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Investigation of the Composition and amount of Waste Produced by a Household

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Abstract

In this investigation a scientific approach was adopted to study the composition of waste and to estimate its amount generated by a household of two people over a period of four weeks. It has been found that in each society composition of household waste is different depending on the society's way of life.

It also has been found that the best way to minimise the household waste is to recycle any recyclable material and also composting, and in these ways environment is protected and natural resources is saved and eventually sustainability is fulfilled.

Keywords: *investigation, solid waste, recyclable, environment, pollution, sustainability.*

Introduction:

The amount and composition of waste generated by a household varies depending on several factors. Firstly, on the number of people living in a household, secondly, the society's way of life this will decide the type food consumed by a particular society and then composition of waste. For instance; modern society are different in their type of food they are consuming compared to other societies.

These factors and others would certainly decide the composition and amount of waste produced by a household in various societies.Modern consumer society produces a lot of waste. Each of us, whether in Iraq or abroad, throws away around a kilogram of rubbish each day. We have had to develop elaborate and expensive system to get rid of refuse.Collecting waste from individual homes accounts for most of the cost but final disposal is becoming more expensive and difficult as the amount increases (1, 2). The most common way of getting rid of the collected waste is by tipping it at landfill sites. Incineration is becoming more popular as dump sites become harder to find, but the ash still has to be dumped. This in it self can create a pollution problem if ash is allowed to blow about. Kitchen waste disposal units reduce the amount of food waste thrown in the dustbin, but they simply transfer the disposal problem to the sewage works (3, 4).

Most of the waste we throw away could be collected together and sorted into valuable sources of raw material. As well as saving these materials recycling conserves energy and reduces the amount of rubbish that we have to burn or dump. The salvaged materials do not have to be burn or dump (4). The salvaged materials do not have to be particularly valuable to start with; most of them are so-called "disposable" items. Provided sufficiently large amount can be collected on a regular basis it makes good economic sense to recycle low cost product. Special collection centres like bottle banks and paper dumps encourage people to do this. In the long-term the advantages of recycling will be far reaching. It is predicted that it could cut down existing pollution problems by half (5, 6).

Methods of Research

Statistical method has been used to investigate the changes in the composition of waste generated by the household of two people over the period of four weeks. Also the best method to minimise the quantity of waste was investigated.

Equipment and Apparatus:

Kitchen scale, disposable gloves, plastic bags (20), dense plastic box (to keep plastic bags)

Procedure:

Household waste has been separated into 15 categories (only ten were available to be colleted at my house). Plastic bags were used to each category.
Over the course of the week waste has been added into the relevant bag.
Gloves are to be worn when adding waste into each plastic bag (7).
We have collected the following categories:

- Cardboard and paper packaging, such as boxes, drinks cartons, cereal boxes, egg boxes, and paper packaging, e.g. food wrapping, paper bags, gift-wrapping.
- Paper (non-packaging), e.g. newsprint, magazine, computer paper, receipts, leaflets, envelopes.
- Dense plastic packaging, e.g. plastic bottles, food containers.
- Plastic (other), e.g. coat hangers, plastic films (cling film, food wrapping, crisps wrappers, plastic bags).
- Ferrous metal packaging, e.g. steel and tin cans.
- Aluminium packaging, e.g. cans, foil, food containers.

By using magnet I have been able to verify whether tin can is aluminium or not as magnet doest not attract aluminium.

- Metal (other). This is all metal other than ferrous and aluminium packaging, e.g. scrap metal.
- Glass containers, e.g. bottles, jars.
- Textile, e.g. clothes, rags, cleaning clothes.
- Putrescible kitchen waste, e.g. food preparation waste (peeling, etc.), left-over food.
- Garden waste, e.g. pruning, grass cuttings, leaves, soil.
- Disposable nappies.
- Miscellaneous combustible. This is combustible waste not covered in other categories. Typically this is waste timber, waste wallpaper, etc.
- Miscellaneous non-combustible. This is non-combustible waste not covered else ware, e.g. rubble, sheet glass, broken ceramics.
- Fines. This is powered material such as ash, dust and cinder.

