'s photocatalytic activity was discovered in 1972, its widespread use is hindered by limitations such as a large band gap energy and aggregation.

However, modifications like doping and surface modification improve TiO₂'s light absorption, charge separation, and pollutant adsorption. TiO₂-based AOPs are applicable to various industrial wastewaters, including textile, municipal, pharmaceutical, and petroleum waste. Future research should focus on .developing cost-effective and reusable TiO₂ photocatalysts to enhance sustainability