



Investigation of collection and disposal of solid waste on Islamic Azad University of Roudehen Branch

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Abstract

Collection and disposal of solid waste is considered serious environmental problem in modern society. The Coordination of knowledge and experience through proper management framework are necessary to resolve this problem. The objective of this study was to evaluate the composition and characteristics of the generated university solid waste in order to obtain information about the quantity of recoverable solid waste at Azad University of Roudehen Branch. Solid waste sampling and laboratory analysis were carried out according to the random sampling method. The sampling plan was according to random truck sampling which was determined by considering the available facilities and background information of the site location. The first step in waste characterization was to obtain the detail information about the percentage of each individual component in the waste stream. So, separation and measurement of waste were carried out in any place in the autumn, winter and spring. Then, the results were analyzed using SPSS software. The results showed; the daily production rate of the University's solid waste was 50.33 kg. The educational buildings were the most responsible for producing the waste stream of the campus by 58.2 %. The dining rooms and kitchen were the next of ranking by 28.2% and 10.2%, respectively. Also, the laboratories and the other building were with 2%. The main compositions of the daily generated waste were 62.55% paper, 17.9% plastic, and 5% metal and 14.4 other. Sum up, the maximum of the waste of the university is related to paper which is recyclable with economic value.

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Introduction

Weak and fragmented solid waste management is considered serious fundamental environmental problem. Solid waste management is defined as the control of waste generation, storage, collection, transfer and transport, processing and disposal of solid wastes consistent with the best practice of public health, economics and financial, engineering, administrative, and legal and environmental considerations. Solid waste generation is one of the three major environmental problems faced by municipalities in the world (Omran *et al*, 2009). Generally, it is positively related to the level of income and urbanization, with higher income and more urbanized economies generating higher levels of solid wastes per capita. The uncontrolled dumping of solid waste is one of the leading causes of degradation of its natural resources (UNDP, 2010). Recycling has gained increasing attention as a means of protecting the environment since it offers one of the most sensible solutions both economically and ecologically for managing waste. The population of the earth is increasing and the amounts of the solid waste have been increased as a result of it. Environmental and health problems exist due to the low efficiency and unsustainable methods of the collection and disposal of solid waste. So, waste reduction is a probable solution for these problems (Post, 2007). Recovering is aspect of the materials of the solid waste management operation which is not useful for original user to be use in other manufacturing process (Gent *et al.*, 2011). Certain type of waste such as plastic, paper and metals are valuable as recoverable materials. Several studies have carried out to evaluate the potential of recovering of solid waste materials for example; (Kalanatarifard and Yang, 2012) investigated the municipal solid waste of Bukit Bakri landfill, Muar, Malaysia in order to classify the solid waste and determine the feasible method for reduce the amount of disposed waste as well as to evaluate the potential of plastic recovery. The results of their survey showed; recoverable plastic waste was made 12% of the generated waste of Bukit Bakri landfill which included of 9% plastic film, 2% rigid plastic and 1% plastic foam Because of,

understanding households' reasons for not recycling is important to improve participation in the recycling of solid waste (Omran *et al*, 2012) surveyed the effective factors on the participation of households for recycling of domestic solid wastes in Gaza city in Palestine and their results showed; the majority (89.5%) of citizens of Gaza city did not participate in recycling and the most reasons of it related to unawareness about recycling (67%).Also, (Omran, *et al*, 2009) investigated householders' attitudes to the recycling of solid wastes in one part of northern Malaysia, namely Alor Setar town, Kedah State. So that, their results revealed that, participation in recycling of household waste related to the level of awareness and knowing of recycling. So, increasing in public training about the benefits of the recycling of solid wastes, improve the public participation in solid waste management operation. Roudehen is a town located on the east of Tehran province on Tehran-Mazandaran road. The town is just past the fork between Haraz and Firoozkooh roads, at coordinates 51° 55'E, 35° 43' N. It is 1850 meters above the sea level and has a total area of 50 km². The average of annual precipitation of this town is 430 mm. According to the national census in 1976, the population of Roudehen and suburb was 5237 out of which 6.57% were inhabited in the town and the rest in the surrounding villages. Roudehen had a population of 12000 when the Azad University was founded in 1983. Local commuting patterns, housing, and job development increased with the establishment of the Azad University. Now, more than twenty thousand students are studying at Islamic Azad University of Roudehen Branch. Due to the vast area and number of students of this university and the amount of the Waste generated of it, it is essential to study and perform the solid waste management plan at it. Uncontrolled waste disposal causes various ecological impacts and affects human health. Also, weak waste management causes serious financial and socio-economic losses. In addition, the survey shows any specific study has not been done in this field on Islamic Azad University of Roudehen Branch. A vital component in attaining a sustainable campus is the efficient management, reduction and recycling of its solid waste. To effectively

