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PUBLIC AWARENESS ON SOLID WASTE MANAGEMENT: A CASE STUDY IN DUHOK CITY, IRAQ

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ABSTRACT

This research was designed to assess the level of awareness and knowledge of local residents concerning Solid Waste Management [SWM] in Duhok, Iraq.

Primary data were collected from local residents through interview and questionnaire. A total of 60 questionnaires were completed by the respondents that were randomly selected.

In order to determine whether the trash could be recycled, the study goal was to define the household solid wastes produced by the neighborhood, and to use this solid waste to produce energy i.e. waste to energy technology.

The outcomes of a research done in a neighborhood of the Iraqi city of Duhok are presented in this study. In order to determine whether the trash could be recycled, the study's goal was to define the household solid wastes produced by the neighborhood. The outcomes are used to assess the recycling potential in other towns that are comparable to the one under study. These neighborhoods are situated in the city's most active and recent growing area.

The goal of the current study was to estimate the volume and quality of municipal solid trash generated in Duhok City in 2022. The samples were gathered from various city neighborhoods and residences. The income levels of the participants in the generation of municipal solid waste were considered. The generation of solid trash in Duhok city still Food (51 %) of the solid waste produced, followed by (24 %) plastics.

KEYWORDS: Household solid wastes; Wastes management; Wastes composition and quantity

INTRODUCTION

Iraqi towns & cities are largely characterized with having solid waste [SW] disposal problems. They are typified by overflowing dumpsters, mountains of open refuse dumps, and makeshift landfills on the edge of larger suburbs and cities [1,2].

The problems are also evident, especially where burning occurs, since properly operated landfills are nonexistent and often rodent infested with surface and ground water pollution, as well as air pollution concern.

Solid waste management is still very rudimentary, and solid waste collection in Iraq covers mainly urban population since municipal institutions, pursuant to Municipal Administration Act No. 165 of 1964, are not responsible for providing the service to rural areas beyond the borders of the municipality master plan. There are several attempts to provide services in rural areas including collection of waste, backfilling of swamps, and maintenance of roads even though these areas are outside the boundaries of municipality master-plan.[3]

Poor waste management [WM] is increasingly becoming a major challenge for municipalities, globally. Solid waste management is a problem that affects all communities today. Moreover, because more people and authorities are becoming aware of environmental difficulties, coming up with effective solutions to this problem is becoming a challenging challenge.

On the other hand, Hazardous waste includes poisonous materials, high concentrations of flammable materials, explosives, and substances which can interact, corrode and impact the health of human beings, animals, plants and the environment, whether alone or when combined with other materials. The quantity of hazardous solid industrial waste in Iraq reached 119,425 ton/year. [3] Globally the management of SW is an enormous challenge for municipalities. Previous studies indicate increase in population with relating concomitant urbanization dynamics and growth of conurbations will further exacerbate this challenge [3-8]

In order to reduce the environmental damage connected with solid waste, such awareness has often resulted in the development of pollution control technologies and more stringent legislation on waste processing and disposal. European law specifically encourages the creation of local integrated management plans that prioritize prevention, waste reduction, and resource recovery and only permit the use of landfills for the disposal of trash that cannot be recycled [9]

METHODOLOGY

The research was carried out in a community Duhok city of Kurdistan region, Iraq. Duhok city lies in the northwest of Iraq and western part of Kurdistan region, (latitude 36°5'N, longitude 43°0'). It is the 3rd most populous city of Kurdistan of Iraq [10,11]. This city is made up of new communities having fairly expensive households, and there are also some houses constructed to provide low-cost housing for lower-income families. In the current study, the Duhok community chosen as a model for research. Table 1 Shows categories of household waste that are utilized to study the content of household wastes.

