



Baseline Assessment of Waste Stream Metrics and Socio-Technical Feasibility for Integrated Solid Waste Management in Mundemba, South West – Cameroon

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ABSTRACT

Municipal solid waste management remains a growing environmental and public-health challenge in rapidly urbanizing municipalities in sub-Saharan Africa. This study assessed waste stream metrics, current waste-handling practices and socio-technical feasibility for integrated solid waste management in Mundemba, South-West Cameroon. A mixed-methods design combined household waste measurement, manual waste composition analysis, household questionnaires, and interviews with municipal officials and waste handlers. Waste generation was estimated at 255.85 tonnes/week, equivalent to 36.55 tonnes/day and approximately 0.69 kg/person/day. Kitchen and food-preparation waste was the main waste source (52.9%), followed by house-clearing waste (24.5%). Material composition was dominated by organic waste (61.0%), plastics (24.3%), glass (9.8%), metals (2.9%), electronic waste (1.0%) and other materials (1.0%). Waste storage and disposal were largely informal: 66.26% of households stored waste in open piles, 85.29% reported no waste-collection service, and the main disposal practices were open dumping (33.3%), burning (26.5%), disposal into water bodies (19.6%), composting or land application (16.7%) and burial (3.9%). Despite these constraints, 51.96% of respondents were willing to participate in composting, 66.67% in community clean-up activities and 75.49% in financial contributions for improved services. The findings indicate strong technical potential for decentralized composting and material recovery, but implementation will require source segregation, strategically located collection points, institutional strengthening, transparent cost-recovery mechanisms and sustained community engagement.

KEYWORDS: Municipal solid waste, Waste characterization, Composting, Source segregation, Socio-technical feasibility, Integrated solid waste management, Cameroon

ABBREVIATIONS

MSWM: Municipal Solid Waste Management; ISWM: Integrated Solid Waste Management; WGR: Waste Generation Rate; NEP: United Nations Environment Programme; SPSS: Statistical Package for the Social Sciences; PPE: Personal Protective Equipment.

INTRODUCTION

Municipal solid waste management (MSWM) is a growing environmental and public health concern across the globe, reaching crisis levels in many developing countries, particularly in Sub Saharan Africa. Rapid population growth, accelerating urbanization, and evolving consumption patterns particularly in Sub Saharan countries have led to a sustained increase in waste generation, often outpacing the infrastructural and institutional capacity of local authorities to manage it effectively.^{1,2} As a consequence, more than 70% of waste generated in developing countries is disposed of through informal and unsustainable practices such as open dumping, indiscriminate burning, and disposal into water bodies.^{2,3} These practices introduce significant hazards, contributing to water and air pollution, increasing the risk of vector borne disease outbreaks, and causing widespread ecosystem degradation.⁴

In Cameroon, waste management responsibilities have been delegated to municipal councils under national decentralization and environmental protection laws. However, many local authorities face serious challenges including inadequate financing, limited technical expertise, insufficient infrastructure, weak institutional coordination, and poor enforcement of environmental regulations.⁵ These challenges are particularly severe in small and rapidly growing municipalities where population growth and commercial activities are increasing faster than the development of waste management systems.

Mundemba municipality, located in Ndian Division of the South West Region of Cameroon, is an emerging urban municipality with rising population and economic activity, this council represents a typical example of a semi-urban municipality experiencing increasing waste management challenges. It faces socio-technical difficulties including limited trained personnel, the absence of engineered disposal facilities, and inadequate collection infrastructure. These conditions have rendered the existing waste management service highly inefficient. To transition the municipality from this state of crisis to a sustainable model, a holistic understanding of the problem is required.

Effective implementation of Integrated Solid Waste Management (ISWM) systems requires accurate baseline information on waste generation, waste composition, existing management practices, institutional capacity, and community participation.^{2,6} Such a baseline assessment provides the critical waste stream metrics including generation rates and composition necessary for engineering design and technology selection. The evaluation of socio-technical feasibility, which involves understanding institutional readiness, assessing public attitudes, and quantifying the community's willingness to participate in essential activities like source segregation and cost recovery is equally vital.⁷ This study provides a comprehensive assessment of MSWM practices in Mundemba, focusing on waste categories and types,

generation rates, storage and collection systems, disposal practices, and institutional challenges. Findings contribute to strengthening municipal planning and support the development of integrated waste management strategies tailored to rural urban transition areas.

