

Municipal Solid Waste Management in Ethiopia: Systematic Review of Physical and Chemical Compositions and Generation Rate

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Abstract : Municipal solid waste management (MSWM) in Ethiopia is a complex issue with institutional, social, political, environmental, and economic dimensions, impacting sustainable development. Effective MSWM planning necessitates understanding the generation rate and composition of waste. This systematic review synthesizes qualitative and quantitative data from various sources to aggregate current knowledge, identify gaps, and provide a comprehensive understanding of municipal solid waste management in Ethiopia. The findings reveal that the generation rate of municipal solid waste in Ethiopia is 0.38 kg/ca/day, with the waste composition being predominantly food waste, followed by ash, dust, and sand, and yard waste. Over 85% of this MSW is either reusable or recyclable, with a significant portion being organic matter (73.13% biodegradable) and 11.78% recyclable materials. Physicochemical analyses reveal that Ethiopian MSW is suitable for composting and biogas production, offering opportunities to reduce environmental pollution, and GHGs, support urban agriculture, and create job opportunities. However, challenges persist, including a lack of political will, weak municipal planning, limited community awareness, and inadequate waste management infrastructure, and only 31.8% of MSW is collected legally, leading to inefficient and harmful disposal practices. To improve MSWM, Ethiopia should focus on public awareness; increased funding, infrastructure investment, private sector partnerships, and implementing the 4 R principles (reduce, reuse, and recycle). An integrated approach involving government, industry, and civil society is essential. Further research on the physicochemical properties and strategic uses of MSW is needed to enhance management practices. Implications: The comprehensive study of municipal solid waste management (MSWM) in Ethiopia reveals the intricate interplay of institutional, social, political, environmental, and economic factors that influence the nation's sustainable development. The findings underscore the urgent need for tailored, integrated waste management strategies that are informed by a thorough understanding of MSW generation rates, composition, and current management practices. Ethiopia's lower per capita MSW generation compared to developed countries and the predominantly organic composition of its waste present significant opportunities for sustainable waste management practices such as composting and recycling. These practices can not only minimize the environmental impact but also support urban greening, agriculture, and renewable energy production. The high organic content, suitable physicochemical properties of MSW for composting, and potential for biogas and briquette production highlight pathways for creating employment, reducing waste, and enhancing soil fertility. Despite these opportunities, Ethiopia faces substantial challenges due to inadequate political will, weak municipal planning, limited community awareness, insufficient waste management infrastructure, and poor policy implementation. The high rate of illegal waste disposal further exacerbates environmental and health issues, emphasizing the need for a more effective and integrated MSWM approach. To address these challenges and harness the potential of MSW, Ethiopia must prioritize increasing public awareness; investing in infrastructure, fostering private sector partnerships, and implementing the principles of reduce, reuse, and recycle (3 R). Developing strategies that involve all stakeholders and turning waste into valuable resources is crucial. Government, industry, and civil society must collaborate to implement integrated MSWM systems that focus on waste reduction at the source, alternative material use, and advanced recycling technologies. Further research at both federal and regional levels is essential to optimize the physicochemical analysis and strategic use of MSW. Prompt action is required to transform waste management into a pillar of sustainable urban development, ultimately improving environmental quality and human health in Ethiopia.

Keywords : biodegradable, healthy environment, integrated solid waste management, municipal

Conference Title : ICWMRE 2024 : International Conference on Waste Management, Recycling and Environment

Conference Location : Sydney, Australia

Conference Dates : December 02-03, 2024