Table 1 Categories of household waste that are utilized to study the content of household wastes

	Recyclable	Potentially recyclable	Non-recyclable
Organic components	Food remains and Paper and corrugated cardboard	Food remains, Paper and corrugated cardboard, Yard trimmings, Textiles, Wood and Leather	
Inorganic components	Aluminum, Glass and Steel cans	Plastics and nylon bags, Miscellaneous and metals such as copper, iron, lead.	Inert waste and Sanitary waste

RESULTS AND DISCUSSION

It has been determined that the composition and volume of household refuse varies from place to place. The variations are due to different consumer style, per capita waste production, and population composition, social, economic and cultural status [12]. It has been Observed that that waste from household in Duhok was mainly organic, most of which was food 51%, followed by Plastic 24 % and Paper and Cardbord 13%, Glass 4%, Textile 3%, Rubber 2%, Metal 1% and Hazardious 1%.

Tables 2,3 and 4 show average (AV) and S.D for Low Incomes, Medium Incomes and High Incomes Respectively

Table 2 shows AV and S.D for Low Incomes

Low Incomes		
Material	AV	S.D
Food	2.92	1.31
Glass	2.83	1.59
Hazard	1.92	1.00
Plastic	2.83	1.34
Rubber	1.83	1.03
Metals	2.17	1.59
Textile	2.50	1.51
Medical	1.50	0.90
Paper and cardboard	3.17	1.99

Tables 3 shows Av and S.D for Medium Incomes

Medium Incomes		
Material	AV	S.D
Food	5.25	6.82
Glass	3.3	4.52
Hazard	2.35	1.95
Plastic	5.4	9.16
Rubber	2.25	2.07
Metals	2.9	2.77
Textile	2.1	1.37
Medical	2.5	1.28
Paper and cardboard	5.7	10.62

Tables 4 shows Av and S.D for High Incomes

High Incomes		
Materials	AV	S.D
Food	5.26	5.75
Glass	3.79	4.22
Hazard	2.47	1.98
Plastic	5.32	8.68
Rubber	2.05	1.22
Metals	3.26	6.55
Textile	2.16	1.38
Medical	2.05	1.22
Paper and cardboard	2.89	1.56

Total Municipal Solid Waste (MSW) generation in Duhok City, Iraq in 2021 was 276640 million tons; approximately 51% was Food, 24% was Plastic, 13% was Paper and cardboard, 4% was glass, 3% was textile, 2% was rubber, 1% was metal and 1% was hazardous as shown in Figure 1.1.

