

The solid waste management and the recyclability

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Abstract

In this modern era, by increasing the production volume, the solid waste management has found an important place. Improper solid waste management will lead to environmental pollution and economic loss. This study aims to investigate the solid waste management in Zahedan city, Iran in 2013 and 2014. Three sample regions of this city were selected randomly and the solid waste of them was investigated. Some physical and chemical tests were performed on the solid wastes and the results showed the highest percent of these wastes included the organic matters which can convert to fertilizer. So it is important to take the practical steps to recycle them in order to decrease the environmental pollution and also use them in an economic and efficient way. Due to the increasing population and consequently the growth of per capita solid waste, it is necessary to perform some appropriate policies such as separating, collecting, recycling and processing the solid wastes. Some special strategies must be performed in compatible with social cultural and ecosystem.

Key words: Solid waste management, recyclability, pollution, zahedan city

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Introduction

The most important principle of environmental engineering is solid waste management that avoiding this principle would cause economic loss and eventually destruction of sources and environmental pollution. The Solid waste production, has been an integral part of human life since the beginning of human creation so far. Over the last decade, development of technology and greater use of natural resources such as oil, Gas and turning them into petrochemical matters and polymeric added to a variety of size and complexity of material production (EPA, 1993). The rate of waste production and physical components of waste such as corruptible materials, paper, carton, plastic, textile, cloth, metals, glass and wood depend on various factors which are divergent in different regions. Different factors like geographical positions, economic situation, culture and customs are very effective in Quality and quantity of waste (Salvato, 1992 and Tchobanoglous et al, 1993). The statistics in 2008, showed that per head of waste production was nearly 820 gr in Iran and totally, waste produced in all cities of Iran is about 32000 tons (Waste Management in Tokyo, 2002). While, per capita in developed countries is higher than above mentioned amount. In Tokyo, per capita of waste production reported to be 1340 to 1380 gr per head in a day (Yoon, 2002) that this statistics are greater in contrast to that one of per capita average waste production all around the Japan (1106 gr head in a day) (Treatment of Municipal Solid Waste, 2003). In a study conducted by USA (Environment Protection Agency) it turned out that rate of waste produced in USA was 1.3 percent (Glynn, 1996). Thus, it represents a significant statistic in 1990. Qualitative analysis of solid waste in city of Tehran and Tokyo has been reported that content of organic matter found over the city of Tehran compared to Tokyo is higher and conversely, we observed the paper and wood among solid wastes are relatively lesser (Sakai, 1996 and M.A. Abdoli, 1995). Rate of The daily production of waste estimated 250000 tons and 300000 tons in 2010 and 2011 respectively. The growing population and improving the economic and social situation of people would be the basic reason representing the huge mass of waste. In fact, changes occurred in living condition and consumption model in recent years cause a huge per capita of solid waste production including remanent of edible sources that can be easily fermented and convert very high. It is possible to make use of this waste products and turn it into organic fertilizer for agricultural section, if properly planned. The appropriate way how to minimize the problems resulted from the solid waste is to employ the modern systems of management along with advanced technology. Recycling and reuse of solid waste suggests an economic model for reduction in the expense of raw materials production, optimizing energy, Reduce the cost of raw materials, regarding shortage and losing sources and consequently, developing various kinds of environmental pollutants. This strategy not only lower the urban authorities shortcomings but also would be valuable to check the growing of national income. Plan of economical explanation of recycling performed across the Iran regarded as a basis to large plans provided with recycling in 2003. In the program, the Sistan and Baluchestan province wholly being studied. Before 2003, a few studies had been done in Sistan and Baluchestan province (Goodini and Shams, 2003). The study purpose was to consider the present situation of solid waste management in city of Zahedan. As well as introducing the applicable strategies for optimizing the solid waste management.

Research Method

The Position of Investigated Area

City of Zahedan is a city which extended over 36581 km², involved in three towns (Sistan and Baluchestan capital), Zahedan, Mijaveh and Nosrat Abad that located in southeast of Iran. The geographical coordination of Zahedan is 60 degrees, 51 minutes, 25 seconds of east longitude and 29 degrees, 30 minutes, 45 seconds of north latitude. This city is 1385 meters above sea level. Based on the last census, the number of people living in city of Zahedan is 865000. This area has dry and mild climate.

Methodology And Date

The process of study for solid waste management in each town, requires parameters such as components of matters producing solid waste, measurement of weight, qualitative and quantitative parameters. Thus, based on the last recommendations of the world, over a given year samples provided from different parts of city so that they can be used as a model in related plan after evaluation and adaption with situation. The present study performed to measure the recycling potential, physical and chemical analysis of solid waste. At first city of Zahedan divided by three major districts and first district divided by four regions and the rest by three regions to select for sampling station. We took up 30 samples in each region, totally 90 samples were chosen and studied during the year. Sampling continued for 10 months and it being performed 4 days in a month. To determine the quantity, all machinery, collecting apparatus and transportation recorded by weighbridge. The weighing program performed separately for each district. Taking the measurement of density and physical degradation calculated in physical analysis. To evaluate the material density of waste production, after identification the collecting apparatus and abstracting the jam, we could calculate the mass of waste production and divided it by content eventually solid waste density determined with kg/m³. In the process of providing samples from waste transportation in each region randomly at least provided three samples. Furthermore, these samples were evaluated in specific containers along with a given content. Some samples provided from different regions, separated into bread pieces, paper, carton, metals glass, PET, plastic, textile. Thus, its percentage determined for city of Zahedan. To evaluate the humidity of waste at the end of the day, 200 gr of compostable material chosen in three repetitions of each region and combined and finally sent to the laboratory. In the chemical tests, about 1 kg of compostable compound collected in a particular sack that a special label determined with a number on eventually sent them to laboratory at the end of dehumidify. PH obtained from PHM with potentiometric.