MATERIALS AND METHODS

Study Area

Mundemba Municipality is located in Ndian Division of the South West Region of Cameroon. It lies approximately between latitude 4°58'12" N and longitude 8°54'35" E. The municipality covers an estimated surface area of approximately 1,557 km² and has a population of about 53,405 inhabitants. The municipality consists of 43 villages and three major semi-urban centres: Mundemba town, Manja, and Bulu Camp. It shares boundaries with Eyumojock Subdivision to the north, Isangele and Ekondo-Titi subdivisions to the south, Toko, Konye, and Dikome-Balue subdivisions to the east, and Nigeria to the west. The municipality is situated near Korup National Park and falls within the he equatorial rainforest zone and experiences high annual rainfall averaging approximately 4,000 mm, with temperatures ranging between 23°C and 30°C throughout the year. The predominant economic activities include subsistence agriculture, cocoa farming, palm oil production, fishing, petty trading, and small-scale commerce. These activities influence the waste stream, which is largely organic. Rapid settlement expansion and increasing market activity have intensified waste-management pressure without corresponding improvements in waste services. The municipal council is responsible for waste collection and disposal under Cameroon's Law No. 2004/018 on decentralization, but faces financial and logistical constraints that hinder effective service delivery.

Research Design and Sampling

A mixed-methods research design was adopted, combining quantitative measurement of waste generation and composition with qualitative and quantitative assessment of socio-technical feasibility. Stratified random sampling was used to select representative households across Mundemba town, Manja and Bulu Camp, with representation from residential, commercial and mixed-use areas. A sample of 150 households was targeted for waste characterization.

Waste generation rate (WGR) was measured by providing selected households with two labelled plastic bags for a continuous seven-day collection period. Sampling covered both rainy and dry seasons over six months, including three months in the rainy season and three months in the dry season. Participants were instructed to deposit all waste generated during normal household activities into the bags. At the end of each sampling week, waste from each household was weighed using a calibrated spring scale. The WGR was calculated as:

$$WGR = \frac{W}{P \times D}$$

Where WGR is waste generation rate in kg/person/day, W is the total mass of waste collected from sampled households in kilograms, P is the total number of persons in sampled households, and D is the number of sampling days. Total municipal waste generation was estimated by multiplying the average WGR by the municipal

population and converting kilograms to tonnes.

Waste composition was determined by transporting composite waste from the sampling period to a central sorting area. The quartering method was used to obtain a representative sub-sample of approximately 100 kg. The sub-sample was manually sorted using personal protective equipment into organic waste, plastics, paper/cardboard, glass, metals, textiles/leather, electronic waste and other materials. The mass of each category was weighed and recorded. Composition was calculated as:

$$\text{Composition (\%)} = \frac{\text{Mass of material category}}{\text{Total sorted sample mass}} \times 100$$

The socio-technical assessment focused on current management practices, institutional capacity and public perception. A household questionnaire survey was administered 300 households to assess storage, collection, disposal, willingness to participate in source segregation and willingness to pay for improved waste services. Key municipal personnel, including the Mayor, environmental officer and finance officer, were interviewed using semi-structured questionnaires. Interviews with formal and informal waste handlers explored logistical constraints, occupational hazards and collection efficiency.

Data Analysis

Quantitative data were entered into Microsoft Excel and analysed using Minitab 19 and SPSS 21. Descriptive statistics were used to summarize waste generation, waste composition and survey responses. Percentages were multiplied by the estimated total waste generation where appropriate to estimate weekly and daily waste quantities by source, composition or disposal practice. Qualitative

interview data were analysed using thematic content analysis to identify recurring institutional, logistical and technical constraints.

RESULTS

Waste Generation Rate

Mundemba generated an estimated 255.85 tonnes of municipal solid waste per week, equivalent to 36.55 tonnes/day and an average per capita waste generation rate of about 0.69 kg/person/day. The largest share of the population (65.1%) generated less than 5 kg of waste weekly, 27.4% generated 5-10 kg weekly, 5.6% generated 11-15 kg weekly and 1.9% generated more than 15 kg weekly (Table 1).

Sources of Waste

Kitchen and food-preparation waste formed the largest source of waste in Mundemba, contributing 52.9% of the waste stream, or approximately 135.34 tonnes/week. House-clearing waste was the second-largest source at 24.5%, equivalent to approximately 62.68 tonnes/week. Gardening or yard waste and packaging from goods each contributed 5.9%, old clothing and furniture contributed 7.8%, and e-waste accounted for 2.9% (Table 2).

