

# **COMPARATIVE ANALYSIS OF HOUSEHOLD WASTE IN THE CITIES OF STUTTGART AND KUMASI – OPTIONS FOR WASTE RECYCLING AND TREATMENT IN KUMASI**

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## **ABSTRACT**

The composition of household waste from two cities (Stuttgart and Kumasi) in a developed and a developing country are compared, the methods of treatment of household waste in Stuttgart are discussed and options for household waste treatment in Kumasi are considered. For household waste treatment to be efficient in Kumasi, separate collection at source, as is practised in Stuttgart, must be considered first. This would enhance the chances of recycling of waste fractions such as Paper/Cardboard, and Rubber/Plastics. Household waste from Kumasi was found to contain a larger portion of Organic waste than that from Stuttgart, making composting a good option for waste treatment in Kumasi since incineration would be expensive. The other components Metal, Wood, Fabric and Glass which constitute only about 5% could be land filled.

*Key words: household waste, recycling, waste fractions,*

## **BACKGROUND**

In cities in developing countries, rapid population growth coupled with lack of infrastructure for adequate solid waste treatment and indiscriminate disposal of waste, results in accumulation of waste in large quantities, the repercussions of which are

pollution and health hazards. The scenario is however, the exact opposite in cities in developed countries where solid waste is better managed, ruling out problems associated with indiscriminate dumping and subsequent urban pollution. In this study, household waste in these 2 different scenarios are characterised and the methods of treatment discussed. Stuttgart is chosen as an example of a typical city in a developed country where information and accurate data on household waste is documented and as a result it is easier to plan the collection and treatment of household waste. Kumasi is a typical city in a developing country where the documentation of accurate data is faced with many handicaps, making it difficult to plan the collection and treatment of household waste for the years ahead.

Stuttgart is the largest city in the state of Baden-Württemberg and the state capital. It covers a surface area of 210km<sup>2</sup> [1] with a population of 589 198 (as at 2003) [2]. Due to the separate collection system of waste in Stuttgart, household waste comprises Domestic waste (referred to in this study as Miscellaneous waste which is made up of Biowaste and non-biodegradable waste) with a specific generation per Capita of 223kg and Recyclable material with a specific generation rate per Capita of 139kg [2] giving a total of 362kg/C.yr. Since there is little or no indiscriminate dumping of refuse, it is estimated that all the waste generated is collected. The Department of Waste Management and Town cleaning (Amt 70) is responsible for household waste management in the city.

Kumasi is the second largest city in Ghana and the capital of the Ashanti region, it covers a total surface area of 254km<sup>2</sup> [3] and accommodates an estimated population of about 1 million as at the year 2000[4]. The daily waste generated per Capita is estimated to be 0,6kg [4], giving a yearly specific per Capita of 219kg and a total of about 263Mt per annum for the entire city. Out of this amount an estimated 70% is collected by private companies and dumped without pre-treatment on a sanitary landfill site in Dompoase [5]. The rest (which is not collected) is dumped by individuals usually in open spaces or in drains. Household waste comprising mainly organic waste is collected without source separation in 120L bins, old boxes, buckets, polythene bags etc The Waste Management Department (WMD) of the Kumasi Metropolitan Authority (KMA) has the responsibility of overseeing the activities of the companies sub-contracted for household waste collection in the metropolis.

## **Aims of Study**

The aim of this study is to compare household waste composition in Stuttgart to that of Kumasi and propose ways in which household waste could be treated in Kumasi drawing from the experiences in Stuttgart. Secondly, factors which make household management more effective/efficient in Stuttgart would be considered and recommendations made to improve household waste management in Kumasi.