Finding

The result of physical and chemical analysis waste found in city of Zahedan represented in 1 and 4 table respectively. In addition, the daily average of dried recyclable wastes and non-recyclable in 2013 and 2014 represented in the table 2 and 3.

Table 1. Physical traits of wastes city of Zahedan

Kg/m ³ Density	512
Humidity	68.2
Percapita of domestic waste(Kg per head in a day)	0.624

Physical analysis of waste in city of Zahedan

This analysis performed in three economic sections rich, medium- income low-income. Based on dried recyclable wastes, the significant point is that large amount of waste disposal being separated and accumulated by itinerants.

Table 2. Daily average amount of recyclable and non recyclable dried waste in 2014

Type of waste	Rate of dried waste recyclable (Ton)	Type of waste	Rate of dried waste non recyclable (Ton)
3.1	textile	55	Rubber and plastic
57	wood	97	pet
95	tire	95	White patch
6	leather	48	Colourful patch
51	soil	5.4	paper
20	disinfection	38	carton
-	-	4	copper
-	-	6	aluminum
-	-	69	glass

Chemical analysis of waste in city of Zahedan

These traits are represented in table 3.

Chemical traits of wastes city of Zahedan Table 2.

PH	8.1
N	3.73
C	41.34
C/N	26.1
Heat value of solid waste matter with)KJ/KG(humidity	11121
Heat value out of)KJ/KG(humidity	19533

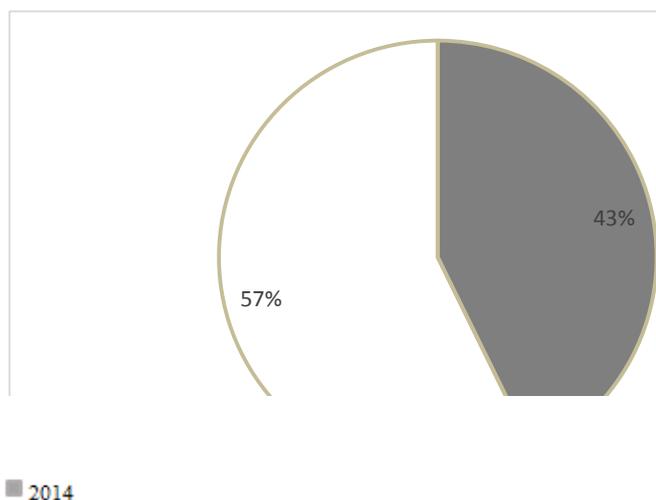


Figure 1. The rate of dried wastes recyclable

Economical estimation of recyclable materials collected in 2013 and 2014

Table 4. Review of economical value of recyclable materials collected in city of Zahedan in 2013

Index	The collection rate	Unit price Dollar/Kg	Economic value per year for recyclable (thousand dollar)
Paper	1016360	15240	15489326400
Carton	1130630	13000	14698190000
PET	1640945	20000	3281890
Rubber and Plastic	7680460	84600	649766916000
Tire	716950	35741	25624509950
Glass	898350	25610	23006743500
White and Colourful patch	484760	10400	5041504000
Copper	93190	74600	6951974000
Aluminum	8409490	34800	292650252000

Table 5. Review of economical value of recyclable materials collected in city of Zahedan in 2014

Index	The collection rate	Unit price Dollar/Kg	Economic value per year for recyclable (thousand dollar)
Paper	1285274	17180	22081007320
Carton	1184565	14000	16583910000
PET	1899320	37110	704837652
Rubber and Plastic	9151447	28000	256240516000
Tire	793990	111500	88529885000
Glass	865479	49630	42953722770
White and Colourful patch	523432	17500	9160060000
Copper	99564	94280	9386893920
Aluminum	993270	48100	47776287000

DISCUSSION:

