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Assessment of Municipal Solid Waste of the Karwi

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Abstract: Due to rapid increasing population, urbanization and industrialization waste generation rate also increases but, Municipal authorities are not able to collect all waste and they are not having advance technology for treating such waste it gives result in form of pollution. The paper aims to characterize the waste generated in municipality of Karwi, in the state of Uttar Pradesh, India. Municipal Solid waste(MSW) is a heterogeneous waste and composition of the waste varied from place to place. First of all, the entire study area was surveyed to obtain essential information regarding waste generation areas and collection points. On the basis of information, representative sample were selected in each point. Collected samples were thoroughly mixed and segregated into different categories and data represented in percentage. The characteristics of the municipal solid waste were determined in terms of the components, average mass (kg) and percentage .Characterization of municipal solid waste shows Karwi waste comprise maximum plastic (29.01%), *Metal (0.025%)*, *Wood(0.0215%)*, *Cardboard(3.77%)*, *Rubber(1.9%)*, *Paper(5.1%), Rags(3.22%)*, *Packaging Material (11.02%)*, *Glass (8.42%)*, *Compost (8.025%)*. ***Thus, on the basis of this study we may conclude that solid waste management and recycling is major issue of Varanasi district. We can reuse various types of waste depending upon the nature of waste. We can also make alternate use of that waste like energy production. Community participation in solid waste management may be a better option.***
Keywords: Municipal solid waste, Classification of waste, Waste Generation

I. INTRODUCTION

Waste generation is an attribute of every life and a human being ceases to generate waste only when he is no more and is to be disposed as waste. The quantity and quality of municipal solid waste (MSW) generated varies in space and time with the variation attributed to rising consumer attitude, population growth, seasonality and development of technologies. The rudimentary nature of MSW characterisation data, especially in developing countries makes waste management more difficult. Besides the absence of data, waste management solutions in developing countries are usually constrained by financial deficiencies, lack of policy implementation and inefficient community participation.

Municipal solid waste includes wastes generated from residential, commercial, industrial, institutional, construction, demolition, process, and Residential Single and multifamily dwellings generate food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes.

Commercial Stores, hotels, restaurants, markets generate paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, etc (Tchobanoglous et al., 1993). The composition and characteristics of municipal solid waste is influenced by certain factors, which include the area (residential, commercial, etc), the economic level (differences between high- and low-income areas), the season and weather (differences in the amount of population during the year, tourist places) and culture of people living or doing business in the area. High-income areas usually produce more inorganic materials such as plastics and paper, while low-income areas produce relatively more of organic waste. Uncontrolled or improperly sited open solid waste dumpsites constitute health hazards and damage the aesthetic beauty of many cities in Nigeria (Napoleon et al 2011). Waste characterization data consists of information on the types and amounts of materials (paper, food waste, glass, yard waste, etc.) in the waste stream. It depends on a number of factors such as food habits, cultural tradition, socioeconomic and climatic conditions. It varies not only from city to city but even within the same city itself (Gawaikar, 2004). According to Gawaikar (2004), characterization of municipal solid waste helps in determining the quantity of waste generated in a particular location at a particular time of the year. This help in identifying the trend of generation as well as the influencing factors. It makes proper planning of solid waste management, determining the size and number of functional units and required for managing the waste, the needed resources for the protection of environment and public health. Characterization is also important to determine its possible environmental impacts on nature as well as on society (Alamgir et al, 2005).

II. MATERIAL AND METHODS

First of all, the entire study area was surveyed to obtain essential information regarding waste generation areas and collection points. On the basis of information, representative sample were selected in each point. Collected samples were thoroughly mixed and segregated into different categories and data represented in percentage. The research gathered data from two main sources namely: secondary and primary sources. For primary source of data generation, sampling was done at four different sites. The samples were sorted out manually into waste components. The weight fraction of each component in the sorting sample was calculated by the weights of the components.

