Contribution to the management of solid household waste in the urban municipality of Kindia (Republic of Guinea)

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ABSTRACT

The present study, which was carried out during the period from February to April 2022 in the city of Kindia, had as its general objective the study of the management of solid household waste in the urban municipality of Kindia. The specific objectives relate to determining: average daily production of waste per household, per inhabitant and per district; average daily production of types of waste per household; the average ratios by type of waste and the annual production of household waste in Kindia. The survey covered ten (10) households in eighteen (18) neighborhoods out of the thirty-three (33) in the town of Kindia. The main results obtained are: the average daily production of DMS per household for three months, February (41.87 kg); March (53.62 kg) and April (56.66 kg); the average daily production per inhabitant (0.62 kg/capita/d); the average annual waste production of the 18 neighborhoods (1157.07 tonnes per year) for a population of 92,413 inhabitants; that of any city of Kindia (37883.479 tons per year) with a population of 170437 inhabitants and the average ratios by type of waste, fermentable (60.01%); cardboard/paper (2.50%); textiles (5.51%); plastics (6.24%); glasses (0.16%); metals (0.09%); sands (9.99%) and others (15.50%). These results show that the production of waste per household is a function of the standard of living of the populations of the different neighborhoods (low standing, medium standing and high standing) and the different activities carried out by these populations.

Keywords: *Management, Waste, Household, Solid, Kindia.*

1. Introduction

Waste management is a current difficulty and an essential issue for our future and that of the planet given the quantities produced. Consequently, waste actively participates in degrading the environment through the diversity of pollution it can generate. When issues like the waste of primary resources pose a threat to the environment, poor waste management also contributes. It is therefore essential to take charge of our waste in a responsible and environmentally friendly manner [1, 2]. Solid waste management is a local issue with global implications. As the world's population continues to grow, so does the amount of waste produced. In 2015, the world generated 2 billion metric tons of solid waste. This figure is expected to reach 3.4 billion metric tons by 2050. In low-income countries, the amount of waste is expected to more than triple by 2050 [3].

Currently, social concentrations, the intensification of industrial activities, the launch of new consumable products (plastic materials, polymers, textiles, synthetic dyes, household detergents, etc.) have completely changed waste management. The residues accumulate and even when they are biodegradable, they are rejected in such quantity that the natural mechanisms of resorption, metabolization and fermentation are deeply disturbed [4]. More than 2.01 billion tons of household waste are produced each year [5].

Waste generation will continue to grow, due to the increase in size and density of cities and global economic growth. In Africa, waste generation could continue to increase until after the end of the 21st century [6]. There is a strong correlation between the level of development of a country and the production of waste. High-income countries generate on average seven times more waste per year than low-income countries [3, 7].

Household waste is a concern for cities in all countries of the world: its collection along urban roads and its treatment are expensive. In cities in Developing Countries (DCs), where landfills receive on average only 30 to

50% of the waste produced, the concern is more intense because of the health risks linked to piles of rotting waste and the congestion of streets and drainage canals [8].

In Guinea, waste management in general and solid household waste in particular is a major problem. The inoperative nature of household waste collection and disposal structures encourages the establishment of uncontrolled wild dumps in the streets. Uncollected rubbish, unchanneled waste water, degraded roads have become the nightmare of the population. The latter clog the drainage channels and pollute the shores through lack of removal. Faced with this problem, the authorities have put in place legal and institutional tools, projects/programs and studies to find adequate management strategies [9].

The city Kindia is one of the 38 urban municipalities of Guinea, located 135 km from Conakry the capital, it is not immune to this inconvenience of poor management of solid household waste. This city has experienced a population explosion in recent decades without adequate sanitation and waste management infrastructure. However, the sustainable access of populations to sanitation and the management of household and other waste is a priority for African countries in order to achieve the Millennium Development Goals. Because sanitation and waste management are essential elements for improving the living conditions of populations.

Waste management in the city of Kindia is provided by the Municipal Water and Sanitation Agency, the Municipal Sanitation Service, Small and Medium Enterprises and Non-Governmental Organizations. But, it turns out that the city is cluttered with rubbish here and there, especially during heavy rains, it is characterized by the absence of regulated dumps and household waste is thrown into the gutters and rivers.

Thus, waste management in the city of Kindia must concern educational and research institutions in order to provide proposals for solutions to this problem. It is in this perspective that this research falls under the general objective of contributing to the management of solid household waste in the urban municipality of Kindia. The specific objectives are, among others: to determine the ratios of waste production per household and per district during three months of the dry season (February, March and April); assess the amount of waste produced during these three months in the municipality and characterize the waste produced.

2. Materials and methods

2.1 Materials

2.1.1 Study environment

Kindia is a city of Guinea located 135 km from the capital Conakry, it is the capital of the region, cosmopolitan, it is populated mainly by Soussous and Fulani. It is a traditionally agro-pastoral city. The urban commune of Kindia has a population of 170,437 inhabitants distributed in 33 districts [10].