The first step in conducting a management program of solid waste is to obtain information about the quality and quantity of materials. To plan and represent a program regarding the discharge of solid waste, it should be utilized systematically in the solid waste management which is based on scientific engineering principles and taking advantage of the whole techniques. The Average per capita of waste production is 0.624 kg/per head in a day and the average of daily waste produced in city of Zahedan varied from 400 to 500 and 600 to 700 in 2013 and 2014 respectively. Among with, large amount devoted to house hold section and the rate of about 70 to 75 percent form organic matter. Thus, 81.80 percent of the wastes is recyclable but 19.19 percent is non recyclable parts of city of Zahedan, solid waste would scale and discharge-except bran and rummage found in location recycling factory and After the recyclable waste being processed and separated, the rest of waste would be buried in a landfill located in a distance of 13 KM from city of Mirjaveh. Physical analysis represent that

waste provided in city of Zahedan composed of 71.2 wet waste and 21.9 dried waste. In the past times, separating the dried waste accomplished by the religious beliefs of people living in this area. But now, about 3.05 of dried waste is being separated by the families. As the figure 1 shows, it can be concluded that in near future the per capita of solid waste production increasingly because of factors such as distribution of population in city of zahedan, welfare promotion and life quality. Tables 5 and 6 show that in each day, there are more than 400 tons recyclable waste in city of Zahedan that contains plastic, glass, paper and different types of metals. through , PET found with maximum rate and copper with minimum rate since the copper is valuable metal and also its source separation and collection, it found in low amount. In a research being done on waste of city of Khaf. It determined that the rate of waste produced in city of Khaf is 1763 Kg and The annual production of waste is about 6435 tons in mentioned city. From which about 62.5 is made up of organic matter and 37.5 is provided with inorganic matters. The average waste production per year is 0.824 Kg per head. The highest rate obtained from winter and the less rate relates to spring season. The procedure by which the waste disposal is buried, called Ramp that is a sanitary Landfill(Alidadi et al, 2006) . The quantitative and qualitative analysis of waste disposal in city of Gorgan proved That in spring season about 100 tons of solid waste would made per day and about 120 tons would be made in autumn season. The average per capita of solid waste produced in this city reported to be 0.537 Kg and 0.644 Kg in spring and autumn season respectively Such findings show that daily production of waste in autumn is higher than the one compared in spring season. However, the highest rate of solid waste devoted to corruptible matters that was 85.6 percent and the lowest one was 0.8 percent which related to metals (Mehdinejad,1998). In USA, Amount of waste produced was 229.2 tons in 2001, also the percapita of solid waste was 4.4 pound per head in each day (*World Bankhead in each waste was 4.* In USA, the rate of waste production has been raised since 1990 and reached the Permanent rate after this rate. Such these are resulted from the appropriate decisions made about solid waste management as well as economic factors. The strategies of solid waste management since 2001 included 57 percent the waste recycling and compost, 17 percent the combustion of waste and 55.7 percent landfill. In European, the rate of solid wastes is 540 Kg per head. So, strategy of waste management in such countries contains 20 percent recycling, 16% combustion, 57% landfill and 7% other ways (*Herbert and Lund,2001*). In European countries with high standard of environmental, the practical plans applied to solid waste management are the application of Waste burning furnace and recycling the energy. Contrary to European countries, it seems that most of strategies regarding solid waste, highly performed by landfill, though, the recycling projects found the least. Such projects just involved in division of recyclable waste, for the purpose of reuse and compost making. However, compost is very valuable. Due to the economic value of waste and to recycle it again with the development of science and technology as well as to reduce environmental pollution, waste management methods must be used.

Strategies of solid waste management in city of Zahedan:

It beings to work for the separation plan from the instructional group activity that lasts unit may 2005.

Finally, the factory of biocompost beings to work in city of Zahedan at may 2005

1- Instruction: A team composed of 35 professionals (experts)engaged in city of Zahedan recycling organization did their job by referring to the people home and face to face performance of instruction based on waste segregation. So these experts successfully trained 30000 families. (about one third of city is under the control of organization).

2- Separation:

Each family received a green and gray bucket together with a yellow sack, so that they could be able to separate the food remenants 9 green bucket), non- recyclable and burring waste (grey bucket) and dried-recyclable waste (yellow sack) aparat from each other. Organization is planning to supply 12 to 14 families with 240 liter-capacity tanks in the green and grey colours and installed these tanks at each alley to save the assembling time.

3- collection:

The khavar trucks assembling about 50 percent of solid waste at present time. Some plans related to application of assembling porch machinery are being made. About 15 percent of wastes are collected non systematically by itinerants.

4- Recycling:

The separated wastes enter the project site to turn the contents of green bucket into the bio compost fertilizers by the technical operations. After being tested, the fertilizer planned to be sold to municipality and other organizations. The recyclable wastes are glass, bottle, paper and cans which take under the pressure by compressor. In the end, such compressed wastes will be purchased in a auction by factory owners of other cities.

5- Processing:

Each day, 140 tons out of 340 tons solid waste of city of Zahedan enter the factory and 10 tons turn into bio compost fertilizer and produced 40 tons of fertilizer.

So the rest would move to landfill to be buried or discharged. The aim of this plan is to recycle the wastes and changing them to bio compost which are operated by experts. It would expect to apply this experience in other locations.

Conclusion

To reach a development in urban areas, it requires so many changes and adaptations, furthermore, all the urban potential instructions should encourage the citizens to cooperate more and more. Thus, having and advanced instructions, we will have to use the strategies in which social expectancy along with instructional designs lead to positive improvements. Also, it must be compatible with social cultural and ecosystem environmental model.

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