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Research Article

Pharmaceutical Pollution in Aquatic Environments and Public Health Risks

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Pharmaceutical contamination is turning into a real problem for both the environment and public health. This happens because active ingredients from medicines end up in our ecosystems- people toss unused drugs in the trash or down the drain, hospitals and factories send effluents into water systems, farms use veterinary drugs, and, of course, humans excrete traces of what they take. Most wastewater treatment plants just aren't built to catch these chemicals, so they stick around in rivers and lakes. Even tiny amounts can mess with fish and other wildlife, fuel antimicrobial resistance, and create long-term health risks for people. Right now, laws and regulations haven't caught up with the scale of this issue. The whole idea behind "green pharmacy" is to get ahead of the problem - design drugs that break down safely, teach people how to dispose of medicines the right way, and improve water treatment. To really deal with pharmaceutical pollution, everyone has to pitch in: scientists, lawmakers, and the public all need to get involved.

Keywords: Pharmaceutical pollution, Aquatic environment, Public health, Antimicrobial resistance, Green pharmacy, Wastewater treatment.

INTRODUCTION

The extensive use of medications has greatly enhanced global health results. Nevertheless, the accidental discharge of active pharmaceutical ingredients (APIs) into the environment has become a significant issue. Pharmaceutical contamination, especially in water-based ecosystems, is increasingly being seen as a growing environmental and public health concern that needs immediate action [1, 2].

1. Sources of Pharmaceutical Pollution

Pharmaceutical pollutants enter the environment via various routes, such as the incorrect disposal of medications, discharges from hospitals and industries, agricultural runoff, and human waste. Wastewater treatment facilities are frequently not built to fully eliminate these substances, resulting in their buildup in surface and groundwater systems [3, 4].

2. Environmental Impact

Even in small amounts, medications can negatively impact aquatic life. Antibiotics play a role in promoting antimicrobial resistance among environmental microorganisms, and hormones have the potential to interfere with the endocrine systems of fish and wildlife. The continued presence and accumulation of these substances in the environment further increase ecological risks [5, 2].

3. Human Health Concerns

The detection of drug remnants in drinking water sources brings up worries regarding prolonged human exposure. Even though levels are usually low, long-term exposure to combinations of drugs can lead to risks including toxicity, interference with hormone function, and the emergence of drug-resistant organisms [6, 1].

4. Current Regulatory Gaps

Even with increased awareness, many countries still have insufficient regulations to address pharmaceutical pollutants. Current guidelines mainly concentrate on traditional pollutants and frequently neglect new contaminants such as APIs. There is an urgent need for more rigorous oversight and revised environmental risk evaluation procedures [3, 7, 9].

5. Sustainable Strategies and Green Pharmacy

The idea of a "green pharmacy" presents hopeful approaches to reduce pharmaceutical pollution. This involves creating environmentally friendly medications that break down easily, enhancing waste disposal methods, encouraging the responsible use of medications, and adopting advanced wastewater treatment techniques like Nano filtration and biodegradation [3, 8].

6. Future Perspectives

Future research should concentrate on creating new detection techniques, evaluating the combined impacts of drug mixtures, and incorporating environmental factors into the process of drug development. The cooperation among scientists, government officials, and the pharmaceutical sector will be essential [2, 4].

CONCLUSION

Pharmaceutical contamination poses a quiet yet substantial risk to environmental sustainability and public health. Tackling this problem demands a multifaceted strategy that integrates scientific advancements, policy changes, and increased public understanding. As future pharmacists, it is our duty to promote sustainable practices that safeguard both public health and the environment.

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8. Author Contributions

Anish Arora: Writing-original draft. Komal Kishor: Data Curation.Yashika: Data Curation. Sachin Yadav: Data Curation Dr, Amandeep Singh: Supervision

9. Disclosure statement

The authors have declared no conflict of interest. The authors alone are responsible for the content and writing of the paper

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