A. Study Area

Chitrakoot Dham is a city in the Chitrakoot district, in the Indian state of Uttar Pradesh. It is the headquarters of the Chitrakoot district. Situated in the Bundelkhand region, it holds great cultural, historical, religious and archaeological importance and it is said that Rama, a major deity in Hinduism, spent 11 years of exile in Chitrakoot. It is connected to the town of Chitrakoot, situated in the Satna district of Madhya Pradesh. As of the 2011 census, Chitrakoot Dham had a population of 66,426, with 54% being male, and 46% female. The city has an average literacy rate of 67%, with male literacy at 75% and female literacy of 58%.

B. Sample Collection

The waste collected for 4 days was mixed thoroughly on 4th day and a 40 kg samplefrom /each site was taken. The samples were collected for 4days (from 5/09/2024 to 09/09/2024) in a row from one to four sources in each category and community bins and their locations. Because MSW is seriously physically and chemically heterogeneous, it is difficult to collect samples on behalf of the whole city perfectly. The samples were collected from different locations such as at four sites i.e. Dhus maidan (DM), LIC bazar (LB), Bus Stand (BS) and Galla Mandi (GM) in Karwi. Various components like paper, plastics, polythene,plastic bottles, paper pouches, cardboard, polyester, rubber, leather, batteries, concrete, stone, ash, sand, glass, metals, plastic, soft drink cans, carton packs, synthetic textiles, coating chemicalslike latex etc. was segregated manually. Now the wastes were categorized into different components like food waste, plastic, garden waste, paper, textile, leather, ash, cardboard and inert waste etc. All separable physical components were segregatedmanually on-site. These wastes were analyzed further.

C. Sample size and Classification of Waste

The waste collected for 4 days was mixed thoroughly on 40 kg samplefrom each site was taken. Variouscomponents like paper, plastics, polythene,plastic bottles, paper pouches, cardboard, polyester, rubber, leather, batteries, glass, metals, plastic, carton packs were segregated manually. Now the wastes were categorized into different components like food waste, plastic, garden waste, paper, glass, cardboard and other waste etc.

D. Waste Composition

Waste composition depends on a wide range of factors such as food habits,cultural traditions, lifestyles, climate and income, etc. (Gupta et al., 1998). The composition of municipal solid waste.in generation sources and collection points were determined on a wet weight and is mainly composed of a large organic fraction (40%-60%), ash and fine earth (30%-40%), paper (3%-6%) and plastic, glass and metals (each less than 1%). The C/N ratio varies between 800 and 1000 kcal/kg (Sharholy et al., 2008).

Table.1 Type and sources of municipal waste

S.N.	Source	Type of waste
1	Residentialareas	Food waste, paper, cardboard, plastic, textiles, glass, metal and non-hazardous waste, batteries, construction debris and demolition waste
2	Commercialareas	Paper, cardboard, plastic waste, glass, metal and e-waste
3	Institutionalareas	Paper, cardboard, plastic waste, glass, metal and e- waste, hazardous waste, processing waste, ashes,infectious and toxic waste
4	Industrial areas	Paper, cardboard, plastic waste, metal, e-waste, hazardous waste, and nonhazardous waste
5	Municipal services like street cleaning,parks, water andwastewater treatments	Green trash, silt/ashes, construction and demolitionwaste, sludge

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Table 1.2: Biodegradable and Non-biodegradable Waste: Degeneration Period

Category	Types of waste	Approximate time taken to degenerate
Biodegradable	Organic waste such as vegetable and fruit peels, leftover foodstuff, etc.	A week or two
	paper	10-30 days
	Cotton cloths	2-5 month
	Woollen items	1 year
	wood	10-15 year
Non-biodegradable	Tin, aluminium and other metal items such as canes	100-500 year
	Plastic bags	One million year
	Glass bottle	Undetermined

Source: http://edugreen.teri.res.in

E. Waste Generation

Figure 1 shows the waste generation of each area for 4 days where it represents one consecutive week. Total municipal solid waste generated during one week of collection at four different sites.

