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Environmental Fate, Ecotoxicity, and Remediation of Heterocyclic Pharmaceuticals as Emerging Contaminants: A Review of Long-Term Risks and Impacts

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Heterocyclic Pharmaceuticals: A Growing Environmental Concern

Description

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Conducted within the framework of the **PRIMA-SAFE** project, a review published in *Organics* analyzes the occurrence, toxicity, and persistence of **heterocyclic pharmaceuticals** in water and soil. These widely used compounds are now recognized as critical emerging contaminants due to their resistance to degradation and potential ecological impact.

Key Findings

- Heterocyclic compounds, which constitute over **90% of newly developed drugs**, are persistent and often detected in **surface and groundwater**, sometimes at concentrations as high as **11,000 ng/L**.
- These compounds can cause **neurotoxicity, genotoxicity, carcinogenicity**, and **endocrine disruption** in both humans and wildlife.
- Their high solubility and stability allow them to accumulate in the environment, even at low

concentrations.
- Conventional wastewater treatments are largely ineffective; **advanced oxidation processes, membrane filtration, bioremediation, and adsorption techniques** show greater potential for removal.

Implications

The study highlights the urgent need for new regulatory frameworks and **innovative treatment solutions** to prevent the environmental and health hazards associated with heterocyclic pharmaceuticals. It also stresses the importance of adopting a **One Health approach** that recognizes the interconnection between environmental, human, and animal health.

Reference

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