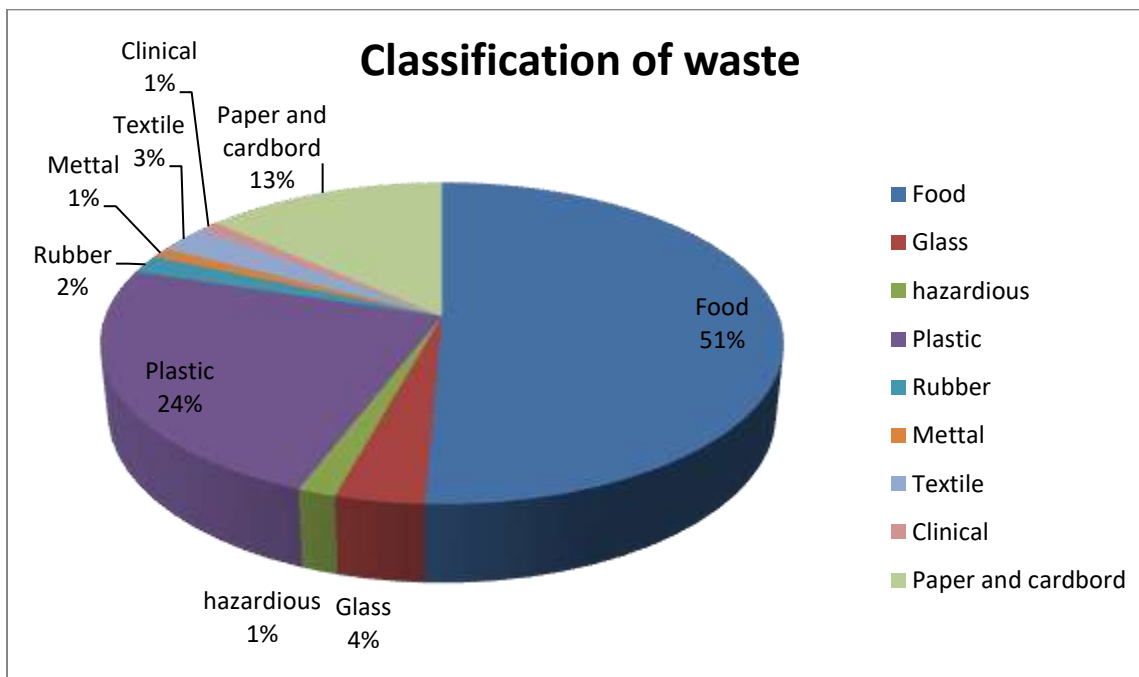


Figure 1.1 Composition of municipal solid waste in Duhok Iraq.

Fig.2 Shows the ranking of environmental condition in Duhok city.

A lot of wasted foods [where millions of tones] produce during celebrating many specific events [e.g. religious, National, etc] or festivals in Iraq by people from diverse ethnic communities. Top 4 most wasted foods are Rice, Bread, Vegetables, fruits.

If any food is left un- eats, that is still safe to eat, it can be donated to local community groups and charities. or the large percentage could be used to produce energy rather than going to landfill.

Iraq is rather in upper list of Asian's Most Wasteful Countries, where million tonnes of household and commercial waste straight to landfill; may be enough to fill the Colosseum [in the city of Rome]. over more than 20 times. We can turn wasted foods into compost, fertiliser, or used to generate energy. One of the best things to do with any food waste you produce at home is to add it to a compost pile.

France, is taking pride in its reputation as a gourmet nation, France can also be proud of its record in curbing food waste. The country has repeatedly earned the top spot in the Food Sustainability Index.

Also, A lot of the plastic was contaminated with stuff that made it difficult and expensive to recycle – paper, food waste, plastic wrap (which is not recyclable). And some of the plastic was hard to recycle and thus not profitable to import. However, we can use plastic for producing energy. i.e. The large percentage could be used to produce energy rather than going to landfill.

Also, Norway recycles 97% of its plastic bottles. Through this system, 97% of all plastic bottles in this Scandinavian country are recycled, making Norway the highest recycling country for plastic.

Thanks to the sensitiveness of its citizens to the environment & sophisticated collection techniques

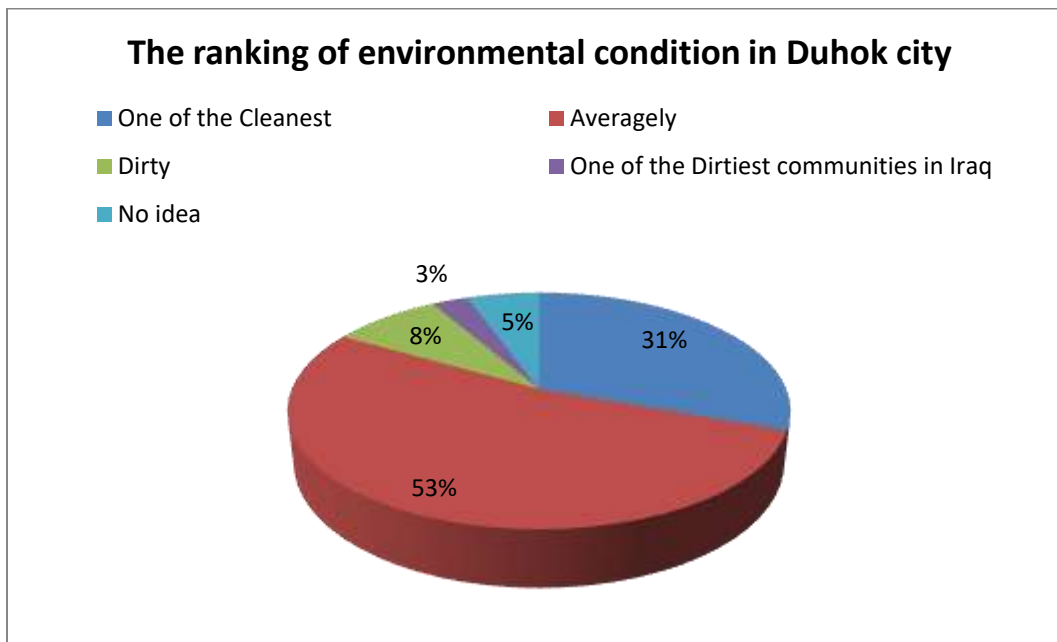


Fig.2 The ranking of environmental condition in Duhok city

Satisfaction of residents on solid waste management the respondents were also evaluated based on their satisfaction with solid waste management in Duhok city.