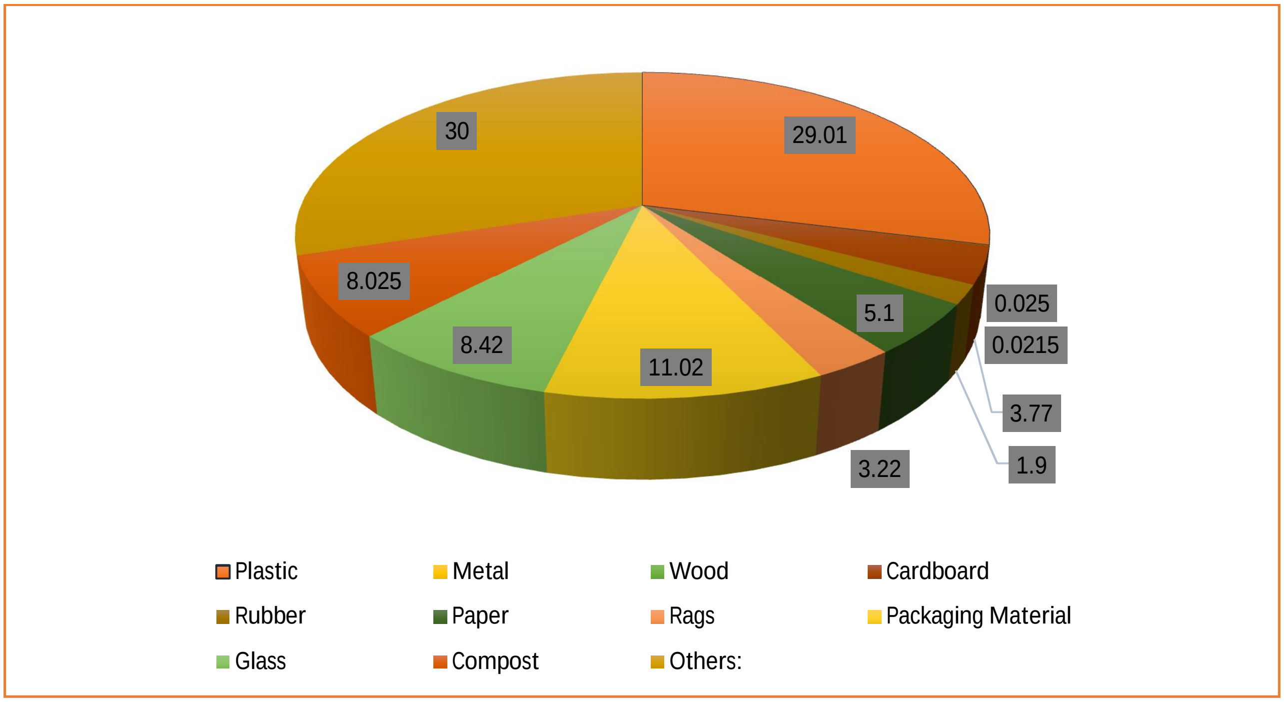

Figure 1. Average physical composition ofMunicipal solid waste of Karwi city

1) Plastic (29.01%)**:** Plastic constitutes the largest percentage of material usage in this dataset, underscoring its dominant role in packaging, consumer products, and industrial applications. However, this high dependency on plastic raises serious environmental concerns, particularly regarding pollution and waste management. The need for alternatives, such as biodegradable materials or increased recycling initiatives, is paramount to mitigate the ecological footprint associated with plastic waste.
2) *Metal (0.025%):* The minimal presence of metal indicates a specific focus on materials that may be more sustainable or cost-effective in certain applications. This low percentage could suggest a potential shift towards using lightweight materials or alternatives that reduce energy consumption during production and transportation. Further exploration of the implications of reduced metal usage is necessary, particularly concerning resource extraction and its environmental impact.

