Universal Journal of Environmental Research and Technology
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Available Online at: www.environmentaljournal.org
Volume 2, Issue 3: 149-153

Open Access **Research Article**

A Survey on the Rural Solid Wastes Characteristics in North Iran (Babol)

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Abstract:

Today, scattering and dumping of solid wastes is one of the basic problems in rural areas of Iran. It is necessary to identify the quality and quantity of solid waste before making any decision about rural solid waste management. This study was an attempt to investigate the rate of per capita generation, density and physical composition of solid wastes in 10 villages of Babol township in north of Iran. In order to measure generation rate of solid wastes in selected villages, the rate of these materials was determined in 3 consecutive days of a week in the second month of each season. In determining of solid waste density and physical composition, the samples were mixed completely and provided in triplicate. Each sample has been transferred to a 0.5 m^3 plastic container and its different components were measured by digital scale. Maximum and minimum generation rates per capita were 0.84±0.21 kg/day and 0.65±0.15 kg/ day respectively. Maximum and minimum densities were 431±36 kg/m^3 and 407±21kg/m^3 respectively. Mean weight percents of putrecible waste, plastics, paper, metal, glass, textiles and others were %76.9, %7.1, %7.4, %1.1, %0.7, %1.3 and %5.6 respectively. Considering composition of degradable materials (%76.9), composting is a suitable method for removal of rural solid wastes in north of Iran villages. According to noticeable amounts of recyclable materials (plastics, paper and metal), segregation and recycle programs of these components of solid wastes should be considered in these rural areas.

Keywords: Solid wastes, Rural areas, Generation rate, Density, Physical composition, North Iran

1.0 Introduction:

Determination of the exact amount and type of waste is one of the basic steps in the integrated solid waste management (Omrani, 2004, Mahmoud, and et al., 2009). Importance of this subject will be doubled by large change in lifestyle and diversity of rural consumption. Thus it increased and changed the quality and quantity of solid waste in the villages of the country (US EPA, 2005). Generation capita rate is one of the key parameters in determining and measuring the amount of solid wastes. This index will be express solid waste generation in terms of gram or kilogram per person per day (Salvato, 2004). Generation rate of solid waste in various communities will be different by geographical, climate, social, economic and cultural conditions (Tchobanoglous, and et al., 2003, Essonanawe Edjabou, and et al., 2012). Solid waste density is important in determining of the capacity of collection, transportation and disposal equipments of waste and land required for burial of solid waste (Salvato, 2004 and Tchobanoglous, 2003). All kinds of solid wastes have different densities. For example, density of household solid waste is different from industrial, hospital and rural solid wastes (Abduli, 2008). Determining of weight percentages of solid waste components is another important subject in urban and rural solid waste management (Tchobanoglous, 2003 and Omrani, 2004). Usage of this index and determining of the main components of solid waste (Recyclable and combustible materials), could be selected some methods for recycling and disposal of solid wastes in urban and rural communities (Abduli, 2008). Considering the important position of villages in creation and preservation of communities sustainable development, it is necessary to recognize rural development factors and affecting barriers (such as rural migration to cities). Unemployment, lack of proper facilities for agriculture and health promotion (such as collection and proper waste disposal systems) are the most important causes of villagers migration to cities (Safa, 2007 and Bemanian, 2007). It is necessary to have accurate information on planning a proper solid wastes management in rural areas of the country. On the other hand, lack of knowledge on the unfavorable health outcomes of solid wastes has increased the occurrence of infectious diseases (such as Plague, Tularemia, Salmonella, Cutaneous Leishmaniasis, Hydatid

Cyst, Ascariasis, and other communicable diseases) and other adverse environmental effects such as soil, water and air pollution(Omrani, 2004, Abduli, 2008). In this study an attempt has been made to determine the quality and quantity of rural solid wastes in north of Iran.

2.0 Materials and Methods:

This cross-sectional descriptive study was performed in 10 villages of Babol township in north of Iran. Villages under study were selected on such factors as geographical position, availability of the environmental health technician in the rural health center, and an easy access to research supervision.

2.1 Determining of the Solid Waste Generation Rate:

In this study all generated wastes were measured in three consecutive days of the second month of each season by digital device Scales (SOEHNLE, model of 6107 with a 0.1 g precision). An access to the per capita rate of generated waste was made through dividing the total daily generated wastes in the number of rural population.

2.2 Determining the Rural Solid Waste Density:

A complete mixture of solid wastes components was performed in the first stage to determine the density or mixed-density of rural solid waste (House hold, animal and agricultural wastes) in each village.

In the second stage, for providing of more accurate data, the sampling of solid wastes was carried out by three replications. By complete mixing in the piles of solid wastes, each of the desired samples was picked in the different parts of it (150 kg) and then the samples were transferred into a 0.5 m^3 cylindrical plastic container. After compacting of rural solid waste in the sample container, the weight of container was determined together with solid waste and was calculated density of rural solid waste by using the digital scale.

