STUDY ON THE GONABAD SOLID WASTE PROPERTIES, IRAN

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ABSTRACT

Municipal solid waste (MSW) has been one of the most important environmental issue for all regions in Iran. This study is conducted in a period of 12 months from the beginning of 2013 on wastes of Gonabad by random sampling; one sample was taken in each month according to the standard instruction and physical analysis. The results showed that, on average of 332.5 tons of waste is generated daily in the city of Gonabad of which 75.5% is corruptible, 11.04% is plastic, 4.47% are papers and cartons, 2.71% is glass, 3.22% is fabric, 1.28% are metals, 0.57% is soil, 0.66% is wood and 0.55% are other things. Also, the average per capita of daily waste generation in the city of Gonabad is 588.75 g per person per day and the average of waste density in transport station is 163.33 kg/m³. According to the results, it follows that in addition to reduce the costs and environmental pollution, we can provide income and employment opportunities in the region through the source separation program and implementation of recycling industry in Gonabad.

KEY WORDS: Solid waste, Waste management, Qualitative and Quantitative, Gonabad

INTRODUCTION

Municipal solid waste and its distribution in environment is one of the most important problems of human society which amount is increasing day by day due to population growth (Amoah and Kosoe, 2014; Biglari et al., 2016a). Rate of waste generation and physical composition of waste such as degradable material, paper and carton, plastic, fabrics, textiles, metals, glass and wood depends on many factors (Biglari et al., 2016c). These factors vary in different regions and accordingly, the quality and quantity of waste is different in various cities. Factors such as geographical location, season, and frequency of collection, economic status and customs affect the quantity and quality of waste (Azemnia and Zarei, 2016; Biglari et al., 2016b). One of the issues to control waste generation, saving in material consumption...
and planning to sanitize the waste disposal system is quantitative and qualitative study of municipal solid waste for establishing management system of collection and solid waste disposal (Rushton, 2003). Eventually, we can specifically pay attention to environmental issues and prevent environmental pollution. In attention to the collection and disposal of solid waste in today’s society due to the variety of quantitative and qualitative composition, uncontrolled urban development and lack of appropriate technology has led to particular problems. Fixing these problems is possible only by careful study and coordination of science and analysis in framework of a proper management (Yilmaz et al., 2016). Basic elements of this management are: less waste generation, technology optimization and correct waste disposal including sanitary landfill or fertilizer, special attention to recycling, health education and raising people’s awareness (Patil and Pokhrel, 2005; Rao et al., 2004; Zhao et al., 2016). In our country, numerous and scattered actions has been done in different times for evaluation and potential of valuable waste (Andreola et al., 2016; Patil and Shekdar, 2001; Al-Khatib et al., 2016). But there has not been an integrated and coherent action so far. The economic feasibility project of recycling in whole country was implemented in 2003 which has been considered as the cornerstone of strategic plans of recycling (Hamer, 2003). Thus designing and planning in solid waste management is based on the recognition of quantity and quality of waste, this study is conducted in order to evaluate quantitative and qualitative characteristics of waste in Gonabad to be able to apply correct management using solid waste information.