3) *Wood (0.0215%):* The low percentage of wood materials raises questions about sustainable forestry practices and the growing reliance on synthetic substitutes. Although wood is a renewable resource, its usage must be balanced with conservation efforts to prevent deforestation and protect biodiversity. The findings suggest that a more integrated approach to sourcing wood sustainably could enhance its role in resource management.
4) *Cardboard (3.77%):* Cardboard remains a crucial material, especially in packaging. Its relatively higher percentage indicates its continued relevance in shipping and consumer goods. This highlights the need for efficient recycling systems and sustainable packaging designs to minimize waste. Encouraging the use of recycled cardboard in production could significantly reduce the environmental impact associated with packaging materials.
5) *Rubber (1.9%):* The percentage of rubber materials reflects its use primarily in the automotive and manufacturing sectors. This proportion suggests a potential opportunity for developing alternatives to natural rubber, particularly in light of climate change impacts on rubber tree cultivation. Promoting recycled rubber products could help reduce reliance on virgin materials and enhance sustainability in these industries.
6) *Paper (5.1%):* The presence of paper at 5.1% emphasizes its ongoing significance, even in an increasingly digital world. This highlights the necessity for responsible sourcing and recycling practices to mitigate the environmental effects of paper production. Sustainable forestry initiatives and consumer awareness can play vital roles in ensuring that paper usage remains environmentally friendly.
7) *Rags (3.22%):* Rags are indicative of textile recycling and highlight the importance of sustainable practices within the fashion industry. With increasing awareness of textile waste, promoting the reuse and recycling of fabric materials is crucial for reducing environmental impacts and promoting circular economy principles.
8) *Packaging Material (11.02%):* The substantial percentage of packaging materials signifies their critical role in various industries, particularly e-commerce. This necessitates a push towards innovative packaging solutions that reduce waste and environmental impact. Implementing policies that encourage the use of sustainable packaging materials can significantly benefit both businesses and the environment.
9) *Glass (8.42%):* The percentage of glass usage indicates its importance in packaging and construction. While glass is highly recyclable, its production is energy-intensive. Enhancing recycling programs and promoting the use of recycled glass in manufacturing can mitigate these concerns.
10) *Compost (8.025%):* The presence of compost materials reflects a growing recognition of organic waste management and its potential benefits for soil health and sustainability. Promoting composting practices can reduce landfill waste and enhance nutrient recycling within ecosystems.
11) *Others:* The "Others" category may encompass various materials that are less commonly used but still hold significance in specific applications. It is essential to explore these materials further to understand their environmental impacts and potential for sustainable use.

III. RESULTS AND DISCUSSION

The analysis of material usage reveals important insights into various categories. Plastic leads at 29.01%, emphasizing its central role in packaging and consumer products but raising significant environmental concerns regarding pollution and waste management. This underscores the need for alternatives, such as biodegradable materials and enhanced recycling initiatives. In contrast, metal comprises only 0.025%, suggesting a shift towards more sustainable materials that may reduce energy consumption; this minimal usage invites further exploration into the implications for resource extraction and environmental impact. Similarly, the low percentage of wood (0.0215%) raises concerns about sustainable forestry practices, highlighting the need to balance renewable resource use with conservation efforts to prevent deforestation. Cardboard (3.77%) remains essential in packaging, necessitating efficient recycling systems and sustainable designs to minimize waste. Rubber, at 1.9%, serves mainly the automotive and manufacturing sectors, indicating opportunities for developing alternatives to natural rubber in light of climate change. Paper (5.1%) continues to be relevant, requiring responsible sourcing and recycling practices to mitigate environmental impacts. Rags (3.22%) highlight the importance of textile recycling and sustainable practices in the fashion industry to support a circular economy. Packaging materials account for 11.02%, indicating their critical role in e-commerce and the urgent need for innovative waste-reduction solutions. Glass usage (8.42%) underscores its importance in packaging and construction, necessitating improved recycling programs due to its energy-intensive production. Lastly, compost materials (8.025%) reflect a growing recognition of organic waste management's benefits for soil health. Promoting composting can reduce landfill waste and enhance nutrient recycling. The "Others" category encompasses various less commonly used materials that warrant further investigation to understand their environmental impacts and potential for sustainable use.

IV. CONCLUSION

In conclusion, the percentage values of these materials provide critical insights into their usage and significance in contemporary industry and environmental sustainability. Understanding these proportions allows for the development of informed policies and practices aimed at reducing waste, enhancing recycling efforts, and promoting sustainable resource management. Future research should focus on the implications of these findings in specific industries and their broader environmental impacts. The analysis reveals a pressing need for sustainable practices and innovative solutions across all material categories to address environmental concerns and reduce waste effectively.

