**Development of innovative adsorbents and photocatalysts to remove emergent contaminants**

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The increasing presence of antibiotics such as sulfamethoxazole and ofloxacin in aquatic environments poses a serious threat to ecosystems and public health due to their persistence and potential to induce antibiotic resistance. Addressing this challenge requires the development of efficient, sustainable, and cost-effective remediation strategies. In this context, the integration of photocatalysis and adsorption has emerged as a promising approach, leveraging the complementary strengths of these techniques.

Titania (TiO₂) is widely recognized as an effective photocatalyst due to its strong oxidative power, chemical stability, non-toxicity, and low cost. However, its practical application is often limited by rapid electron-hole recombination, low surface area, and limited light absorption in the visible range.

Chitosan, a natural biopolymer derived from chitin, offers remarkable advantages as an adsorbent, including high surface area, abundant functional groups, biocompatibility, and biodegradability. Its application is currently limited by its insufficient mechanical stability and regeneration potential.

The synthesis of multifunctional composites integrating titania and chitosan with magnetic nanoparticles has facilitated easy separation and recovery after treatment, also improving the synergistic removal of pollutants.

The inclusion of carbon dots (CDs) into these systems further amplified their efficiency, improving the adsorption capacity of chitosan.

Molecular imprinting techniques were also adopted, significantly enhancing the selectivity of adsorption and degradation processes.

In conclusion, the synergistic integration of titania and chitosan with magnetic particles, carbon dots, and molecular imprinting represents a promising step toward advanced water purification technologies that are environmentally sustainable and economically viable.

REFERENCES

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