The main activities are trade, agriculture and livestock. Its climate is of the humid tropical type, characterized by the alternation of two seasons of variable duration, a dry season from November to April and a rainy season with abundant rainfall from May to October with an average rainfall of 2500 mm of water per year. With temperatures ranging from 25°C to 39°C [11].

2.2 Work materials

The work materials used for the collection, transport and sorting of waste are as follows: scales, shovels, bags, packaging bags, gloves, mufflers, rakes, wheelbarrow, three-wheeled motorcycle, sorting table, etc.

2.3 Methodology

Garbage or waste management refers to all the operations and means implemented for their elimination, reduction and recycling or recovery, in order to reduce their effects on human health and the environment. The management of domestic or household solid waste generally translates into: pre-collection, collection, transport, sorting and recovery [12].

Of the 33 neighborhoods in the city of Kindia, we conducted the survey in eighteen (18) neighborhoods (Abattoir I, Bamban, Banlieue, Cacia I, Caravanserail, Féréfou I, Filigbé, Gangan, Gare, Kenendé, Koliady I, Lack Mosque, Lack TP, Sekhouya, Sinaniya, Tafori Almamiya, Tafori Weather, Yéolé). Ten (10) families or households of 6 to 10 people with an average of eight (8) were selected per district according to the standard of living (high standing, medium standing and low standing), the garbage bags were deposited in these different households and we collected and weighed once a week for three months (February, March and April). Sorting was done at the dump every week, taking into account the following components (fermentable or organic waste, plastics, paper, textiles, metals, sand and others).

To better predict the size of collection, treatment facilities and disposal centers, and better plan the management system, knowledge of the quantity of waste produced in a given environment is essential [9]. This quantity which varies according to space, time, climatic, geographical, demographic and economic factors [13]. The ratio of the daily quantity of waste produced per inhabitant is determined by the equation below [14].

$$R_j = \frac{Q}{P \times t}$$

Where :

Rj: Daily ratio of household waste per person in (kg/inhabitant/d);
Q: Total mass of waste collected at household level during time t (kg);
P: Total number of the population concerned during time t;
t: Characterization time in days (d).

3. Results and discussions

3.1 Results

The results obtained during this research relate to: (i) the average daily production of solid household waste in the eighteen (18) neighborhoods surveyed during the three months (February, March and April); (ii) the average daily production of waste per household for three months per district; (iii) the average daily production of waste per inhabitant of each district; (iv) the average daily production of types of waste by family and by neighborhood; (vi) average ratios by type of waste by neighborhood. These results are illustrated by the diagrams in figures 1, 2, 3, 4 and 5.

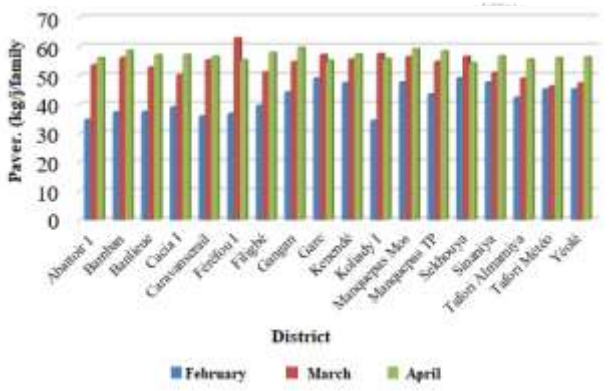

Figure 1: Average daily waste production per household or family and per neighborhood

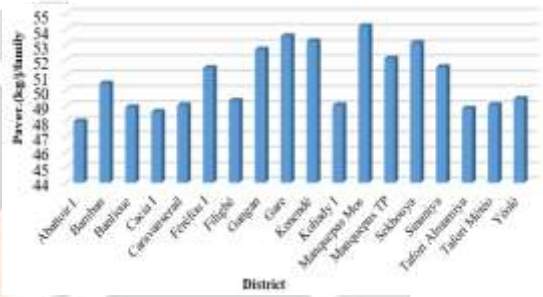

Figure 2: Average daily production of waste per household or family for three months per district