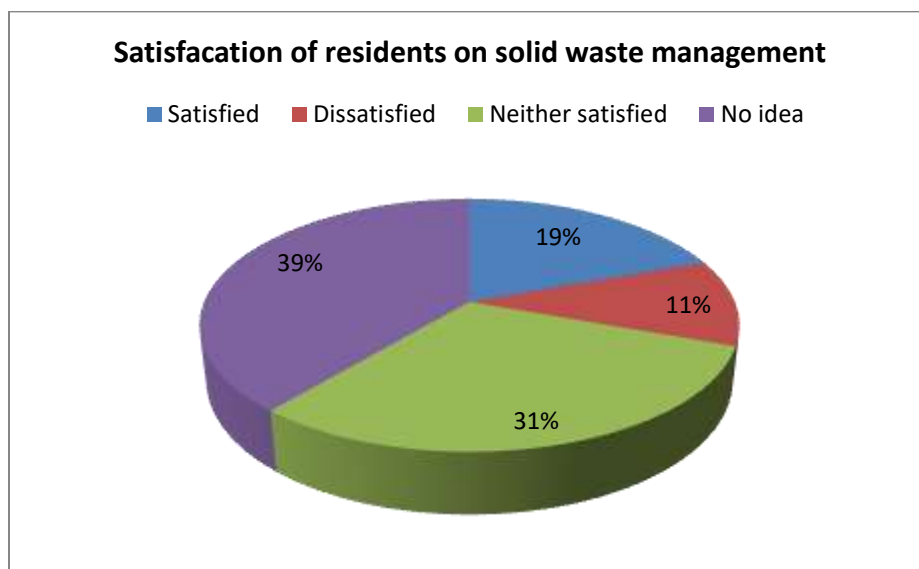


Fig.3 Satisfaction of residents on solid waste management

The importance of knowledge on proper disposal of solid waste the respondents were asked to rate the statement, "Awareness about the importance of proper disposal of solid waste collected by authorities". Using a five-point scale, ranging from 1 (strongly not important) to 5 (strongly important)

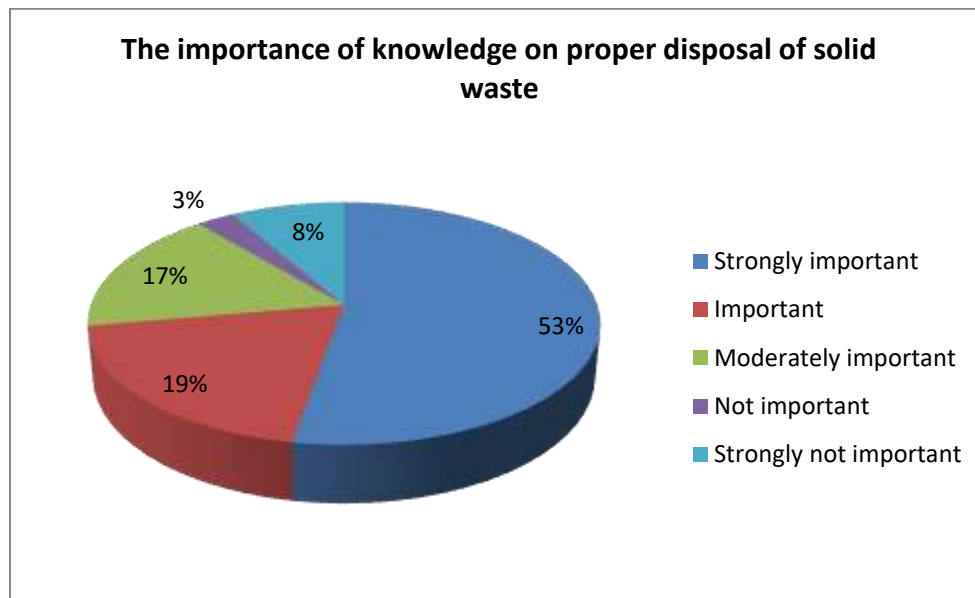


Fig.4 The importance of knowledge on proper disposal of solid waste

The importance of knowledge of health impacts of solid waste.

