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Characterization of Commercial Solid Waste Stream in Bayelsa State, Nigeria

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Abstract

The problem associated inappropriate management of municipal waste to the ecosystem cannot be overemphasized. This study involved the physical characterization of municipal solid waste streams in 4 commercial dumpsites in Yenagoa Metropolis, using the quartile estimate method. Results showed that out of a total mass of 79.82kg; the individual mass composition was reported for garbage (food) waste 33.32 (39%), paper waste 14.90 kg (40.82%), plastic waste 5.12 kg (6%), nylon 11.01kg (13%), metal 4.31 kg (5%), wood 2.29 kg (3%), electronic 5.69 kg (7%), glass/ceramic 3.48 kg (4%) and unclassified waste whose mass was 4.62kg (5%). Disposal of untreated and unsegregated/uncharacterized waste adverse effect to the environment. It is hereby recommended that the populace to desist from illicit disposal of waste stream. In addition all stakeholders and Government in particular should formulate policies the reduction, reuse and recycling of waste stream.

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Introduction

Waste is a universal phenomenon associated with human activities, and that every activity waste is continually generated [1], waste are generated at every stage or process of production and development. The knowledge of the source and type of waste in an environment is required in order to design and operate appropriate solid waste management system [2]. Municipal solid wastes [MSWs] ranges from residential, industrial, commercial institutional construction and demolition and agricultural [3]. It comprises countless different materials including; food wastes, packaging in the form of paper, metals, plastic or glass, discarded clothing, garden waste, pathological and hazardous waste, [4]. The challenges associated with the management [MSWs], has become a source of global concern [5]. Though it varies from region to region and country.

Poor funding and inadequate management strategies on the part of Government has infringe on vital environmental component [6]. It was reported that municipal waste density in Nigeria ranges from 250-370kg/m3 with a daily waste generation rate of about 0.44-0.66kg/ capital /day [7, 8]. Furthermore Nigeria urban population has witnessed a remarkable abrupt growth due to rural-urban migration [9], necessitated by yearning of the populace to keep abreast or understand contemporary technological applications. High population density implicated in poor handling of large waste stream generated [8], due to inadequate waste management facilities and consequently resulting to environmental pollution.

In Nigeria inadequate management, poor funding and week policy implementation by government and lack of awareness by the populace has resulted to reckless dumping of waste which impairs the ecosystem [10].when these waste is dumped into the environment, leachates from MSWs impair the air quality, aquatic and terrestrial biota by the process of bioaccumulation [10]. Another major environmental challenges associated with MSWs stream is in-stu burning of waste in dry season as a process of waste reduction which causes greenhouse effects. With man's continual generation and illicit dumping of waste stream into the environment there is an urgent need of MSWs characterization.

Materials and Method

Study Area

The study area is Yenagoa metropolis which is the capital city in Bayelsa State of Nigeria. Bayelsa lies central southwest on the Nigerian map and located on latitude 4° 41N and 5° 23N and longitude 6 ° 10E and 6°33E with a population estimate of over 300,000. Since attaining the status of a state capital in 1996.

Waste Characterization

The magnitude of commercial waste stream in terms of mass and volume were determined. Four commercial (market) dumpsites (Akenfa, Etegwe, Opolo and Kpansia) were visited for sampling, collection and characterization of waste stream. The quartile system of characterization was used during sampling. The area of the individual dumpsites were measured and divided into four equal quarters (A, B, C, and D), following research protocols as documented in literature [10, 11]. Calculation were made such that when characterized waste streams of the workables or assorted quarter/faction was multiplied by the entire quarter it will give a representative estimate of the entire dumpsite area. During the sampling, the waste stream were weighed before sorting them out to their various components for reweighing. Components of waste includes; garbage or food, plastic/rubber, metals glass/ceramics, wood, and other unclassified wastes.

Statistical Analysis

All data were expressed as mean, chart was plotted using the 2016 version of Microsoft excel.

Results and Discussion

Table 1 presents the physical characterization of waste streams from the 4 sampling stations (commercial waste dumpsites). Results on the magnitude of garbage wastes ranged from 5.79 – 9.11 kg, out of a total garbage waste stream of 33.32 kg (Table 1), with a percentage composition of 39% (Figure 1). The results of the individual composition of paper waste streams was reported in the range 2.43 – 5.00 kg with a cumulative mass and composition of 14.90kg (Table 1) and 18% (Figure 1) respectively. The mas of plastic waste was reported in the range of 0.84 – 4.91 kg, with a total magnitude of 5.12 kg

Table 1. Physical Characterzation of municipal waste stream based on mass

Waste stream Coordinates	A (Akenfa) Mass (kg) N04° 59ᴵ 57.8ᴵᴵ E006° 23ᴵ 23.6ᴵᴵ	B (Etegwe) Mass (kg) N04° 57ᴵ 57.8ᴵᴵ E006° 21ᴵ 11.6ᴵᴵ	C (Opolo) Mass (kg) N04° 56ᴵ 57.8ᴵᴵ E006° 20ᴵ 08.2ᴵᴵ	D (Kpansia) Mass (kg) N04° 55ᴵ 30.4ᴵᴵ E006° 19ᴵ 04.2ᴵᴵ	Total mass (kg)
Garbage or food	12.46	5.96	9.11	5.79	33.32
Paper	3.33	2.43	5.00	4.14	14.90
Plastic	2.00	0.90	1.38	0.84	5.12
Nylon	2.26	1.12	1.02	6.61	11.01
Metal	0.97	0.75	1.81	0.78	4.31
Wood	0.26	0.44	1.18	0.41	2.29
Electronic	1.28	1.06	1.64	1.71	5.69
Glass/Ceramics	1.03	0.74	0.94	0.77	3.48
Unclassified	1.46	1.01	1.15	1.00	4.62
Total	25.11	14.43	23.24	17.04	79.82

(Table 1), and composition of 6% (Figure 1). The mass of nylon waste ranges from 1.02 – 6.61 kg with a total mass of 11.01 kg (Table 1), and composition of 13% as presented in Figure 1.