## **DATA COLLECTION**

Data for Stuttgart is readily available and was obtained from literature. Because of the separate collection system, the latest data on the different fractions of total household waste generated in a year was used. The fractions are Paper/Cardboard (collected in the Green bin), Glass (collected in a central collection point), Scrap metal, Garden waste, Biowaste (collected in the Brown bin), DSD-LVP (Duales System Deutschland – Leichtverpackungen (DSD-LVP) referred to in this study as Packaging material made of metal, and Aluminium, foils, plastic containers articles with the Green dot embossed on them etc, collected in the Yellow sack), Bulky waste (large size articles which do not fit into the waste bin, such as beds, mattresses, furniture ladders etc), and Miscellaneous (old clothes, diapers, CDs, floor mats Baking tins etc, collected in the Grey bin). In Kumasi, the area under study was divided into 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Class residential areas based on parameters such as population density, housing quality, level of community facility etc. The 2<sup>nd</sup> Class areas fall between the 1<sup>st</sup> and 3<sup>rd</sup> Classes, -sometimes it is difficult to distinguish between the 1<sup>st</sup> and 2<sup>nd</sup> Classes and the 2<sup>nd</sup> and 3<sup>rd</sup> Classes. The composition of household waste was obtained by weighing the different components of the contents of 120L bins from households in the study area. The main components considered were: Rubber/Plastics, Paper/Cardboard, Metal, Organic waste, Fabric, Glass, Wood and Miscellaneous (usually comprising sand, ash, sweepings, and wrapped packages left unopened for safety reasons)

## **RESULTS AND DISCUSSIONS**

The most part of household waste in Stuttgart is the Miscellaneous fraction (48%). 95% of this fraction is incinerated and 5% is land filled [1]. Bio- and Garden waste are composted and the rest of the fractions: Paper, Glass, Scrap metal and Packaging

material is recycled. Bulky waste is normally collected and reused or sent to the Landfill site.

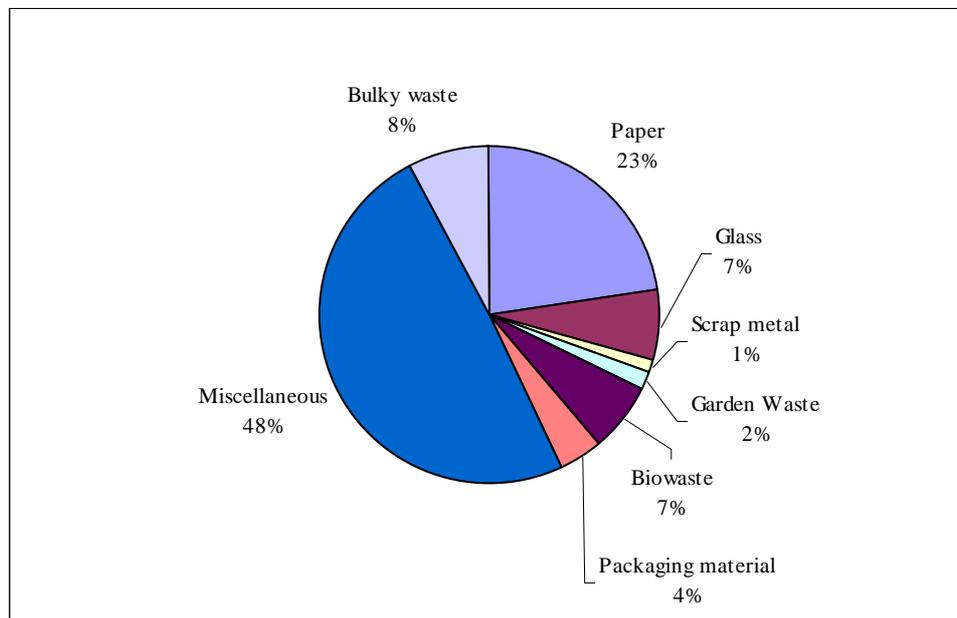


Figure 1 Total Household waste composition in Stuttgart for the year 2002 [2]

In Kumasi, the bulk of household waste was found to be Organic waste with an overall average of 55% from the three residential areas. The 1<sup>st</sup> Class areas had the highest fraction of Organic waste (71%) Figure 2, whilst the 2<sup>nd</sup> and 3<sup>rd</sup> Class areas had 56% and 48% respectively, Figures 3 and 4. The Miscellaneous fraction (comprising usually of ash, sand, small stones sticks and sweeping from the rooms in the household was highest in the 3<sup>rd</sup> Class areas (34%). The other fractions (which have a mass percent less than 10%) such as Rubber/ Plastics, Paper/Cardboard have similar proportions in all the three residential Classes.