manage solid waste generated at the Azad University of Roudehen Branch, it is essential to understand and identify the waste types and quantities disposed the sources of these materials, and the possible opportunities for further reduction and recycling. Furthermore, it is important to identify and analyze the quantity of waste currently captured by recovery efforts versus the quantity disposed. So, present study carried out to evaluate the composition and characteristics of the generated university solid waste in order to obtain information about the quantity of recoverable solid waste at Azad University of Roudehen Branch.

Materials and methods

Sampling and testing methods

Information on the techniques employed for managing the solid waste on the main campus was collected and assessed by both reviewing publications from the University and interviewing staff members. Information on how waste is managed on campus, how the campus recycling program works, and other reduction, recovery and educational approaches the University utilizes was gathered. This included accumulating information on the number, location, volume, and collection frequency of solid waste receptacles available on campus, such as trash receptacles, recycling containers and dumpsters. Solid waste samplings were carried out according to the random sampling method (ASTM, 1988). The sampling plan was according to random truck sampling which was determined by considering the available facilities and background information of the site location.

Determination of quantity and component of samples

Moreover, historical data on the weights of solid waste disposed monthly was also gathered and analyzed for generation numbers and trends. Solid waste laboratory analyses were carried out according to the standard method (ASTM, 1988). The first step in waste characterization was to obtain the detail information about the percentage of each individual component in the waste stream. So, separation and

measurement of waste were carried out in any place in the autumn, winter and spring.

Statistical analysis

One-way ANOVA and LSD tests were carried out to determine the percentage of each individual component in the waste differ significantly upon type of the samples and wastes using SPSS software.

Results and discussions

Individual component pattern of the waste samples

Fig. 1 shows the result of Comparison of the daily individual component of the waste samples. According of these results; the daily production rate of the Azad University of Roudehen Branch's solid waste was 50.33 kg. Also, fig..2 shows the result of Comparison of the annually individual component of the waste samples. The stratified random sampling was used in the present study and the categories included the educational buildings (number 1 to 8) with the area of 26,638.09 square meters, the office building with the area of 6535.92 square meters (number 9), the other building including guarded buildings, janitor, library, dormitories, sports halls in total area of 290,649.42 square meters (number 10),the laboratories with the area of 6019.6 square meters (number 11) and the dining rooms and kitchen with a total area of 1874.16 square meters (number 12). According of the results of Fig..1 and Fig..2; the educational buildings were the most responsible for producing the waste stream of the campus by 58.2 %.

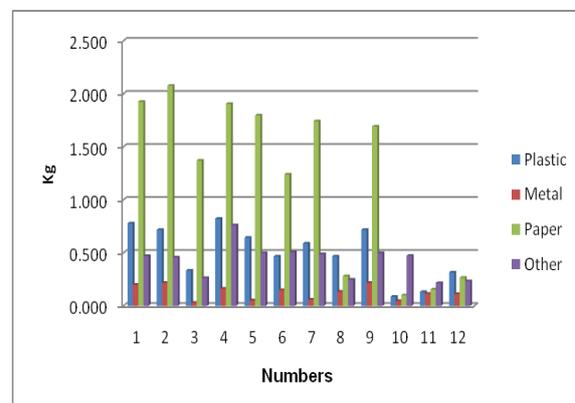


Fig.1. Comparison of the daily individual component of the waste samples.

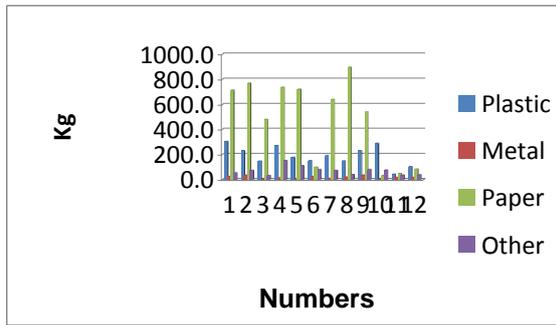


Fig.2. Comparison of the annually individual component of the waste samples.