Results on the magnitude of metalic waste stream was in the range of 0.75 – 1.81 kg, with a total value of 4.31 kg (Table 1), with a composition of 5% (Figure 1). As presented in Table 1, mass of wood waste was reported in the range of 0.26 – 1.18 kg, having total mass and composition of 2.29 kg and 3% respectively. Meanwhile electronic waste stream had a total magnitude of 5.69 kg, with values ranging from 1.06 – 1.71 kg (Table 1), and composition of 7% (Figure 1). The magnitude of glass/ceramic waste stream ranged from 0.74 – 1.04 kg, with total mass of 3.84kg (Table 1), and composition of 4% as presented in Figure 1. Results on the mass of unclassified waste showed values ranging from 1.00 - 1.46, with an overall mass and composition of 4.62 kg and 5% in Table 1 and Figure 1 respectively.

Comparatively, in Benin metropolis the total magnitude of commercial waste stream was 2323.93kg; with values of individual percentage components reported for; garbage 44.96%, plastic 25.43%, paper 14.27%, metal 3.21%, glass 3.89%, and 8.24% for other waste which includes but not limited to ceramics, foam, clothes [12]. Furthermore, nylon waste stream was reported to be the highest composition, which is in tandem with this study. In Abuja metropolis where magnitude of waste stream is reported for garbage (56.20% dry season and 52.0% wet season), rubber (dry season10.20% and wet season 3.56%); paper (wet season 10.00% and dry season 12.46%), glass/ceramics (dry season 7.60% and wet season 1.42%) plastics (7.4% and 2.85%), metals (2.60% and 0.71%), and unclassified waste having values of 5.60% in dry season and 25.62% in wet season [13].

A recent study on the seasonal characterization of household solid waste 100-domestic unit showed composition for dry and wet seasons respectively for; garbage 211.50kg (40.82%) and 285.70kg (42.81%), Plastic/rubber 127.00kg (24.51%) and 138.01kg (20.68%), paper 70.30kg (13.56%) and 98.41kg (1476.68%), glass/ceramic 56.20kg (10.85%) and 62.59kg (9.37%), metal 29.50kg (5.70%) and 39.40 (5.90%), and wood waste streams with seasonal values of 12.70kg (2.45%) and 24.23 (3.63%) as reported by Angaye et al., [14].

In Enugu metropolis magnitude of waste stream had a total of 161112 kg, with42 % as biodegradable waste, compared to non-biodegradable waste which was 58 % [11]. In Jigawa metropolis the daily volume of per

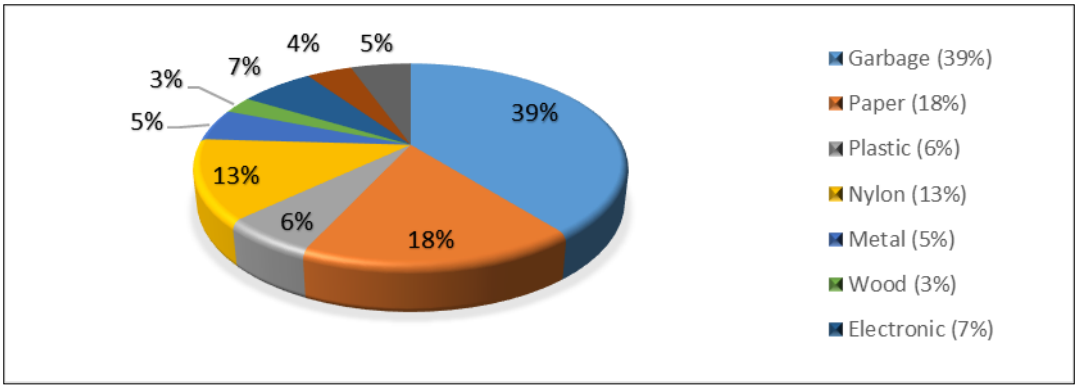

Figure 1. Composition of characterized waste stream

capita waste stream 0.85 x 10^{-3} in dry season and 0.88 x 10^{-3} m^3/person/day in wet season [15]. In their study, the individual percentages compositions of organic wastes was reported in dry [53.18%] and wet season [62.75%], compared to inorganic having values of 46.82% and 37.25% respectively [15]. Characterization is an intrinsic aspect of waste management aimed as waste reuse, recycling and reduction of waste stream. It also helps to determine the toxicity and flammability and overall hazard associated with illicit handling of waste.

Conclusion

The characterization of commercial waste stream was investigated in Yenagoa metropolis. Incidentally the characterization showed that garbage, paper, plastic, nylon, metal, wood, glass/ceramics as well as unclassified waste were components of waste streams from the study area. Unfortunately most landfill have become dumpsites comprising of unsegregated/ characterized wastes streams, that can be treated, reduced, reuse recycled. In addition, uncharacterized wastes are burnt off in attempt to reduce them, thereby infringing on ambient air quality. It is recommended that there is need to enact policies to reduce, reuse and recycled to avoid their attendant adverse effects in the ecosystem.

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