Waste Composition

The municipal solid waste stream in Mundemba was dominated by organic waste, which constituted 61.0% of the total waste and amounted to approximately 156.07 tonnes/week or 22.30 tonnes/day. Plastics were the second largest component at 24.3%, equivalent to 62.17 tonnes/week. Glass accounted for 9.8%, metals for 2.9%, and electronic waste and other miscellaneous materials each accounted for 1.0% (Table 3).

Table 1. Waste generation rates according population.

Generation Rates (kg/week)	Percentage of population	Waste Generated (tons/week)	Waste Generated (tons/day)
< 5 kg	65.1	86.92	12.42
5–10 kg	27.4	109.75	15.68
11–15 kg	5.6	38.88	5.55
> 15 kg	1.9	20.3	2.9
Total	100	255.85	36.55

Table 2. Estimated waste generation by source.

Waste Source	Share of population (%)	Waste Generated (tons/week)	Waste Generated (tons/day)
Kitchen/food preparation	52.9	135.34	19.33
House clearing	24.5	62.68	8.95
Gardening/yard work	5.9	15.1	2.16
Packing from goods	5.9	15.1	2.16
Old clothing/furniture	7.8	19.96	2.85
E-waste	2.9	7.42	1.06
Total	100	255.85	36.55

Table 3. Waste composition in Mundemba council area.

Category	Proportion (%)	Generated rate (tons/week)	Generated rate (tons/day)
Organic waste	61	156.07	22.3
Plastics	24.3	62.17	8.88
Glass	9.8	25.07	3.58
Metals	2.9	7.42	1.06
Electronic waste	1	2.56	0.37
Others	1	2.56	0.37
Total	100	255.85	36.55

Waste Handling Practice

Storage Practices

Most households in Mundemba stored waste in open piles. Approximately 66.26% of households used open dumping within residential compounds as a temporary storage method. Reusable plastic containers were used by 21.88% of households, while 9.73% relied on sacks for temporary waste storage (Figure 1).

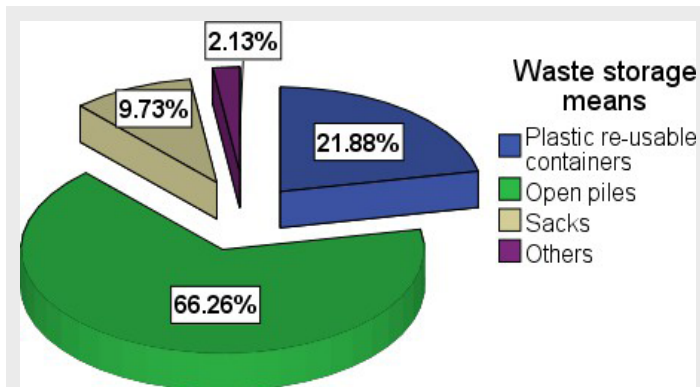


Figure 1. Waste storage means.

Waste Collection Frequency

The study revealed that formal waste collection services were largely absent within Mundemba Municipality. Approximately 85.29% of respondents reported that waste was never collected, while 11.76% indicated that collection occurred occasionally. Only 2.94% of respondents reported receiving weekly collection services (Figure 2).

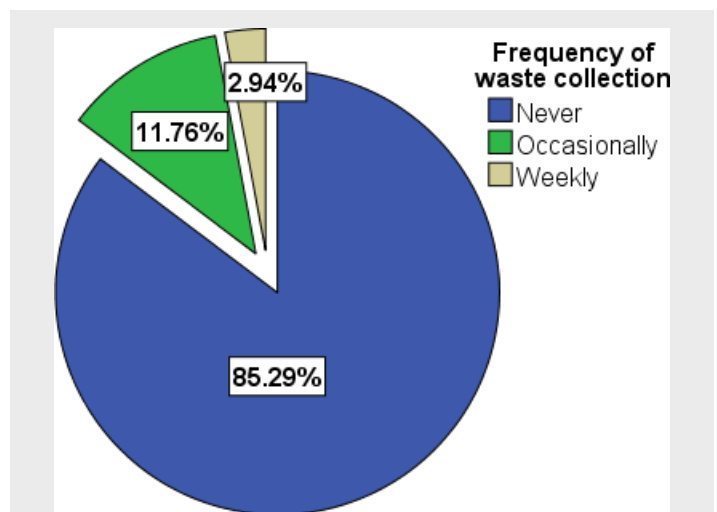


Figure 2. Frequency of waste collection.

