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Utilising Untreated Guava Seeds (*Psidium guajava*) as a Natural Biosorbent for Microplastic Removal from Water: A Review

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ABSTRACT :

Microplastics are an emerging class of environmental contaminants increasingly detected in aquatic systems. These particles pose ecological and potential human health risks due to their persistence, bioaccumulation, and ability to act as vectors for toxic substances. Conventional microplastic removal methods are often costly and energy-intensive, motivating research into sustainable alternatives. Agricultural wastes have gained attention as low-cost biosorbents. Guava seeds (*Psidium guajava*), a by-product of fruit processing industries, have shown adsorptive potential for dyes and heavy metals. This review evaluates the feasibility of using untreated guava seeds as a biosorbent for microplastic removal from water, discussing material properties, probable removal mechanisms, experimental approaches, advantages, limitations, and research gaps.

Keywords: Guava seed, Psidium guajava, biosorbent, microplastics, water treatment

Introduction

Microplastics (MPs), defined as plastic particles smaller than 5 mm, are now ubiquitous in freshwater, marine, and wastewater environments. Their small size and hydrophobic nature allow them to persist, interact with pollutants, and enter food chains. Existing water treatment processes can partially remove MPs, but their efficiency varies and often involves high operational costs.

Consequently, research has shifted toward sustainable, low-cost biosorbents derived from agricultural residues. Guava seeds are produced in large quantities during juice and pulp processing and are typically discarded, making them an environmentally attractive raw material for biosorption applications.

Properties of Guava Seeds Relevant to Biosorption

Guava seeds consist primarily of lignocellulosic material, proteins, and lipids. The presence of hydroxyl, carboxyl, and other oxygen-containing functional groups enables potential interactions with pollutants. Lipid-rich fractions may favor hydrophobic interactions with plastic polymers such as polyethylene and polypropylene. Although untreated guava seeds possess lower surface area compared with activated carbons, surface roughness and internal voids can facilitate physical entrapment of microplastic particles.

Evidence from Previous Guava Seed Biosorption Studies

Several studies report the use of guava seeds or guava-seed-derived activated carbons for removal of dyes, chromium, lead, cadmium, and other contaminants from water. These studies demonstrate the presence of active functional groups and favorable surface morphology for adsorption. While these investigations focus on dissolved pollutants rather than particulate microplastics, the findings suggest that guava seeds possess inherent characteristics suitable for adsorptive applications.

Possible Mechanisms of Microplastic Removal

The removal of microplastics by untreated guava seeds is likely governed by multiple mechanisms, including hydrophobic attraction between plastic particles and seed lipids, physical entrapment within irregular seed structures, and hydrogen bonding with weathered microplastic surfaces. In natural waters, heteroaggregation mediated by organic matter may further enhance removal efficiency.

Advantages and Limitations

The key advantages of using guava seeds as biosorbents include their low cost, abundance, biodegradability, and minimal processing requirements. However, limitations include relatively low surface area, potential hydraulic issues in filtration systems, and uncertainties regarding regeneration and disposal of spent biosorbent containing captured microplastics.

Research Gaps and Future Outlook

Despite promising indirect evidence, there is a lack of direct experimental studies evaluating untreated guava seeds for microplastic removal. Future research should focus on controlled batch and column experiments, comparison with modified or activated forms, assessment under realistic water conditions, and life-cycle analysis to establish environmental sustainability.

Conclusions

Untreated guava seeds represent a promising, sustainable biosorbent candidate for microplastic removal from water. Their utilization could add value to agricultural waste while contributing to low-cost water treatment solutions. However, systematic experimental validation is essential before practical application.

REFERENCES (REPRESENTATIVE)

1. Elizalde-González, M. P., et al. (2009). Guava seed as an adsorbent and as a precursor of carbon.
2. *Bioresource Technology*.
3. Mulindwa, P., et al. (2024). Bioadsorbents for removal of microplastics from water: A review. Bhagwat, K. P., et al. (2024). Effective removal of microplastic particles using natural fibers.