Characteristics of Domestic Solid Wastes in the Judiciary of Tuz Khurmatu/ Iraq

Shno Mustafa Ali[1] & Younis Mustafa Ali[2] & Mariwan Ridha Faris[3]

[1,3] Civil Engineering Department, Faculty of Engineering, University of Kirkuk, Iraq
[2] Civil Engineering Department, University of Sulaimani, Iraq
Correspondence: Shno Mustafa Ali, University of Kirkuk, Iraq. Email: shnoma@yahoo.com

Abstract: Solid wastes are materials which come up from various insert, toxic, inflammable, and unsuitable treatment and they can cause many environmental problems especially in the judiciary of Tuz Khurmatu in Iraq. This study was conducted on domestic solid wastes in the judiciary of Tuz Khurmatu in Iraq so as to determine the characteristics of domestic solid wastes in the city such as the rate of domestic solid wastes, density, and moisture content. Samples of 1155 were collected during three months of year 2014 (March, April, and May). These samples were provided by 55 families in the judiciary from four districts which they are: Jumhuria, Jamila, Askary and Asry. The results showed that the rate of domestic solid wastes was (0.574) kg/capita/day which is within the range of cities of high income. The average density for all locations was 140.3 kg/m^3 which is within the limits of countries with high income. In addition, the average value of moisture content was 25.8% which is also within the limits of moisture content for countries with high income. The results can be used to manage the solid materials in the city.

Keywords: Solid Wastes, Domestic, Density, Moisture Content

1. Introduction

Solid wastes are any garbage, refuse, sludge from a wastewater treatment plant and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from commercial and industrial, and from community activities. These waste materials become a source of contamination of the environment at large leading to air pollution such as acid rain or traffic pollution, water pollution and oil pollution (Purohit & Agrawal, 2010). Generally there are three types of solid wastes; domestic, industrial and hazardous wastes. The main components of domestic wastes are food wastes, ashes and residues, paper, metals, plastic which are normally discarded as useless or un-wanted materials (Srinivasan, 2009). Solid wastes may be classified in many different ways according to its origin domestic, industrial, commercial, clinical, construction, nuclear, agriculture or even proprieties. The quantity of solid wastes generated depends on a number of factors such as food habits, standard of living, degree of commercial activities and seasons (Upadhyay, Jethoo & Poonia, 2012).

2. Previous Study

Many studies have been achieved on solid wastes characteristics such as rates of solid wastes, compositions, density and moisture content. In study of solid wastes in Jaipur city by Upadhyay *et al.* (2012) at residential area, the rate of solid waste was 0.4 kg/capita /day and the food waste was 36% of total wastes, plastic, paper, glass, wood, metal, garden trimming, other materials as tins, dust,

leather, cardboard and their percentage were 7%, 5%, 8%, 4%, 8% ,20%, 10% respectively. Morwood (1994) found in the study of solid wastes in Australia that food wastes represented 23.6%, while paper, plastic, glass, metals represented 39.1%,9.9%,10.2%,6.6%, respectively. Al-Rawi (2014) studied the density of solid wastes in Mosul city in Iraq and the density of solid wastes was 167 kg/m^3. Qasir (1978) on the other hand stated that the solid wastes in Baghdad consist of organic materials of 90%, while paper, plastic, glass, metals and other materials were 5%,1%,2%,1%,1%, respectively. Also he determined the density of solid wastes which was 454 kg/m^3, while the moisture content was 78.7%. Ali (2008) determined the density of solid wastes in Pakistan which was 350 kg/m^3. The review of literature revealed the necessary study of waste solid materials in cities so as to find suitable method to manage these solid materials. However, in the judiciary of Tuz Khurmatu in Iraq, there is no any study or information about the characteristics of solid waste materials. The aim of this study was to determine the characteristics of domestic solid wastes in the city.

3. Location under Study

This study was done in Tuz Khurmatu city which is considered as a medium income cities. The city is located within the longitude of 44°65´ and latitude of 34°93´ (municipality of Tuz). Four locations were selected in the city which represents different social and economic levels for the families. These locations are (Jumhuria, Jamila, Askary and Asry districts). These locations are presented in Figure 1. Two plastic sacks were given to each family one for food wastes and the other one for other domestic wastes as (paper, plastic, wood, glass, metal, clothes, garden wastes etc.). The number of families and number of people in each family were recorded and presented in Table 1. The samples of domestic solid wastes were taken during three months (March, April and May) in 2014 at seven days per each month. The number of samples were 1155 (21*55) samples during three months of the study, each month 385 samples were collected and all these samples were taken from 399 people.
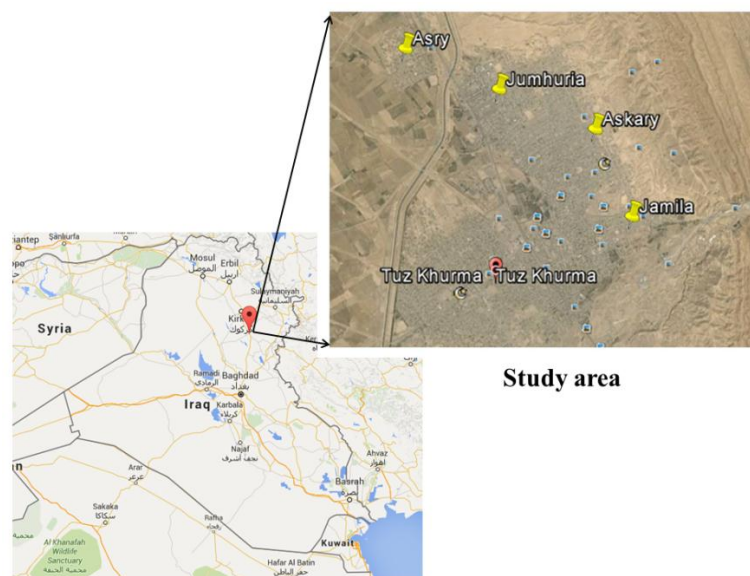