The weight of the bag empty was recorded in advance. At the end of each seven days period a weekly weight has been obtained for each category, using kitchen scale. The difference between the bags contains the waste category and the empty bag is calculated and the weight of each category is recorded in the waste generation table. The procedure repeated for four consecutive weeks and the result recoded in the waste generated table (8).

Results and Discussion:

The following pie chart (Figure 1) shows the percentage of each waste category produced by a household over a period of four weeks:-

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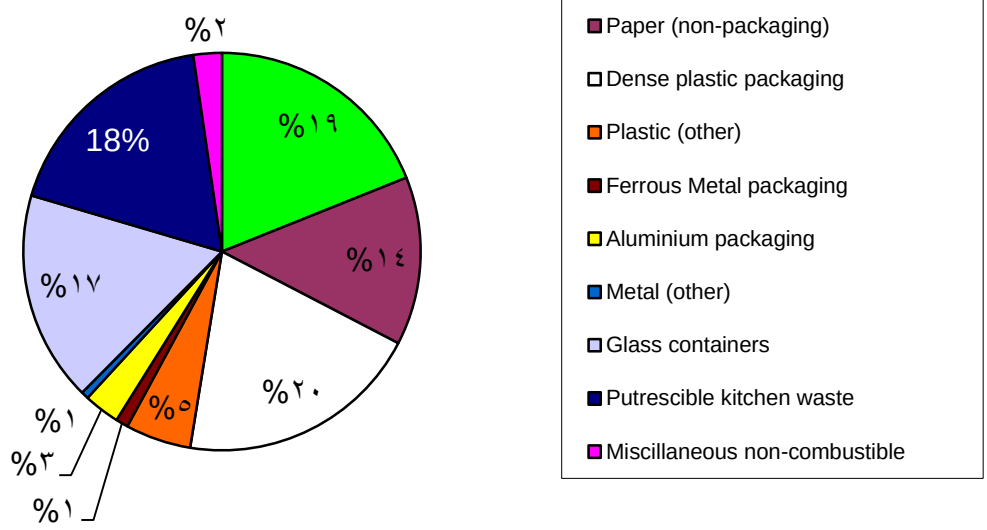

Figure 1: Percentage of each waste category produced over the period of four weeks

Household waste survey chart (Figure 1) shows the variation in the percentage of waste generated for each category over the period of four weeks.

Looking at the chart it is quite clear that the amount of dense plastic, cardboard and paper packaging are the highest among the other waste categories, which is a general indication the kind of food the household is consuming to produce such a waste. This means large amount of fresh food and mostly half cooked meals the household is consuming and that why both types of waste packaging are exceeding the rest of generated waste categories. Also the amount of putrescible kitchen waste is the third higher as it emphasises the consumption of fresh food such as vegetable and half cooked meals, as mentioned earlier (9).

In the context of material recovering, the generated waste as a result of sort of food consumed, these material could well be find their way to recycling facilities and that means less waste to be taken to burial site (landfill) or incinerated, consequently less pollution to the environment.

Calculation of standard deviation(σ):

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Table 1: Stages in calculating standard deviation of solid waste changes in kg

Waste Category	X_i (change)	$\overline{X}$ (mean change)	$X_i - \overline{X}$	$(X_i - \overline{X})^2$
Cardboard & paper packaging	0.94	0.497	0.443	0.196
Paper (non-packaging)	0.68	0.497	0.183	0.033
Dense plastic packaging	0.99	0.497	0.493	0.243
Plastic (other)	0.265	0.497	-0.232	0.054
Ferrous metal packaging	0.05	0.497	0.447	0.200
Aluminium packaging	0.145	0.497	-0.352	0.124
Metal (other)	0.03	0.497	-0.467	0.2180.125
Glass containers	0.85	0.497	0.353	0.162
Putrescible	0.90	0.497	0.403	0.146
Miscellaneous non-combustible	0.115	0.497	-0.382	
Mean	0.497	0.497		
Sum				1.501

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{\left(X_i - \bar{x}\right)^2}{n}}$$

σ **= 0.387**

The change in solid waste listed in Table 1 has a mean of approximately 0.497 with standard deviation of 0.387.

