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Application of Circular Economy Models in Waste Resource Recovery

With rapid population growth and urbanization, the generation of solid waste has increased dramatically, making waste management a critical challenge for urban environmental governance and sustainable development. Traditional waste disposal methods, such as landfilling and incineration, occupy substantial land resources and may cause secondary pollution and greenhouse gas emissions. Simultaneously, resource scarcity and environmental pressures have driven the search for more efficient waste utilization pathways. The circular economy (CE) model, centered on the principles of "reduce, reuse, and recycle," emphasizes the resource recovery of waste, achieving a balance between economic development and environmental protection, and providing a sustainable solution for modern urban waste management.

Under the circular economy framework, waste is treated as a potential resource rather than a mere environmental burden. Through physical, chemical, and biological technologies, waste can be converted into energy, raw materials, or high-value products. For instance, organic waste can be transformed into biogas via anaerobic digestion; waste plastics can undergo pyrolysis or mechanical recycling; and construction debris can be repurposed as recycled building materials. CE practices optimize material flows and enhance resource circulation, while reducing environmental impacts through waste minimization, process improvement, and supply chain optimization, thus promoting sustainable waste management.

Nevertheless, applying circular economy principles in waste resource recovery faces technological, economic, and policy challenges. Technologically, diverse waste types require tailored treatment processes. Economically, the balance between recovery costs and market value is critical. Policy-wise, the absence of comprehensive regulations and incentives can hinder CE adoption. Systematic analysis, life cycle assessment, and market mechanism integration are therefore necessary to develop effective and context-specific waste resource recovery strategies.

This study aims to explore strategies and outcomes of applying circular economy models in waste resource recovery, focusing on technology selection, resource recovery efficiency, environmental benefits, and economic feasibility. By integrating case studies and policy assessment, the research seeks to provide theoretical guidance and practical recommendations for efficient waste utilization and sustainable urban development.