Availability of Public Waste Collection Infrastructure

A substantial majority of residents, over 92%, reported the complete absence of waste collection facilities like public waste collection bins, only less than 3% confirmed their presence while approximately 5% of the population were unsure (Figure 3).

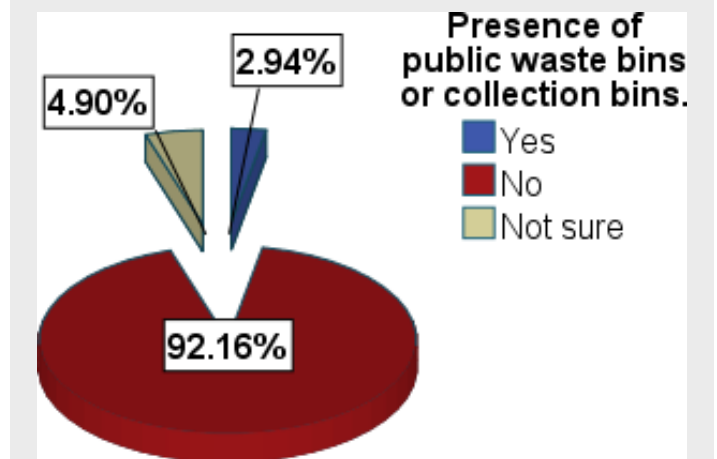


Figure 3. Presence of public waste collection points or bins.

Distance to Nearest Collection Point of Dump Site

Waste disposal points were unavailable to the vast majority of the Mundemba population, 81.37% of residents who did not specify a distance were unable to do so because a nearby collection point

or dump did not actually exist in their area. For the small remaining group who could provide an estimate, 14.71% lived within 100 meters of a site, while 3.92% lived between 100 and 500 meters away (Figure 4).

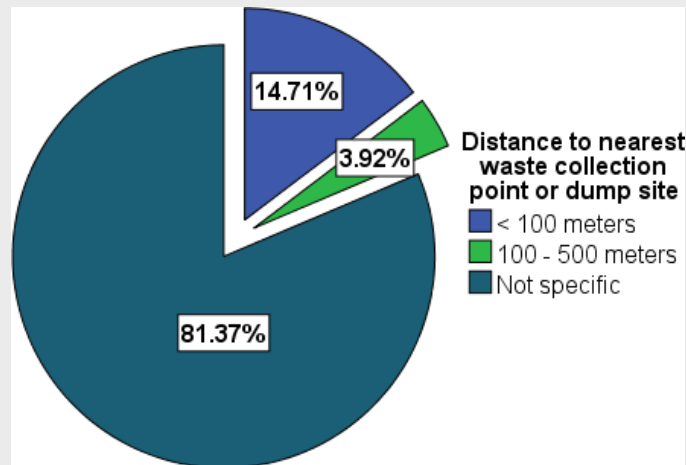


Figure 4. Distance from waste collection point.

Waste Disposal Methods

Five primary waste disposal approach were used by the population. The most common approach was dumping waste in open areas, which accounted for 33.3% and an estimated 85.2 tons of waste per week (Table 4).

Burning followed as the second most frequent method (26.5%), adding another 67.8 tons weekly to the output, while a significant portion, 19.6%, was disposed of directly into water bodies (around 50 tons per week). More sustainable practices were notably less common: composting or land application made up 16.7% (42.7 tons weekly), and burial was the rarest method at just 3.9% (10 tons weekly). These combined practices resulted in a substantial total estimated waste output of over 255 tons per week (or 36.5 tons per day) being managed through largely uncontrolled means.

Socio-Technical Factors Influencing Waste Management Community Perceptions and Participation

Community perception of the existing waste collection system was highly negative. A total of 93.14% of respondents rated the current system as non-functional, while 2.94% rated it as poor, 2.94% as very poor and only 0.98% as somewhat effective (Figure 5)

Table 4. Waste disposal methods

Waste disposal methods	Percentage	Waste Disposed (tons/week)	Waste Disposed (tons/day)
Burn	26.5	67.8	9.69
Buried	3.9	9.98	1.43
Dump it in open areas	33.3	85.2	12.17
Dump in water bodies	19.6	50.15	7.16
Compost/land application	16.7	42.73	6.1
Total	100	255.85	36.55

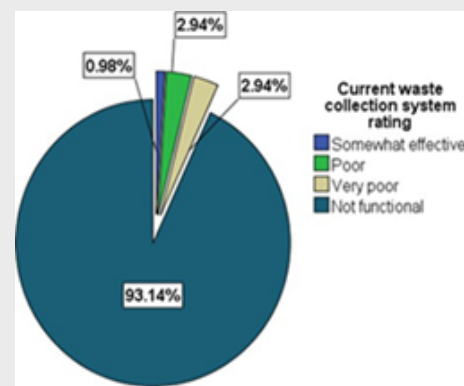


Figure 5. Waste collection system ratings.