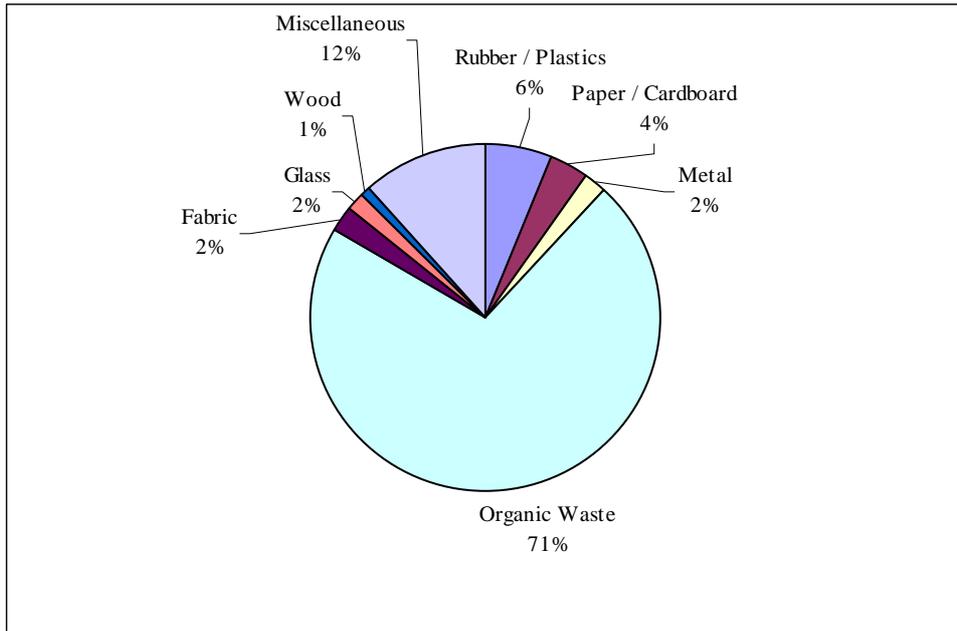


Figure 2 Average Household waste composition in 1<sup>st</sup> class areas

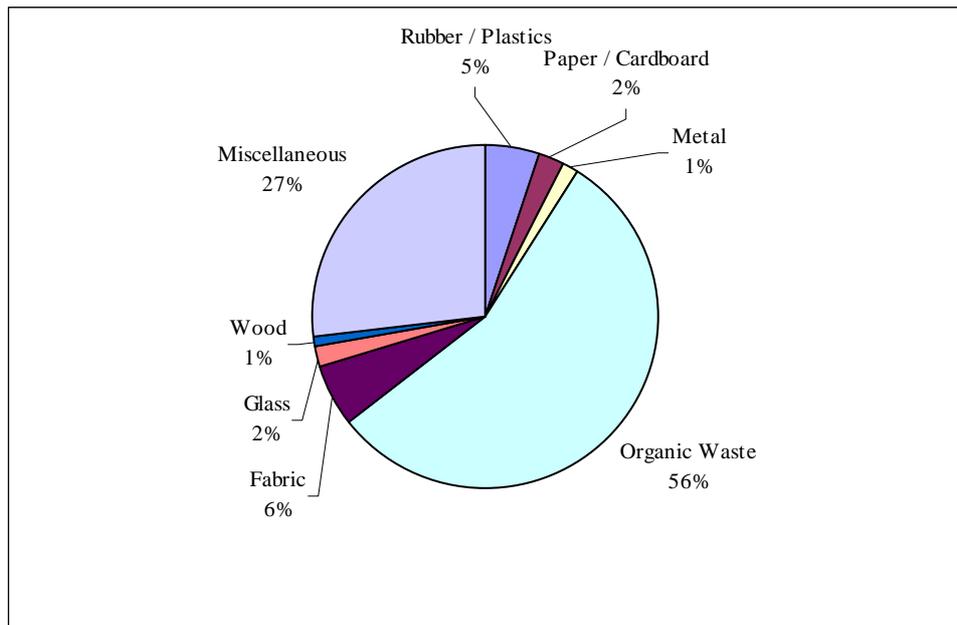


Figure 3 Average Household waste composition in 2<sup>nd</sup> class areas

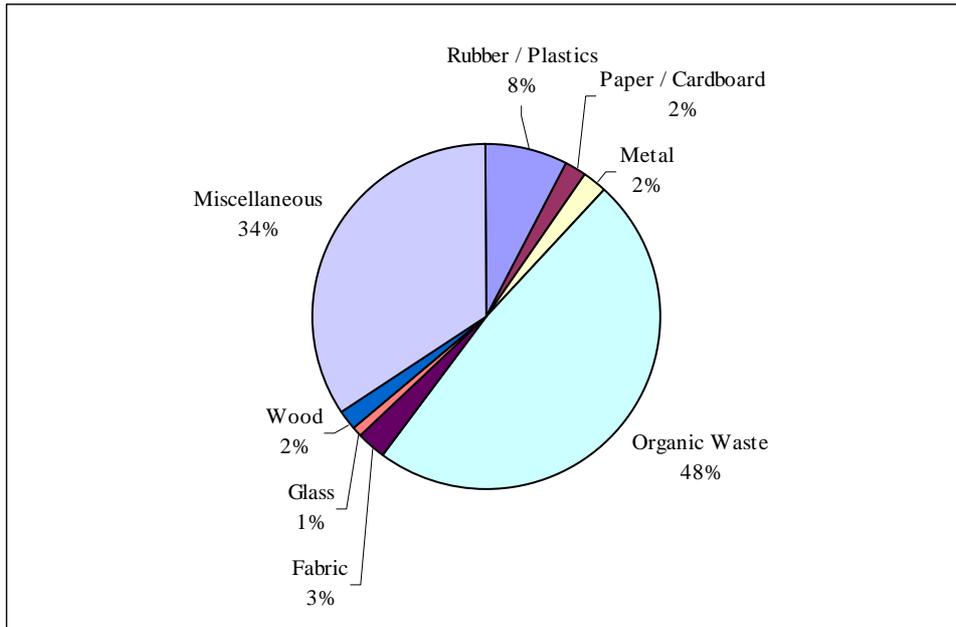


Figure 4 Average Household waste composition in 3<sup>rd</sup> class areas

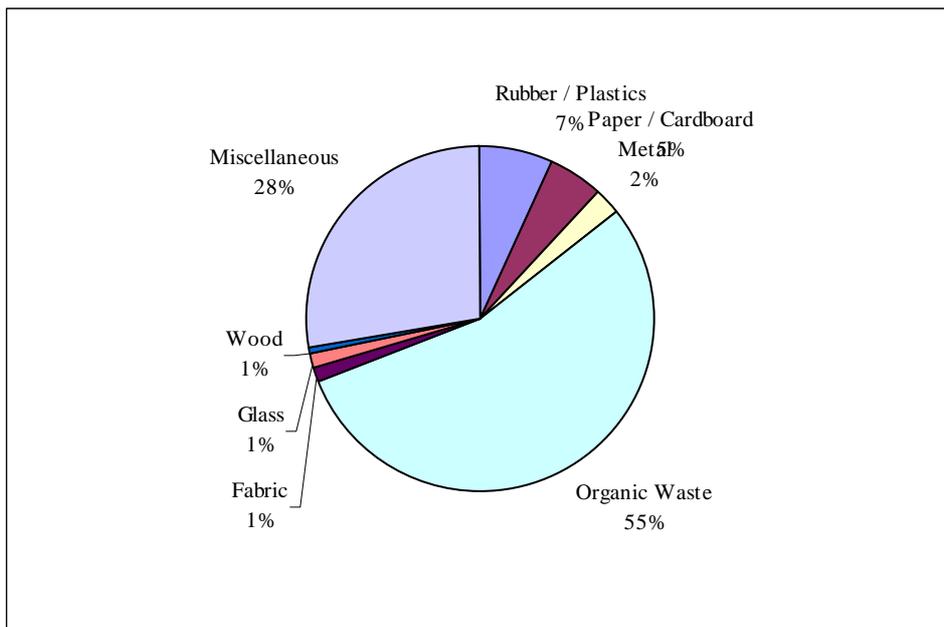


Figure 5 Average Household waste composition of all areas

## Options for Household waste recycling in Kumasi

To consider recycling as an option for household waste treatment, it is important to separate the waste, like it is done in Stuttgart, at source into at least 3 fractions – ‘Biowaste’ ‘Miscellaneous’ and ‘Others’, to make participation easier for the residents. Since this is not a practice that would be adopted easily by the people a lot of education must be done to sensitise the people to make the programme successful.

As most part of Household waste from the metropolis is biodegradable Organic waste (Figure 5) the option which could be primarily considered is composting. The bottlenecks, however, with this method would be availability of market for the compost produced as it would be competing with chemical fertilisers and the willingness of the residents to buy the product. Secondly, composting could be done to decrease the volume of waste before it is land filled.