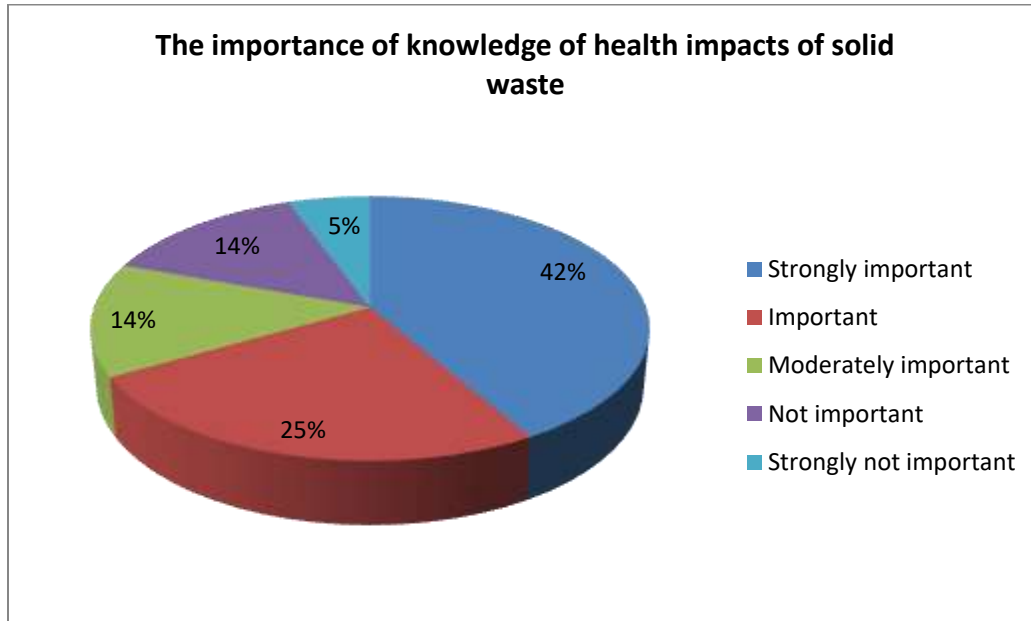


Fig.5 The importance of knowledge of health impacts of solid waste

Preference group to handle solid waste collection and disposal

Fig.6 shows the preference of responsible about the responsible of stakeholder in handling solid waste collection and disposal.