**RESULTS AND DISCUSSION**

Collection and transportation of municipal waste are the most important parts of municipal waste management and has direct relation with the way of its’ final disposal (Miyazaki and Une, 2005, Nabizadeh et al., 2011). In Gonabad, collection and transportation of waste is done by municipality recycling organization. To this purpose, wastes are collected from homes and production centers by some vehicles and transferred to the compost plant located in 20 km away from the city. The wastes in sorting station of compost plant are separated partially and some are recycled. A part of waste which is appropriate for fertilizer is used for compost and the rest is transferred to the landfill. Regarding the waste final disposal method in Gonabad, it was found that the disposal method is sanitary landfill which is located in 20 km of the road Gonabad-Sarbaz. According to the studies, this place has suitable soil storage and reliable in terms of water pollution. Some of main features of this place is to be away from any facilities, main roads and human community centers and also non-locating in eye-view and low level of ground waters. The trench method is used in this region for sanitary landfill of waste; excavator is used for digging canals and bulldozer was used for covering the waste with soil. Regarding the quantitative determination and the waste per capita as also mentioned, the weight analysis is used which in current situation more practical is according to the condition of most cities in our country. According to the population of Gonabad and surveys conducted on the generated wastes, it was determined that the average of generated waste in each day was 35.310 tons and the average of generation per capita for each person in this year was equal to 588.75 g/day. Also, comparing the values obtained for the waste...
density in different seasons in Table 1, it can be seen that the highest density of waste belongs to summer which was an average of about 173.3 kg/m³ and the lowest density of waste related to winter which was an average of about 156.33 kg per cubic meter. Quantitative analysis of waste in Gonabad shows that the highest amount of waste generation related to summer which was an average of about 350 tons per day and the lowest amount of waste generation related to winter which was an average of about 305 tons per day. Also, the average of waste generation in Gonabad during four seasons in 2013 was obtained 35.310 tons. The results of physical analysis of waste components showed that the highest percentage of waste components was in August relating to corruptible materials to the amount of 70.2%. Table 2 has provided full results of waste physical analysis in terms of month for each sample. Well as the Table 1 has indicated the percentage of corruptible materials in different months and the Table 2 has shown the percentage of other components of waste in different seasons. About 20% of municipalities’ costs relate to urban waste management and most of these costs (about 80%) relates to transportation costs. So, recognition of solid waste is essential for evaluation and selection of equipment and designing plans (Al-Omari and Al-Dwairi, 2005). The rate of solid waste generation and density varies in different seasons of the year due to variety and type of food intake; for example, more waste is produced in late summer and early fall due to more use of fruits and vegetables compared with spring (Miyazaki and Une, 2005). Quantitative study of wastes in Gonabad shows that waste generation per capita in this city has increased at a rate of 146.5 g compared to the past (2003) and this can be due to the improve of people’s quality of life. Findings from this study also shows that a high percentage of waste is allocated to corruptible materials (64.35), after that plastic (10.1) and then paper and carton (4.6). There should be methods with less health hazards due to high percentage of corruptible materials in this city and high costs of waste landfill and health hazards caused by improper and not systematic waste disposal. The high amounts of soil also in the waste can be because of weather and economic status. However, various studies have been conducted in other regions for waste recognition but different results have been obtained (Nabizadeh et al., 2011). In terms of quantity, on average, people in America generate 2000 g per day, 1000 g in Germany per day and 657 g in Iran per day (Al-Khatib et al., 2016; Nabizadeh et al., 2011). Perhaps the main reason of high per capita waste generation in mentioned countries is better economic situation of these countries compared with Iran. Physical analysis conducted on municipal waste material of Portugal in 2002 showed that municipal waste material is made of 33 to 41.5% waste organic materials, 17 to 27% paper and carton, 3 to 5.5% fabric, 10 to 14% plastic, about 2% metals, 3.5 to 6.5%...
glasses and about 0.7% wood. In the same study also it was found that in 2002 in Portugal, 72,000 tons of glasses, 20,000 tons of paper, 5000 tons of plastic and 1000 tons of metal have been recycled (Barata, 2002). During the studies in the city of Hamadan in 2006, the waste generation rate in spring was 300 tons and its’ per capita was 743 g and it was 317 tons in autumn. In the same city in 2001, the waste generation rate in spring was 229 tons and 235 tons in autumn and its’ per capita was 667 g (Barata, 2002). The waste quality as well as its’ quantity varies in different cities. Also, in a study conducted in the city of Kashan in 2011, the average rate of waste in this city was obtained almost 0.412 kg per person per day (Moharamnejad et al., 2011). One of the methods to eliminate waste which has become more widespread is to construct the compost production plant. Given that there is a composting plant now in Gonabad, lack of proper utilization of existing equipment and lack of proper segregation of waste from the origin has led to inability of this factory to produce good fertilizer practically and offer suitable product to the market. According to the high percentage of corruptible materials in wastes of Gonabad, we can follow the plan of waste separation from the source seriously by reforming the waste collection model from the origin through cultural activities and continuous trainings to citizens. On the other hand, the use of compost generated from waste can reduce the use of chemical fertilizers that cause health risks for soil and ground waters (Kulivand et al., 2009). Expansion of the petrochemical industry in the country and the subsequent expansion of the use of plastic materials in various industries have led to increase the percentage of plastic existing in wastes day by day. Plastic waste forms the second percentage of municipal waste of Gonabad in terms of frequency. To have a high percentage of plastic waste in the city of Gonabad can be due to change in social, economic and cultural condition of people in recent years. In Gonabad, in addition to separate waste and recycle from the origin, we can both prevent the mentioned problems by final separation in separation station of compost plant and also prevent their production by returning these wastes to the production cycle (Moharamnejad et al., 2011). After corruptible materials and plastic, the highest waste share belongs to paper and carton with 4.6%. The high level of paper and carton in the municipal waste confirms that if the recycling system starts from its’ generation origin which means administrative and educational institutions, it can help to prevent cutting down thousands of trees and protect environment.

**CONCLUSION**

The results showed that, on average of 35,310 tons of waste is generated daily in the city of Gonabad of which 75.5% is corruptible, 11.04% is plastic, 4.47% are papers and cartons, 2.71% is glass, 3.22% is fabric, 1.28% are metals, 0.57% is soil, 0.66% is wood and 0.55% are other things. Also, the average per capita of daily waste generation in the city of Gonabad is 588.75 g per person per day and the average of waste density in transport station of this city is obtained 163.33 kg/m³. According to the obtained results, it follows that in addition to reduce the costs and environmental pollution caused by waste disposal with available methods, we can provide income and employment opportunities in the region through the source separation program and implementation of recycling industry in Gonabad.

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