The Miscellaneous fraction comprising a mixture of organic and inorganic material cannot be composted and must land filled.

Even though on the average Rubber/Plastics constitutes only 7% by mass of household waste,(Figure 5) ,its presence in household waste is significant due to its bulky volume. Taking this fraction to the Landfill would fill it up quickly, thus shortening the lifespan of the landfill. Burning Plastics is always associated with air pollution due to additives such as heavy metals for colouring, this rules out the option for burning. The option for recycling could be considered if the fraction is sorted at source to keep it clean. It could then be used to make sturdy products such as chairs, buckets and products which could replace hardwood products.

The Paper/Cardboard fraction if collected dry and clean could be used for manufacturing toilet-roll and egg crates. The rest of the fractions, - Metal, Glass and Fabric could be land filled.

Land filling is a good option but the volume of waste sent to the Landfill site must be as low as possible to prolong the lifespan of the Landfill. Incineration of the waste would not be an economical option due the high water content, the treatment of the emissions associated with the process and the maintenance of such a plant would be expensive.

## **CONCLUSION**

For effective recycling of household waste in the Kumasi Metropolis, waste separation at source is necessary and the residents must be well informed to make such an exercise efficient and long lasting. If waste separation is implemented, Composting and/or Land filling would be good options for handling Household waste.

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## **REFERNCES**

1. Fischer, K., Waldbauer, M., Sidaine J.-M (1998) Sortieranalyse des Hausmülls in der Stadt Stuttgart, Project REMECOM (Reseau de Mesures pour la caractérisation des Ordures Ménagères)
2. <http://www.stuttgart.de/sde/menu/frame/top.php?seite=http%3A//www.stuttgart.de/sde/search.php%3Faction%3Dsearch%26search%3Dabfall>
3. Government of Ghana, Ministry of Local Government and Rural Development, Kumasi Metropolitan Assembly Development plan for Kumasi Metropolitan Area (1996 – 2000) July 1996
4. Owaahene, C. (Private conversation)
5. Daily Graphic (issue number 149248) October 2004
6. [www.stgt.com/stuttgart/allginfo.htm](http://www.stgt.com/stuttgart/allginfo.htm)