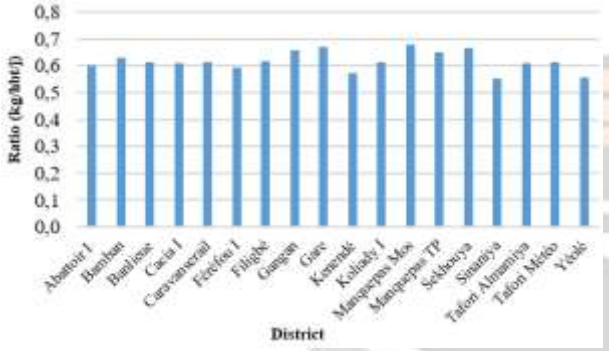

Figure 3: Average daily production of waste per inhabitant in each neighborhood

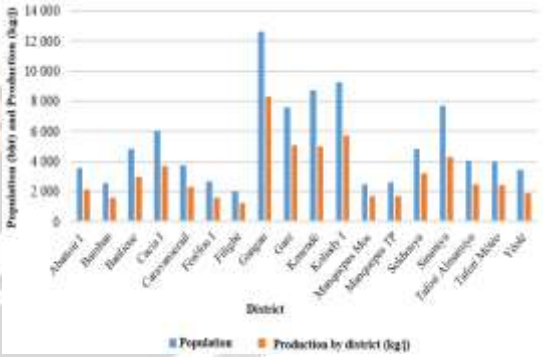

Figure 4: Daily waste production and population by district

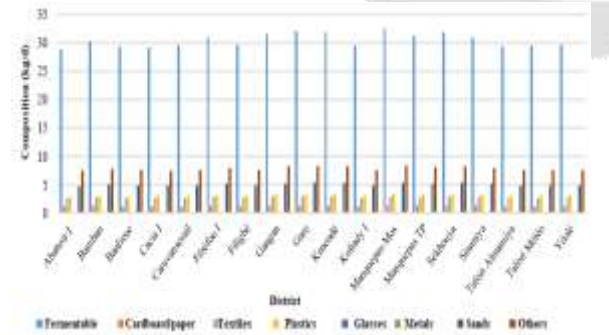

Figure 5: Average daily production of types of waste by family and by neighborhood

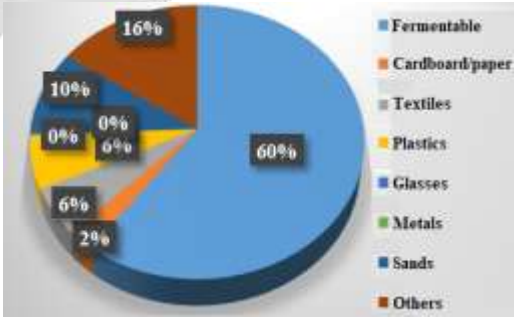

Figure 6: Average ratios by type of waste

3.2 Talks

The results of this study show that, during the three months of February, March and April, 2022 of the survey of ten (10) households in eighteen (18) districts of the city of Kindia, the average daily production of solid household waste per household and per neighborhood varied respectively from 34.26 kg to 48.92 kg in February; 46.15 kg to 62.73 kg in March and from 54.13 kg to 59.46 kg in April, with respective averages of: 41.87 kg; 53.62 kg and 56.66 kg (Figure 1). The average daily production of waste per household and per district during these three months varied from 48 kg to 54.22 kg in the respective districts of Abattoir I and Manquepas Mosquée, with a general quarterly average of 50.72 kg (Figure 2). These results show that the production of waste per household is a function of the standard of living of the populations of the different neighborhoods (low standing, medium standing and high standing).

The average daily production of solid household waste per inhabitant in each district recorded during the survey period varied from 0.55 kg per inhabitant (Sekhouya district) to 0.68 kg per inhabitant (Sinaniya district), with an average of 0.62 kg per capita (Figure 3). The results of this work are in line with those of other authors, who confirm that the ratios of waste production per inhabitant and per day vary between 0.30 and 1.50 kg/inhabitant/d. For which the average ratios used are: low status (0.60 kg/capita/day); average standing (0.65 kg/cap./d); high standing (0.75 kg/capita/day) [7, 9, 15].

The daily production of waste per district according to the populations is 1229.615 kg/d in the Kenendé district and 5012.402 kg/d in the Tafori Almamiya district, with respective annual quantities of 448809.317 kg/d and 3028476.224 kg/d (Figure 4). The annual average of waste production of the 18 districts is 1157.07 tons per year for a population of 92413 inhabitants, which makes it possible to estimate the annual production of solid household waste of the city of Kindia at 37883.479 tons per year, with an average ratio of 0.62 kg per capita per day, with a population of 170437 [10].

The average daily production of households by type of waste is: 30.39 kg for fermentables; 1.265 kg for cardboard/paper; 3.154 kg for plastics; 0.080 kg for glasses; 0.044 kg for metals; 5.050 kg for sands and 7.840 kg for others (Figure 5). Thus, the average ratios by type of waste of the eighteen (18) neighborhoods are as follows: fermentable (60.01%); cardboard/paper (2.50%); textiles (5.51%); plastics (6.24%); glasses (0.16%); metals (0.09%); sands (9.99%) and others (15.50%) (Figure 6). The analysis of these results shows a relatively high production rate of fermentable or organic waste compared to other types, this indicates the large production and consumption or marketing of fruits and vegetables (plant materials) in the city of Kindia.

4. Conclusion

This study is a contribution to the management of solid household waste in the urban municipality of Kindia. It thus makes it possible to propose a better strategy to the various actors in charge of the management of solid household waste which floods the city of Kindia. The main results relate to: the average daily production of waste per household during the field survey period (February, March and April); the average daily production per inhabitant; the average annual waste production of the 18 districts; the average annual waste production of the town of Kindia; the average ratios or compositions by type of waste.

The results obtained during this research show that the sustainable management of household waste requires the promotion of their recovery, which allows the protection of the environment, the reduction of poverty, the satisfaction of food needs and the creation of jobs.

5. References

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