2.3 Physical Analysis of Rural Solid Waste Components:

To analysis and diagnosis of various components in the rural solid wastes (such as putrescible materials, plastics, paper, glass, metal, textiles and other miscellaneous materials), each component of the solid waste within the sample container were transferred to the special plastic containers and were weighed by the scale. In this study, all the data were analyzed by Excell 2007 and SPSS 16.

Figure 1: Location of the studied area

3.0 Results and Discussion:

3.1 Generation Rate and Density of Rural Solid Wastes:

Table 1 shows generation rate and density of solid wastes in the selected villages.

Table 1: Comparison of physical characteristics of solid wastes in the selected villages

village	Population [b]	Generation Rate (Kg/d)	Generation rate per capita (kg/d-person)	Density (Kg/m^3)
1	2854	1853±502	0.65±0.15	418±28
2	2126	1658±417	0.78±0.18	431±36
3	1951	1359±385	0.70±0.16	407±21
4	1539	1210±345	0.79±0.18	419±32
5	1750	1378±393	0.78±0.18	409± 24
6	1893	1505±412	0.79±0.18	412±25
7	1526	1253±364	0.82±0.2	415±28
8	1474	998±247	0.68±0.16	423±24
9	1057	890±213	0.84±0.21	411±22
10	948	674±189	0.71±0.17	424±26
Mean	1712	1278±347	0.75±0.18	417±27
Rural areas[a]	21738893	9825980	0.452	375.8
Babol city	256088	238162	0.93±0.26	392± 21

[a] Rural areas in Iran (Safa 2007) , [b] Population in 2012(Babol Health Center 2012)

In this study, the total average of solid wastes (per capita generation rate) in the selected villages was 750±180 grams per day. Maximum and minimum generation rates of solid wastes in the investigated villages were 840±210 and 650±150 grams per day respectively. In one study, the average generation rate of rural solid wastes in 14 provinces of Iran was 452.3 grams per day per person (Bemanian, 2007). In other studies, these rates were 820 and 646 grams in Guilan and Bushehr Provinces respectively (Gholami, 2007 and Abduli, 2008). According to a study in Oklahoma State in USA, the generation rate of rural solid wastes was 2250 grams per person per day which is much higher than the generation rate of solid wastes in these villages. This average rate in some provinces of Iran such as Razavi and South Khorasan, Khuzestan and Kerman (Heidarzadeh, 2007; Goodarzi, 2007 and Rajabi, 2007) was 480, 420, 330 and 288 grams per day respectively which is lower than that of obtained values in this study. The average generation rate of solid wastes (per capita) in rural areas of some countries such as Pakistan, Sri Lanka, Bangladesh, Vietnam and Syria is 448, 325, 355, 300, and 400 gram per day per person respectively (Pakistan EPA, 2006; Ebert, 2001; Enayetullah et al., 2005). Considering the above results, the generation rates of rural wastes per capita are significantly different in various provinces of Iran and most of the countries. The main reasons due to the difference can be attributed to economic situations, and a difference in climatic conditions and food habits of these regions (Tchobanoglous, 2003 and Salvato, 2004, Essonanawe Edjabou, and et al., 2012). Average density of total waste generated by the mentioned villages was 417±36 kg/m^3 (Table 1). Also in table 1, generation rate and density of rural solid wastes in the selected areas has been compared with those of municipal solid wastes in Babol township. Average density of rural solid wastes in Iran was 375.8 kg/m^3 (Bemanian, 2007). In a study, the average density of rural solid wastes in some provinces such as Guilan, Golestan, Khorasan, Isfahan, Khuzestan and Fars were 452.4, 415.8, 331.9, 301.5, 297.2, and 248.5 respectively(Safa, 2007). The density of solid wastes in rural areas of Bangladesh was between 233 to 333 kg/m^3 (Enayetullah, 2005) which is lower than that of this study. An increased rainfall and air humidity is one of the reasons behind the increased waste density in rural and urban areas of northern provinces of Iran. The large percentages of animal wastes in the solid waste composition in these areas are also among the other reasons due to the increased rural solid wastes density in north of Iran. Considering the large percentage of animal wastes in solid waste composition of these regions, Composting utilization and fertilizer production from putrescible wastes such as animal wastes, food wastes and agricultural wastes is useful for the safe management of rural solid wastes, increasing of environmental and human health levels and developing of agriculture in these areas.

