Urban plastic waste: Pathways to circularity.

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Introduction

This paper explores the transition to a circular economy for plastic waste within urban environments, highlighting key opportunities like innovative recycling technologies and robust policy frameworks. It also addresses significant challenges, including inadequate infrastructure, economic barriers, and limited public participation, stressing the need for integrated strategies to enhance resource recovery and sustainability [1].

This review comprehensively examines recent technological advancements and policy initiatives aimed at recovering resources from municipal solid waste. It details various treatment methods, from material recovery facilities to energy recovery processes, and discusses effective policy frameworks that drive innovation and implementation for sustainable waste management [2].

This article reviews the complex landscape of sustainable municipal solid waste management in developing countries. It identifies critical challenges such as inadequate infrastructure, financial constraints, and weak governance, while also highlighting opportunities through policy reforms, technological adoption, and community involvement for improved waste collection, recycling, and disposal [3].

This review provides an overview of advanced technologies for plastic waste recycling, covering mechanical, chemical, and thermal methods. It discusses their current applications, efficiencies, and limitations, outlining future directions for innovation to enhance plastic circularity and reduce environmental impact [4].

This article critically reviews current policy frameworks and governance strategies essential for achieving sustainable urban solid waste management. It analyzes the effectiveness of various regulatory instruments, economic incentives, and institutional arrangements, emphasizing the need for robust, adaptive policies that foster a circular economy approach and stakeholder collaboration [5].

This systematic review explores the critical role of community engagement in urban waste management, identifying both common challenges such as lack of awareness and trust, and key success factors including effective communication, incentives, and collaborative decision-making. It underscores that active public participation is vital for improving waste collection, segregation, and overall system sustainability [6].

This systematic review delves into the significant challenges faced by developing countries in urban solid waste management, such as rapid urbanization, informal waste sectors, and inadequate resources. It also highlights promising prospects, including the adoption of integrated waste management systems, policy innovations, and international collaborations to foster more sustainable practices [7].

This review provides a comprehensive analysis of Life Cycle Assessment (LCA) methodologies applied to urban solid waste management systems. It discusses various applications, including evaluating different treatment scenarios and identifying environmental hotspots, along with future trends focusing on enhanced data quality, expanded scope, and integration with circular economy principles for more robust sustainability assessments [8].

This review explores cutting-edge innovative approaches in plastic waste management, focusing on advanced recycling, upcycling, and waste-to-energy technologies. It highlights how valorization strategies can transform plastic waste into valuable products, contributing to a circular economy and reducing environmental pollution [9].

This review investigates the emergence of smart waste management systems in urban settings, focusing on solutions enabled by Internet of Things (IoT) technologies. It analyzes how IoT-based innovations improve waste collection efficiency, optimize resource allocation, and provide real-time data for better decision-making, significantly contributing to urban sustainability goals [10].

Conclusion

The transition to sustainable waste management, particularly for plastic waste, in urban environments is a critical global challenge and opportunity. Research highlights the move towards a circular economy, emphasizing innovative recycling technologies—including mechanical, chemical, and thermal methods—and robust policy frameworks as key drivers for enhancing resource recov-

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ery and sustainability. Significant hurdles persist, such as inadequate infrastructure, economic barriers, and limited public participation. These issues are especially pronounced in developing countries, which also grapple with rapid urbanization and informal waste sectors. However, there are promising prospects through integrated waste management systems, policy innovations, and international collaborations. Effective governance strategies, economic incentives, and active community engagement are vital for improving waste collection, segregation, and overall system sustainability. Technological advancements in resource recovery from municipal solid waste, including smart waste management systems leveraging Internet of Things (IoT) solutions, are optimizing efficiency and data-driven decision-making. Life Cycle Assessment methodologies are also key for evaluating treatment scenarios and integrating circular economy principles for robust sustainability assessments. Addressing these complex dynamics requires comprehensive strategies that combine technological adoption, adaptive policies, and strong stakeholder collaboration to reduce environmental impact and foster plastic circularity.

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