Despite the above dissatisfaction, the survey showed meaningful willingness to participate in improvement initiatives: 51.96% of respondents were willing to participate in composting kitchen and yard waste if appropriate materials and support systems were provided (Figure 6).

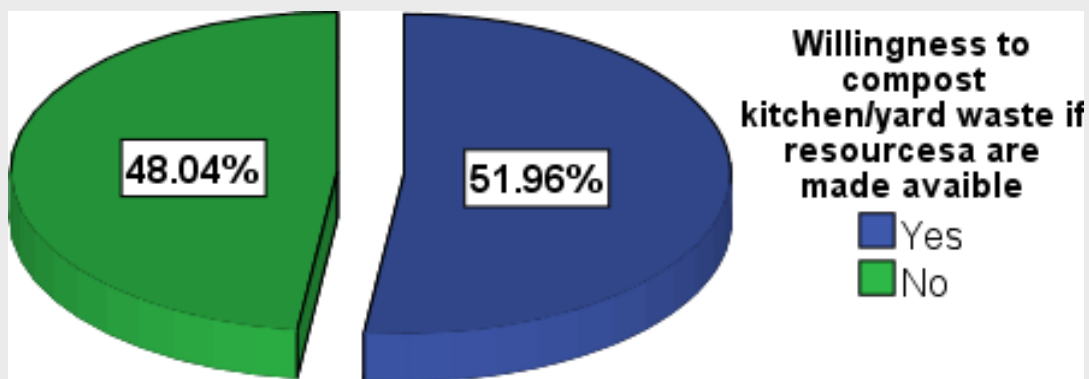


Figure 6. Willingness to compost kitchen/yard waste.

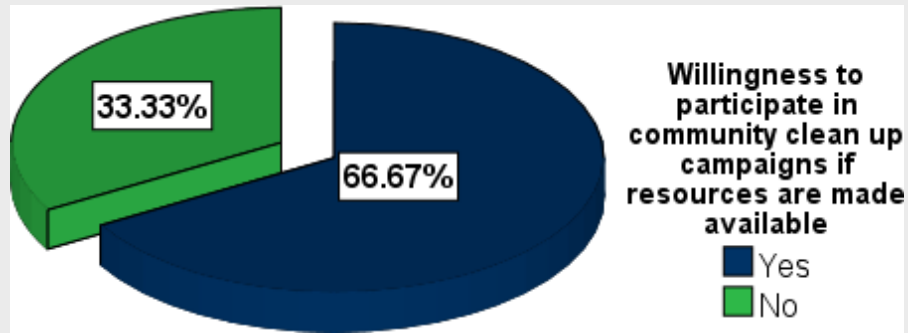


Figure 7. Willingness to participate in clean up campaigns.

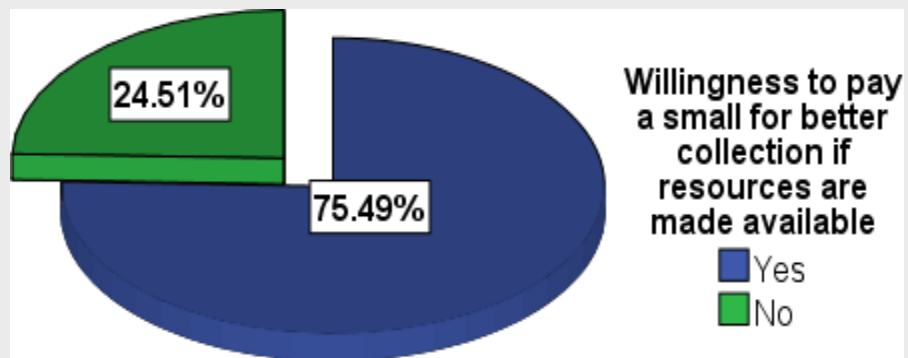


Figure 8. Willingness to pay for better waste collection.