Table 2: Weight percentage of components of rural solid wastes in the selected villages

Village	Putrecible waste (%)	Plastic (%)	Paper (%)	Metal (%)	Glass (%)	Textiles (%)	Other (%)
1	79.4	5.6	6.8	1.1	0.9	1.5	4.7
2	81.5	5.2	6.3	0.8	0.6	1.4	4.5
3	76.5	6.1	5.8	0.7	0.5	1.5	8.9
4	76.4	8.2	7.5	0.8	0.4	1.1	5.6
5	74.8	9.7	6.8	1	0.7	1.3	5.7
6	80.5	6.4	7.8	1.5	0.8	1.4	1.6
7	77.8	6.2	7.3	0.7	0.6	1.5	5.9
8	75.5	9.1	8.5	1.3	0.9	1.2	3.5
9	74.8	6.4	7.2	1.1	0.5	1.1	8.9
10	71.4	8.5	9.6	1.5	0.8	1.4	6.8
Mean	76.9	7.1	7.4	1.1	0.7	1.3	5.6

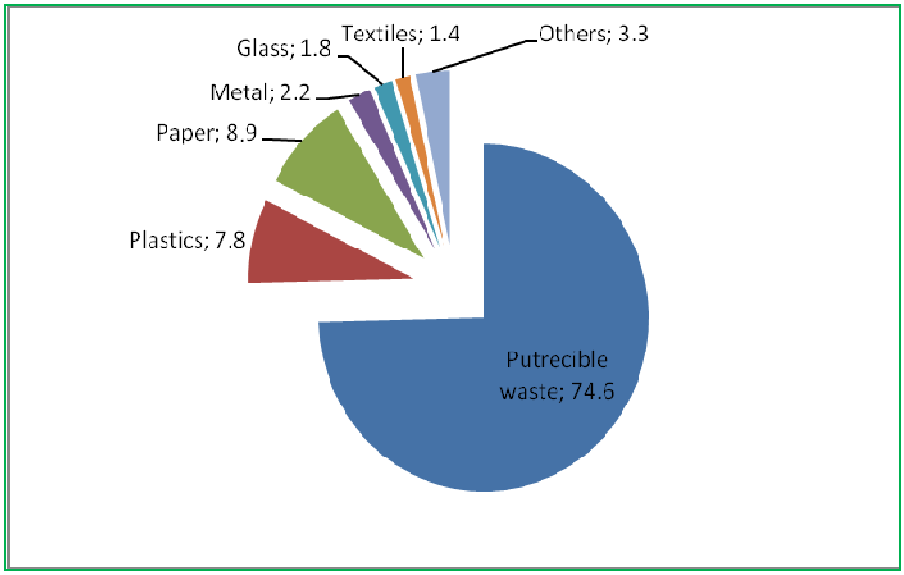

Figure 2: Mean weight percentages of components of municipal solid wastes in Babol city (Abduli, 2008)

Average percentages of putrescible materials, plastics, paper, metals, textile, glass and others in the selected villages were 76.9%, 7.1%, 7.4%, 1.1%, 1.3%, 0.7% and 5.6% respectively. The percentages of degradable wastes in the provinces of Khuzestan, Fars, Golestan, Guilan, Isfahan and Khorasan Razavi were 70.8%, 65.9%, 56.2%, 54.7%, 47.8%, and 41% respectively(Safa, 2007). According to Gholami and et al., the Percentages of plastic and rubber in the provinces of Isfahan, Khorasan Razavi, Golestan and Guilan were 10.5, 10, 9.2, 9.2 respectively(Gholami, 2007). According to a study on physical composition of solid wastes in rural areas of Bangladesh, the amounts of putrescible materials, paper, plastics and trash were 67.7%, 9.7%, 5.1% and 8.8% respectively(Enayetullah, 2005). In another investigation, distribution of materials in Oklahoma rural solid waste as paper, plastic, metal, glass, yard waste and other were 38.8%, 8.6%, 8.3%, 6.1%, 20.6% and 17.6% respectively (Oklahoma State University Cooperative Extention Service, 2010).Considering the amount of biodegradable components of solid wastes in this study (76.9%), more than three-quarters of solid waste generated in the villages of north Iran could be changed to fertilizer by household composting technique (Windraw technique). The consumption of this organic fertilizer reduce immethodical use of toxic chemical fertilizers (and its adverse effects on human health and environment), improved soil quality and increase quality and quantity of agricultural products in Iran. Also, more than 15% of the weight percentages of the components in

the solid wastes of these villages were formed to paper and plastics. Considering to weight percentages of non-biodegradable components such as paper, plastic, metal, textile and glass in the solid wastes of north Iran villages and comparing them with municipal solid wastes of this areas (table 2 and figure 2), this important matter is identified that the solid wastes composition in the urban and rural areas is similar. This phenomenon is caused by Life style changes in these rural regions. A consideration is necessary on the construction and use of some disposable plastic equipment (with good quality) by segregation and their recycling to reduce waste generated in these villages.

4.0 Conclusion:

Due to high percentages of putrescible materials in this study, use of household fertilizer (as an organic fertilizer, natural and healthy alternative to chemical fertilizers) would be very appropriate to reduce the generation of rural solid wastes in north of Iran. Also, for the significant percentage of recyclable components (plastics and paper) it is necessary to consider separation and recycling programs in rural solid wastes in such areas.

5.0 Acknowledgments:

Thanks and appreciations on the part of the authorities to the Management and Planning Organization of Mazandaran province.

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