Figure 1: Locations of study areas in Tuz Khurmatu city

Table 1: Locations of study areas in Tuz Khurmatu city

Locations	Jumhuria	Jamila	Askary	Asry	Total
No. of families	18	10	15	12	55
No. of persons	140	113	81	65	399

4. Results and Discussion

4.1 Rate of Domestic Solid Wastes Production

Table 2 shows the monthly generation of solid waste. The higher values were in Jumhuria and Askary districts, the maximum value was 0.682 kg/capita/day at Askary district in April because April is the season of growing fruits in Iraq and this makes the rate of solid wastes high in all quarters. The rate of solid wastes at each month for all months and districts was 0.574 kg/capita/day which is within the range of high income countries (see Table 3) as classified by Cointreau (2006). The rate of solid wastes was computed for each family using the following equation.

Rate of solid wastes (kg/capita.day) = weight of wastes*7/ No. of persons   (1)

Table 2: The weight of solid waste per month for different locations under study

Locations	March	April	May	Average
Jumhuria	0.604	0.651	0.624	0.626
Jamila	0.521	0.631	0.501	0.551
Askary	0.598	0.682	0.643	0.641
Asry	0.335	0.568	0.532	0.478
Average	0.515	0.633	0.575	0.574

Table 3: Global Perspective on Urban Solid Waste Characteristics

Characteristic	Cities of Low income	Cities of medium income	Cities of high income
Rate of solid wastes (kg/capita.day)	0.25- 0.45	0.65-0.35	0.55-1
Density (kg/m^3)	250-500	170-330	120-200
Moisture content%	40-80	40-60	20 - 35

Source: Cointreau, 2006

Figure 2 shows the rate of domestic solid wastes for all quarters. The higher value of the rate of solid wastes was in both Jumhuria and Askary district because the number of families was higher than the other districts, while the lower value was in Asry district because the number of families was lower than the others.
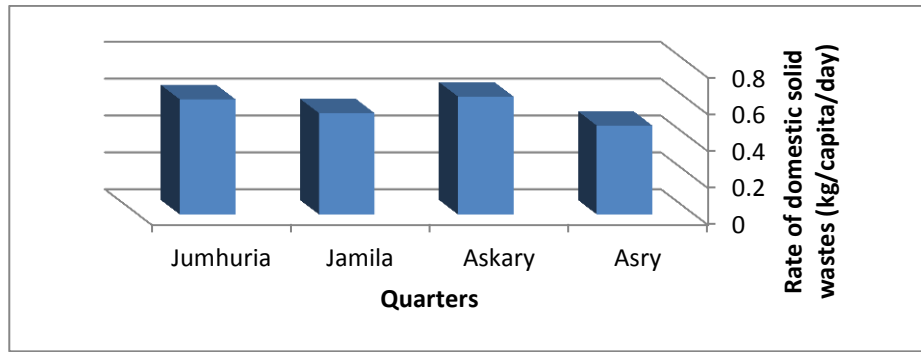
Figure 2: Average rates of domestic solid wastes in each district

4.2 Density of Domestic Solid Wastes

Density is measured by the known weight of solid wastes in a container with a known volume using the following equation:

Density (kg/m^3) = weight of wastes (kg) /volume of container (m^3) (2)

Table 4 shows the density of solid wastes at each month and locations. The higher values of densities were obtained in Jumhuria and Askary district.