A promising result from the survey was the population's expressed willingness to participate in cleanup initiative with 66.67% of population stated that they would be willing to join community clean-up efforts, provided that the necessary resources (like tools and supplies) were available while just 33.33% said they would not take part (Figure 7).

The survey revealed significant community readiness to fund an improved waste management system, as a large majority 75.49% of the population indicated they were willing to contribute financially toward an improved waste management service, contrasting with the 24.51% who were unwilling (Figure 8).

DISCUSSION

This study revealed that Mundemba generates approximately 255.85 tons of municipal solid waste per week, equivalent to 36.55 tons/day and an average per capita generation rate of 0.69 kg/person/day. This waste generation rate falls within the range commonly reported in rapidly urbanizing municipalities in Sub-Saharan Africa. Recent studies by Ferronato and Torretta⁸ and Sharma et al.⁹ reported that waste generation in developing countries is steadily increasing because of urbanization, commercialization, and changing consumption patterns. Similar generation rates have been reported in peri-urban municipalities in Ghana, Nigeria, and Cameroon, where household waste generation commonly ranges between 0.5–0.8 kg/person/day.^{10,11} However, the waste generation rate observed in Mundemba is lower than those reported in highly urbanized African cities such as Johannesburg and Nairobi where per capita generation often exceeds 0.9 kg/person/day due to

higher income levels, industrialization, and greater consumption of packaged materials.¹²

The relatively moderate waste generation rate observed in Mundemba may be explained by the municipality's predominantly agrarian economy, lower household income, and widespread reuse of materials. From an integrated waste management perspective, this moderate generation rate indicates that decentralized and community based waste management systems could still be technically feasible before waste volumes become unmanageable. Studies by Marshall and Farahbakhsh⁷ and Sharma et al.⁹ emphasize that medium-sized municipalities are often more suitable for decentralized waste collection and biological treatment systems than highly urbanized cities because waste volumes remain manageable and transport distances are shorter.

The finding that 65.1% of households generated less than 5 kg of waste weekly further reflects relatively low consumption patterns among the majority of residents. Similar findings were reported by Okot-Okumu and Nyenje¹³ in Uganda and by Akintayo et al.¹⁴ in Nigeria, where low-income households generated smaller waste quantities because of reduced dependence on packaged products and extensive reuse practices. However, the presence of households generating between 5–10 kg/week and above 15 kg/week suggests increasing socio-economic transition and commercialization within the municipality. This pattern is similar to observations in peri-urban municipalities in Ghana and Kenya where waste generation increases with household income and commercial activity.¹⁵

Kitchen and food preparation waste constituted the largest source of waste generated in Mundemba, accounting for 52.9% of total waste generated. This finding is consistent with several recent studies conducted in developing countries where food and biodegradable waste dominate municipal waste streams Ferronato and Torretta⁸, Sharma et al.⁹ and Akintayo,¹⁴ reported that organic waste commonly exceeds 50% of municipal waste in low-income countries because diets rely heavily on fresh agricultural products rather than processed foods. Similar findings have also been reported in Cameroon, Ghana, and Ethiopia where municipal waste streams are largely composed of food residues and agricultural waste.^{10,15}

The dominance of kitchen waste has important implications for the technical feasibility of integrated waste management in Mundemba. Municipalities with high organic waste fractions are particularly suitable for composting and anaerobic digestion technologies because biodegradable materials can be converted into organic fertilizers and soil conditioners.¹⁵ Considering that agriculture remains the dominant economic activity in Mundemba, composting systems could simultaneously reduce waste volumes and improve agricultural productivity. This demonstrates that organic waste recovery could become a central component of future ISWM strategies in the municipality.

House-clearing waste accounted for 24.5% of the total waste generated. This proportion is relatively higher than values reported in several rural African municipalities where house-clearing waste often contributes below 15% of municipal waste streams.¹⁷ The higher proportion observed in Mundemba may be linked to increasing settlement expansion as a result of reduced intensity of the “Anglophone crisis” in the area, housing development, and replacement of household items associated with urban transition. From a technical perspective, this category of waste likely contains recyclable and reusable materials such as wood, plastics, textiles, and metals, suggesting that material recovery and sorting systems could be integrated into municipal waste management plans.

