Revolutionizing Pollution Control with Sonoelectrochemistry: Advancements in Breaking Down Persistent Organic Pollutants

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Abstract

The electrochemical and ultrasonic inputs into a son electrochemical pollutant degradation process are found to be synergistic, producing a faster rate of degradation than that produced by the sum of the purely electrochemical or purely sonochemical inputs on their own. The combination of electrochemistry and ultrasonic irradiation has gained increasing attention in recent years as a method for removing dissolved pollutants from water. This interest stems from the potential for son electrochemical approaches to completely mineralise dissolved pollutants, converting them into harmless mineral species such as water and carbon dioxide. Persistent organic pollutants, often present in industrial wastewater, are perhaps of the most concern, and have been linked to a number of chronic and acute medical conditions, including cancers, hypertension, cardiovascular disease, diabetes, suppression of the immune system, adverse e f ects on cognitive and neurobehavioral function, and disruption of the function of sex steroids and the thyroid gland.

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(UV) light irradiation. e application of ultrasound waves in these systems enhances the dispersion of photocatalysts, promotes the formation of ROS, and facilitates the degradation of POPs [9,10].

Be e a dad a age

e utilization of sonoelectrochemical processes for the degradation of POPs o ers several advantages over traditional methods

E ha ced deg ada i e cie c : e synergistic e ects of ultrasound waves and electrochemical reactions signi cantly enhance the degradation rates of persistent organic pollutants, ensuring more e cient removal.

Se ec i e deg ada i : Sonoelectrochemical processes can be tailored to target speci c POPs, allowing for selective degradation while minimizing the impact on non-targeted compounds.

Red ced e e g c i : e accelerated reaction rates and improved mass transfer achieved through sonoelectrochemistry reduce the energy requirements for pollutant removal, making the process more energy-e cient.

E i e a c a ibi i : Sonoelectrochemical processes operate under mild reaction conditions, minimizing the production of harmful by-products and reducing the environmental impact of pollutant remediation.

C c i

Sonoelectrochemistry has emerged as a promising approach for the degradation of persistent organic pollutants, o ering innovative solutions to transform pollution. e combination of ultrasound waves and electrochemical reactions enhances the degradation e ciency, selectivity, and environmental compatibility of pollutant removal processes. With continued research and development, sonoelectrochemical processes hold tremendous potential for addressing the persistent organic pollutant problem and ensuring a cleaner and healthier. Sonoelectrochemical oxidation for the degradation of pollutants is a growing eld which is garnering ever increasing interest. In this review, we have introduced not only the core concepts behind this technique, but also the key factors behind its e ectiveness, such as electrode materials, reactor design, choice of electrolyte, and operational parameters. is may be abated to some extent by advancements in electrode technology, but in any case such issues will need to be thoroughly investigated and addressed before widespread application of this technique can be achieved. ese obstacles will no doubt be focal points for future study, and we hope that this review will go some way towards inspiring further strides in this eld in the coming years.

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