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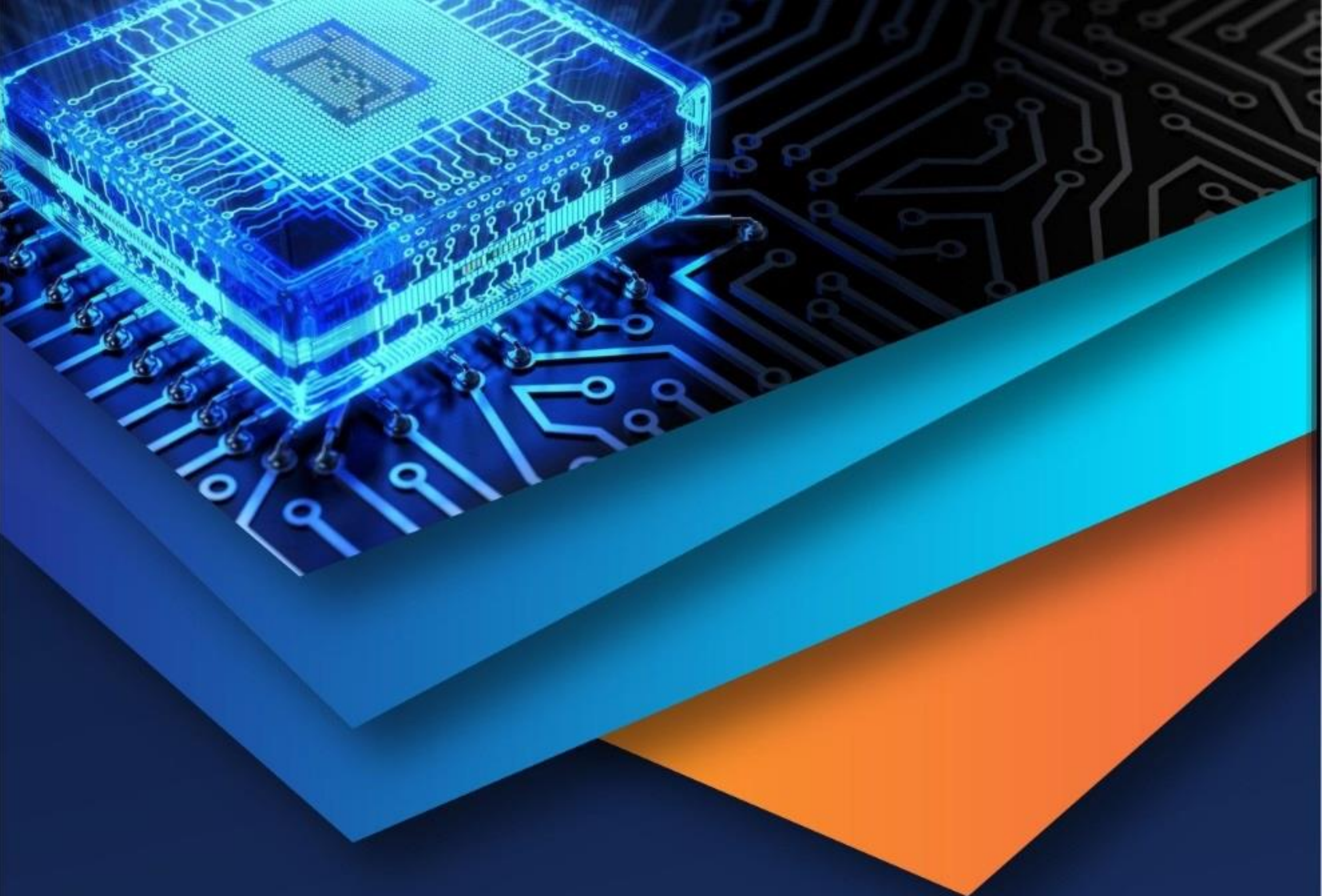

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