The waste composition analysis revealed that organic waste constituted 61% of the total waste stream in Mundemba. This finding is similar to results reported in recent studies from Uganda, Ethiopia, and Ghana where organic waste represented between 55–70% of municipal waste.^{9,18} However, the proportion observed in Mundemba is considerably higher than those reported in developed countries such as Germany, Canada, and Japan where organic waste generally constitutes less than 35% because of advanced recycling systems and higher packaging consumption.⁸

The high organic fraction strongly supports the technical feasibility of biological waste treatment systems in Mundemba. Composting technologies are particularly effective in tropical environments where high temperatures and humidity accelerate biodegradation processes.¹⁹ The tropical climatic conditions of Mundemba therefore provide favourable environmental conditions for decentralized composting facilities and organic waste recycling systems.

Plastics constituted 24.3% of the waste stream, making them the second largest waste category. Similar findings have been reported in

recent studies conducted in Nigeria, Kenya, and South Africa where plastics account for approximately 20–30% of municipal waste because of increased dependence on sachet water, bottled beverages, and packaged products.^{12,20} However, the plastic fraction observed in Mundemba is lower than values reported in highly industrialized urban centres where plastic waste often exceeds 30% of municipal waste streams.⁸

The increasing plastic fraction presents both environmental challenges and resource recovery opportunities. Plastics are non-biodegradable and contribute significantly to environmental pollution when improperly disposed. However, they also represent potentially valuable recyclable materials. The quantity of plastic waste generated in Mundemba suggests that small-scale plastic recovery systems involving informal waste collectors, cooperatives, and private recycling initiatives could be technically feasible if supported through municipal coordination and market access.

Glass waste accounted for 9.8% while metals represented 2.9% of total waste generated. Similar findings have been reported in studies from other parts of Cameroon and Nigeria where glass and metals constitute smaller waste fractions because many materials are informally recovered and reused before disposal.²¹ These recyclable fractions indicate potential for resource recovery systems and community-based recycling initiatives within an integrated waste management framework.

Electronic waste represented only 1% of the total waste stream. This proportion is lower than findings reported in highly urbanized African cities such as Lagos and Nairobi where increased access to electronic devices has significantly increased e-waste generation.¹² The relatively low e-waste generation in Mundemba may be linked to lower technological penetration and slower rates of electronic replacement. Nevertheless, even small quantities of e-waste require specialized management because of their hazardous components. Future integrated waste management systems should therefore incorporate designated e-waste collection mechanisms and awareness programs.

The findings on waste storage practices showed that 66.26% of households store waste in open piles while only 21.88% use reusable plastic containers. Similar observations were reported in peri-urban communities in Nigeria and Ethiopia where inadequate collection systems force residents to rely on open waste storage.^{9,22} However, the prevalence of open storage in Mundemba is significantly higher than values reported in municipalities with organized waste collection systems such as Kigali and Durban where standardized household bins are commonly used.^{23,24}

The widespread use of open waste storage in Mundemba reflects inadequate infrastructure, weak enforcement of sanitation regulations, and limited environmental awareness. Open storage practices increase the risk of disease transmission, vector breeding, odour nuisance, and environmental contamination. From a technical standpoint, this finding indicates urgent need for low-cost household storage systems, communal bins, and improved collection infrastructure as foundational components of future ISWM implementation.

The study further revealed that 85.29% of households did not receive any waste collection service, while only 2.94% experienced

weekly collection. Similar findings have been reported in several municipalities across Sub-Saharan Africa where inadequate financing, poor road networks, and limited municipal equipment constrain waste collection efficiency.^{8,10} However, the situation in Mundemba appears worse than reports from municipalities such as Kigali and Addis Ababa where improved governance and public-private partnerships have substantially increased collection coverage.²⁴

The near absence of waste collection services demonstrates major institutional and logistical weaknesses which is common in many rural communities and even some urban settings in Cameroon. However, the relatively moderate waste generation rate and semi-urban settlement structure suggest that decentralized collection systems using communal transfer stations and small-scale transport systems may be more technically feasible than highly centralized collection systems.

More than 92% of residents reported absence of public waste bins or collection points. Similar findings have been reported in poorly serviced municipalities in Cameroon and Nigeria where lack of disposal infrastructure contributes directly to indiscriminate dumping.¹⁰ Technically, establishment of strategically distributed communal waste collection points would represent one of the most achievable and cost-effective interventions for improving waste management in Mundemba.

Open dumping was identified as the most common disposal method, accounting for 33.3% of disposal practices. This finding is similar to recent studies from other parts of Cameroon and other developing countries where open dumping remains widespread because of inadequate landfill infrastructure and ineffective waste collection systems.^{20,25} However, the prevalence of open dumping in Mundemba is higher than levels reported in municipalities with engineered disposal facilities and stronger environmental regulation.