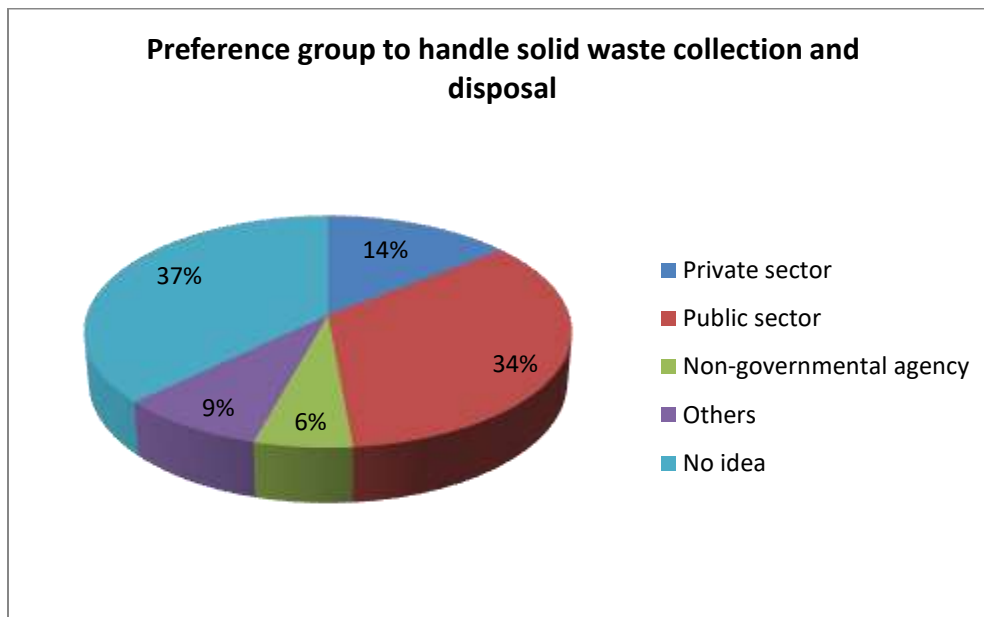


Fig.6 Preference group to handle solid waste collection and disposal

The importance of participating in solid waste management programme. The respondents were asked about the importance of participating in solid waste management programmer to keep the city clean.

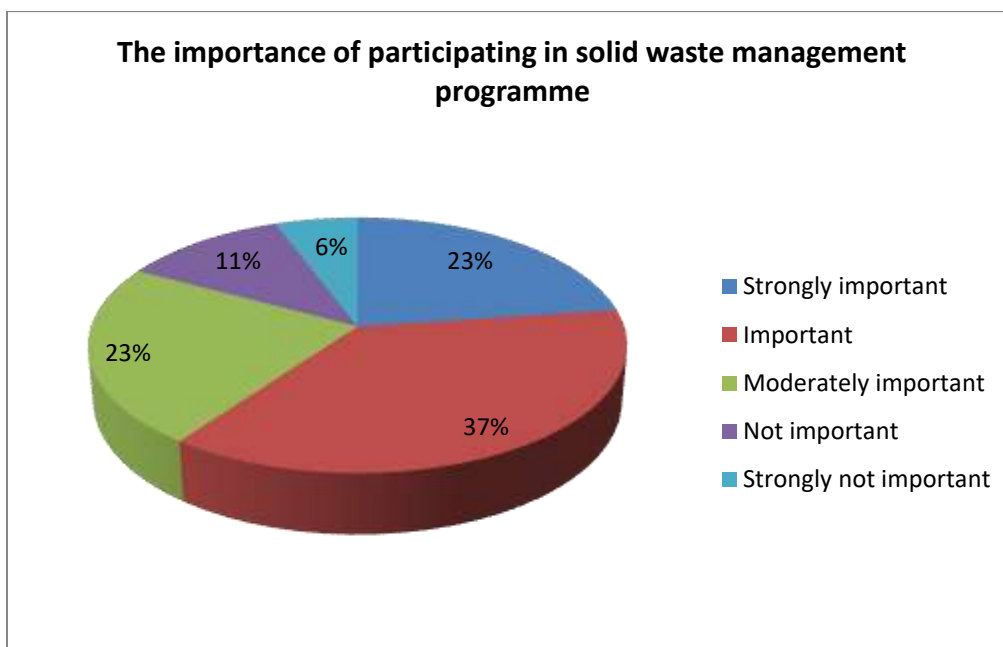


Fig.7 The importance of participating in solid waste management programme

Knowledge on solid waste collected by the designated body in Duhok,Iraq

The respondent knowledge on the soild waste collected by the designated body in duhok city, Iraq is shown in fig.8