Table 2: Estimation the maximum percentages of the two people household waste that could be recovered by materials recycling

Component	***% Recyclable***
Paper and card	85
Dense plastic	30
Glass	77
Ferrous metal	3.5
Non-ferrous metal	0.9
Kitchen/garden waste	72
Assume that the other components are not recyclable	

Table 3: Estimation of the two people household waste that could be recovered by materials composting

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Component	***Calorific value*** *(MJ kg^{-1})*
Plastic film	6.254
Textile	0.00
Miscellaneous combustible	0.00
Miscellaneous non-combustible	0.322
Fines	0.00
Non-ferrous metal	0.00
Metals, glass, electrical/electronic equipment	0.00

Table 4: Maximum recycling and composting

Component	***Calorific value*** *(MJ kg^{-1})*
Paper and card	11.53
Dense plastics	26.43
Glass	0.00
Ferrous metal	0.00
Non-ferrous metal	0.00
Kitchen/garden waste	4.95

As can be seen from Table 3 and 4 that much of the household material are recyclable and that means a significant amount of energy can be recovered through recycling of these material. So recycling is not only to save our resources but also to save energy, which as a result to keep our environment clean from the waste produced from using more fuel (10).

The best management option of my household waste is to produce less waste. Where waste cannot be avoided, it should be reused or recycled wherever possible. It is possible to create less waste through buying food with unnecessary packaging and by buying clothes and household goods that are designed to last several years rather than a few months. Reusing something takes less energy and creates less pollution than reprocessing it to make it a new product.Many items –like clothes, furniture and household goods – thrown away simply because they are old or broken. They could be repaired, refurbished and reused.

Products like food, drinks, household cleaning products and toiletries, could be sold in reusable containers instead of one trip packaging. Studies have shown that reusable packaging systems use fewer materials and less energy than one-trip packs and create less pollution (11).

If waste cannot be reused it should be recycled. Over half of the household rubbish in our dustbins could be recycled, but only between two and a half four and a half per cent of it is.Glass, plastic and metal can be melted and reshaped. Paper can be pulped and made into new paper. Organic waste can be composted. Textiles can be unwoven and re-spun into new cloth. Finally, the best way to manage our household waste is by reduce, reuse and recycle waste (12).

Conclusion:

In the case of my household waste, the finding does not necessarily mean a typical household waste, compared to other households as number of household as mentioned earlier is a factor can make a difference in the amount of waste generated. It also depends on the kind of food a household consumes and that kind of food would

definitely decide the main categories of waste to be generated. Also, in my household of two people, most of the waste mainly was dense plastic packaging and then cardboard and paper packaging (see Figure 1). There is a clear indication that my household waste collected could well be reused and recycled and by this process we can avoid the burden of getting rid of waste whether by incineration or to be buried in a landfill site. Both methods have adverse effects on the environment.

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بحث ودراسة تركيب وكمية النفايات الناتجة من منزل اسرة معينة

الدكتور نعيم محمد علي ابراهيم / قسم الصحة البيئية - كلية العلوم الطبية التطبيقية – جامعة كربلاء

الخلاصة :

في هذه الدراسة تم اتباع اسلوب علمي لغرض تقدير كمية وتركيب النفايات المتولدة من اسرة معينة ولمدة اربعة اسابيع كفترة زمنية تم اختيارها لتقدير وحساب كمية وتركيب النفايات المطروحة.كما تم التوصل الى انه من الافضل اعادة تدوير النفايات المنزلية ما امكن وذلك لتقليل كميتها وبالتالي تقليل تأثيرها على البيئة سواء بالطمر الصحي أو بالحرق وفي كلا الطريقتين تأثير بالغ على البيئة. كما وان اعادة التدوير له مردود ايجابي على حماية البيئة وكذلك الحفاظ على الموارد الطبيعية وبذلك تتحقق التنمية المستدامة.