Waste burning of waste accounted for 26.5% of disposal practices. Similar findings were reported in rural municipalities in other parts of Cameroon, Kenya, Tanzania, and Nigeria where residents burn waste because collection systems are unavailable.¹⁴ However, the prevalence of burning in Mundemba is considerably higher than values reported in developed countries where environmental regulations prohibit open burning because of air pollution and greenhouse gas emissions.⁸

The high prevalence of open dumping and burning highlights urgent need for affordable collection services, controlled disposal facilities, and environmental education programmes. Technically, introducing community-based collection systems combined with composting and controlled disposal sites could substantially reduce these environmentally harmful practices.

A particularly concerning finding was that 19.6% of waste was disposed of in water bodies. This value is higher than findings reported in many African municipalities where disposal into water bodies generally represents less than 10% of disposal practices.¹⁸ This may be associated with Mundemba's coastal location characterised by high rainfall conditions, poor drainage systems, and proximity to rivers and streams. Disposal into water bodies significantly increases risks of flooding, aquatic pollution, and waterborne diseases, indicating urgent need for environmental regulation and public awareness campaigns.

Composting and land application accounted for 16.7% of disposal methods. This proportion is relatively encouraging and higher than findings reported in many urban African municipalities where composting remains poorly developed.⁹ The agricultural background of the population likely contributes to this practice. Existing composting behaviour demonstrates that biological treatment systems could be socially acceptable and technically feasible within the municipality.

The socio-technical assessment revealed that 93.14% of residents considered the waste management system non-functional. Similar dissatisfaction has been reported in municipalities with poor waste service delivery across Nigeria and Cameroon.¹⁰ Despite these challenges, 51.96% of residents expressed willingness to participate in composting programmes if technical support and materials were provided. Similar findings have been reported in Ethiopia and Rwanda where community participation increased significantly after environmental education and technical assistance programmes were introduced.⁹

Furthermore, 66.67% of respondents expressed willingness to participate in community clean-up campaigns. Similar findings have been reported in Ghana and Rwanda where community participation contributed significantly to successful sanitation programmes.¹⁸ This demonstrates strong social feasibility for participatory waste management approaches in Mundemba.

About 75.49% of respondents indicated willingness to contribute financially towards improved waste management services. Similar findings were reported by Al-Khatib et al.²⁰ and Sharma et al.⁹ where households were willing to pay for improved waste services provided systems were reliable and transparent. This indicates strong potential for cost recovery systems and public-private partnerships within future integrated waste management frameworks.

CONCLUSION

The study demonstrates that municipal solid waste management in Mundemba is characterized by increasing waste generation, dominance of biodegradable waste, inadequate waste collection infrastructure, widespread informal disposal practices, and weak institutional capacity. Organic waste constitutes the largest fraction of the waste stream, while open dumping, burning, and disposal into water bodies remain the dominant disposal methods because of absence of effective waste collection and disposal systems. Despite these challenges, the findings reveal considerable technical and social potential for implementation of integrated solid waste management systems within the municipality. The high organic waste fraction, existing composting practices, favourable climatic conditions, and strong willingness of residents to participate in waste management initiatives collectively indicate that decentralized and community-based ISWM approaches are technically feasible in Mundemba. The study therefore concludes that sustainable waste management improvement in Mundemba will require integration of composting systems, source segregation, decentralized collection infrastructure, material recovery initiatives, community participation, institutional strengthening, and public awareness programmes.²⁶⁻³²

RECOMMENDATIONS

To improve municipal solid waste management in Mundemba, the council should adopt an integrated and decentralized waste management approach that combines community-based waste collection, source segregation, and composting, recycling, and improved disposal infrastructure. Since biodegradable waste constitutes the largest fraction of the waste stream, composting programmes should be prioritized alongside the establishment of communal collection points and public waste bins in residential, market, and commercial areas. Municipal authorities should also promote plastic recovery and recycling through collaboration with private recyclers and informal waste collectors while introducing designated collection systems for hazardous and electronic waste. In addition, environmental education and awareness campaigns should be strengthened to discourage open dumping, burning, and disposal of waste into water bodies, supported by stronger enforcement of local sanitation regulations. Public-private partnerships and sustainable financing mechanisms should further be encouraged to improve the efficiency and long-term sustainability of waste management services, while additional studies should assess the economic feasibility of composting facilities, transfer stations, and engineered disposal systems within the municipality.

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CONFLICT OF INTEREST

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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