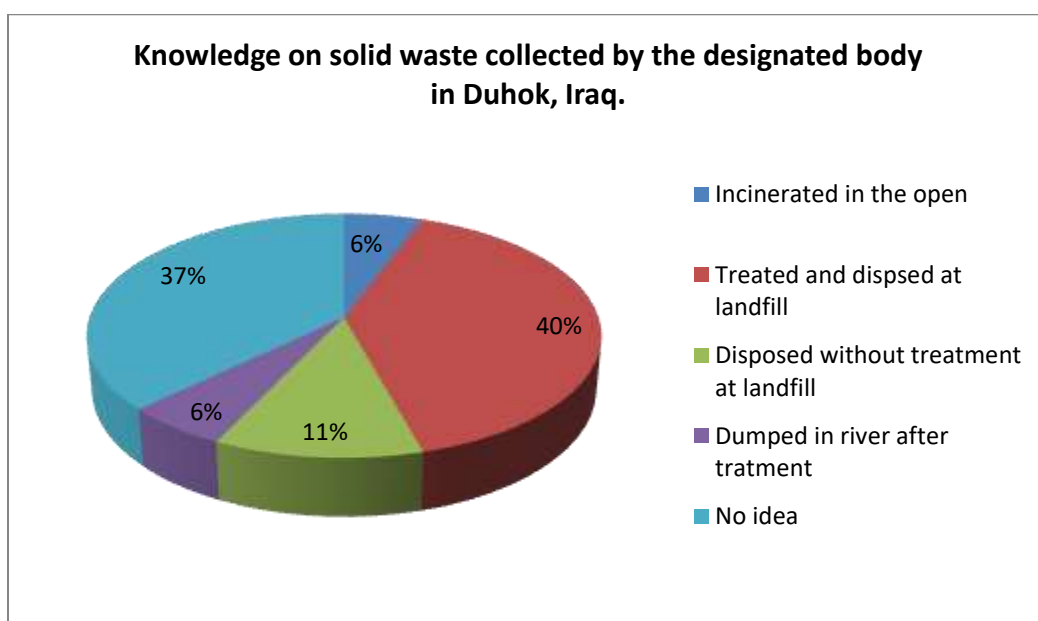


Fig.8 Knowledge on solid waste collected by the designated body in Duhok, Iraq.

CONCLUSIONS

There is a critical need to reduce the amount of solid domestic trash that is dumped in the neighborhood low-grade landfill in Duhok, Iraq, as well as the rest of the developing country. Due to the lack of a sanitary landfill, managing residential solid waste in Duhok City poses a serious environmental danger.

In order to encourage residents of homogeneous areas to participate in pro-environmental behavior such as reducing consumption and recycling, it is essential to create targeted work programs. Municipal campaigns for the collection and sale of recyclable garbage must, however, run concurrently with these programs.

The development of applied research must continue, particularly with relation to solid wastes. Municipal officials' decision-making will be substantially benefited by these initiatives. In order to compare the results, it is essential to conduct characterization and quantification studies using the same methods in communities from various economic classes (lower, middle, and upper).

For some people, recycling may not be a priority due to their lack of concern about the environment or their lack of understanding of how important it is to reduce waste and conserve natural resources.

Environmental education programs must be developed in conjunction with programs for the separation of recyclable wastes so that the activities of separation, repurposing, and recycling may take on a deeper.

Community involvement is necessary for the usage of household garbage, and an integrated plan of community participation must be created. A Citizens' Committee dedicated to practical environmental management based on environmental preservation and protection and the smart use of natural resources must be a part of this plan.

RECOMMENDATIONS

The following are some Recommendations from this study:

1. There is a need for increased awareness among people as well as Government officials to prevent the long-term prevention of health risks associated with pollution due solid wastes management. The impact of his pollution must publish in several newspapers for public awareness. However, government and NGOs can play a significant role in this process.
2. law must be put into force to active SWM law. Solid waste Management [SWM] sector in Iraq is suffering from a severe shortage in the regulations, laws, and technical guidelines on SWM. This is applicable for both the Kurdistan regional government [KRG], & Federal Government where despite the fact that a draft SWM law has been prepared in the Iraqi Parliament and another Law for KRG a couple of years ago, neither law has been put into force up to this date.
3. This study found that Duhok residents were aware of the dangers of improper waste management. They were aware of the need to have a proper waste management but were not aware of the 4Rs programme of solid waste management namely Recycle, Reuse, Reduce and Rethinking. There is need to work with the community to come up with a suitable model of managing waste in Duhok City, Iraq.
4. Energy from Waste is a renewable solution that can provide low carbon electricity. We should encourage the use of Waste for producing Energy by eco-friendly alternatives methods.
5. Establishing an appropriate program to separate waste from the source before transferring it to the landfill by providing multiple containers in residential

neighborhoods.

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