Table 4: Density of solid wastes at each month and locations

Locations	March	April	May	Average
Jumhuria	158.2	156.3	158.5	157.7
Jamila	128.4	122.5	127.7	126.2
Askary	151.2	155.3	154.4	153.6
Asry	124.3	121.4	125.5	123.7
Average	140.5	138.9	141.5	140.3

The average density for all locations was 140.3 kg/m^3 which is within the high income countries according to Table 3; however, Tuz Khurmatu region may be considered as a medium income city. Figure 3 shows the average density of domestic solid wastes in each distracts under study. The Figure shows that the higher value of density was recorded for Jumhuria and Askary districts.
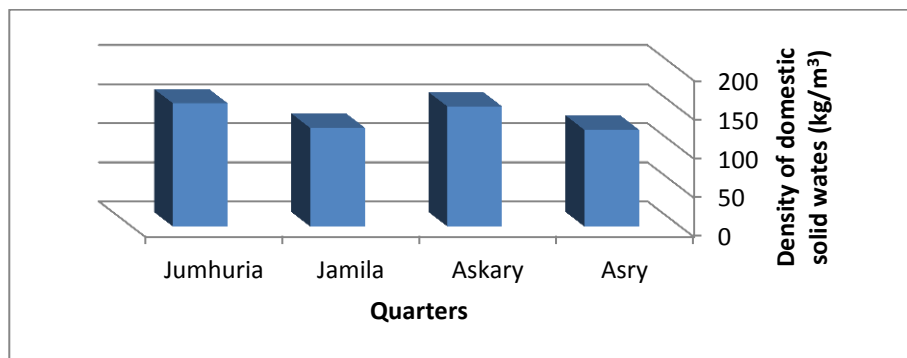

Figure 3: Average density of domestic solid wastes in each quarter

4.3 Moisture Content of Domestic Solid Wastes

Moisture content of samples of solid wastes was measured by drying known weight of solid wastes in oven at 105°C for about one hour then weighing it again to find the dry weight of the solid wastes. The moisture content can be found using the following equation:

$$\textbf{Moisture content \%} = \frac{\textbf{weight of wet solid waste (kg)} - \textbf{weight of dry solid waste (kg)}}{\textbf{weight of dr ysolid waste (kg)}} * \textbf{100} \qquad (3)$$

Table 5 presents the moisture content of solid wastes per month for each location under study. The values were different at each location but the maximum value was measured in April which was 28.41% at Askary district whereas the minimum value was 23.36% at Jumhuria district which was measured in April as well.

Table 5: Moisture content of solid wastes at each month for locations under study

Locations	March	April	May	Average
Jumhuria	25.66	24.22	23.36	24.41
Jamila	26.22	25.31	27.22	26.25
Askary	28.25	28.41	26.31	27.66
Asry	24.54	23.41	26.81	24.92
Average	26.17	25.34	25.93	25.81

The average value of moisture content in this study was 25.8% which is not within the limit of moisture content for countries of medium income as compared with Table 3 and this is due to the method of collection of samples because the food wastes which have high humidity were not mixed with other wastes such as plastic and paper which have less humidity. Figure 4 shows the average value of moisture content at each district.
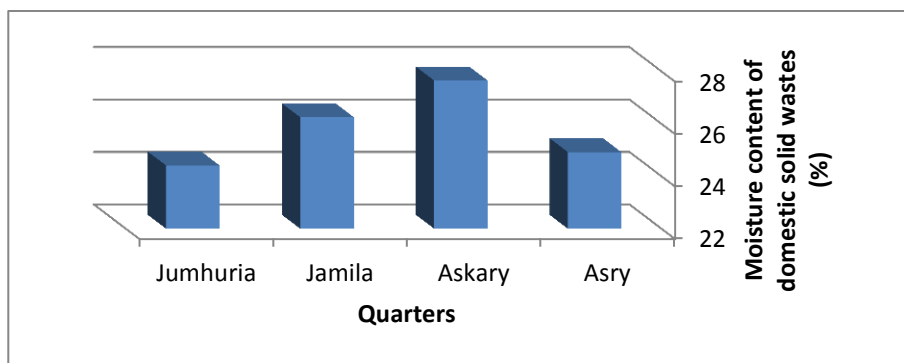

Figure 4: Average moisture content of domestic solid wastes in each district

4.4 Solid Wastes Disposal Method

Solid wastes in Tuz Khurmatu are dumped directly to the open areas located at 1 km from the center of city without using sanitary landfill (municipality of Tuz). Solid waste management in the city appears to be inadequate and needs up gradation. The solid wastes have to be disposed in scientifically method to sanitary landfill and recyclable portion of waste should be recovered.

Segregation of recyclable material would also leads to reduction in quantity of solid waste for final disposal. Higher priority needs to be assigned to the municipal solid wastes by the local authority and a system approach needs to be adopted for optimizing the entire operation of solid waste management encompassing segregation at source, timely, and proper collection, transportation routes and types of vehicles and development and proper operation of sanitary landfill site.

5. Conclusion

The characteristics of domestic solid wastes such as the rate of domestic solid wastes, density, and moisture content were studied for the solid wastes management in the judiciary of Tuz Khurmatu in Iraq. Samples were collected from four districts (Jumhuria, Jamila, Askary and Asry). The results showed that the rate of domestic solid wastes was (0.574) kg/capita/day which is within the range of cities of high income. The average density for all locations was 140.3 kg/m^3 which is within the limits of countries with high income. In addition, the average value of moisture content was 25.8 which is also within the limits of moisture content for countries with high income. Therefore, the city can be considered as high income. The results can be used to manage the solid waste materials in the city. In addition, the municipality of Tuz Khurmatu should look for a better solution of waste disposal considering availability of land fill.

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