The solid waste composition

Fig.3 and Fig.4 show the results of daily and annually percent solid waste composition, respectively. The main compositions of daily generated waste were 62.55% paper, 17.9% plastic, and 5% metal and 14.4 other. The educational buildings were the most responsible for producing the waste stream of the campus by 58.2 %. The dining rooms and kitchen were the next of ranking by 28.2% and 10.2%, respectively. Also, the laboratories and the other building were with 2%. The main compositions of the daily generated waste were 62.55% paper, 17.9% plastic, and 5% metal and 14.4 other. Furthermore, the differences were significant ($p < 0.05$). Sum up, the maximum of the waste of the university is related to paper which is recyclable with economic value. So, we decided to identify the sources of the waste production of the paper sector. The paper consumption in official and financial sectors of the university related to the various directives and printing of the wages' Receipt, respectively. Also, using paper at the human resources of the staff and faculty, related to the corresponding letters. The estimated amounts of these papers were recognized with sampling during different seasons. These statistics' results only depend on papers which are used at corresponding letters not which dumped in the trashes. However, usually, these letters are considered as waste, after a couple of days depend on their content, too. The daily average number of letters which are sent to various departments and offices of the university is 10. Also, the average number of letters which are written for students and staffs or

teachers is 70 in each day. It is necessary to mention, the normal size of these letters is almost one-third of A₄ paper and carries to 2 copies. The other sources of using paper in the university related to research papers of the students that about one- third of them would be considered as waste after presenting. This amount is approximately eight thousand packages of A₄ paper equal 200 tons a year. Another item of increasing of the wasted paper is the exams at university Examinations are held twice a year. Based on statistics' information, the number of examinations which are held in per semester is more than 125 cases. Considering the number of students and the examinations, these papers is approximately 12.760 packages of A₄ paper equal 64 tons a year. According to the price of paper waste in Tehran, recycling of these papers equal 2,200,000,000 Rials. It should be mentioned that, these amount of recycling have directly been done in official aspect, separately.

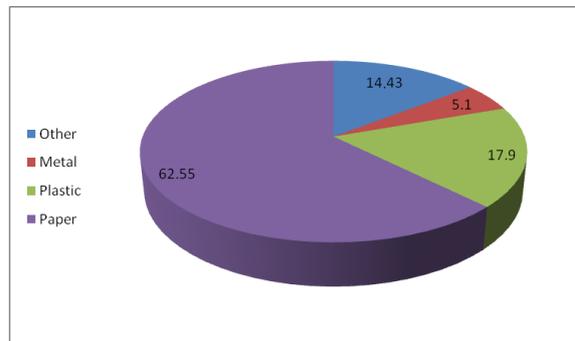


Fig.3. Daily percent solid waste composition (%).

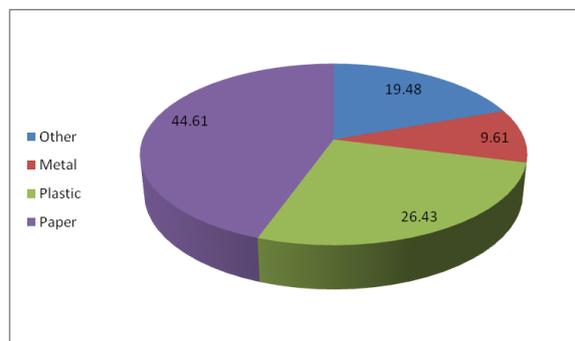


Fig.4. Annually solid waste composition (%).

So, the source specific solid waste quantification and compositions is useful in predicting the waste

quantity from various waste generating sources and can be utilized as a basis for the planning of the system (Gawaikar and Deshpande, 2006). In this case, other researchers have been done an investigation to evaluate the economic and environmental aspects of paper recycling of municipal Solid wastes in Isfahan city, Iran. Their results revealed; the economic and environmental advantages of 15.39% recycling paper in the studied area in year 2006 were saving 689,011 cubic meter water, saving 30,623 gigajoule energy and prevention of cutting 65,061 trees as well as earned about 1,951,841,000 Rials from selling recycled paper (Farzadkia *et al*, 2008). So, it could be recommended that, the increasing in public awareness and improving environmental training about benefits of the participation in recycling should be considered as an important priority strategies of the solid waste management.

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