

***Estimating the Volume of Solid Waste in
AL- Musayyib District up to 2026
and the Required Environmental Management Policies***

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First:Introduction

Solid Wastes term used to refer to non-liquid waste produced by different types of domestic activity and craft, commercial and industrial, mining and other human activities. But a non-means is relative, because sludge from the sludge treatment effluents also fall within the solid waste, and therefore more precise definition of solid waste material that is solid or semi-solid disposed of residues generated when sources are not of merit retain their value. Even if they can be valuable in another location or other circumstances.(Brenda Platt,2007)

The solid waste can be classified into the following items:

- 1 - Household waste: which includes all types of waste resulting from the housing units.
- 2 -Municipal waste: The remnants of the streets and shops and government buildings and remnants of demolished buildings.
- 3 - Medical waste: the remnants of hospitals and medical clinics to private and public.

- 4 - Industrial waste: a cross from products industry and are usually metal or wooden scraps of paper or ---- etc.
- 5 - Agricultural residues: They are remnants of agricultural crops.

The amount of solid waste is changing according to the size of the population and the size of human activities, which reflected negatively on the situation of the population and their health and living. The solid waste may be a major cause of the spread of diseases, addition to spoiling the beauty of cities and pollution, and at the same time may be of economic value in the case of efficient management. It contains wastes (generated by homes and buildings) of different components such as paper, metals, organic materials, and are all components of economic value if it were screened and recycled products have become useful for different uses.

Hence the importance of the need to manage solid waste that requires a study of assessing local conditions and problems facing the solid waste management system and the problems faced by the most prominent and population density

- the lack of financial profile

- atmospheric temperature

- the lack of environmental awareness among the population,

must therefore Planning and development of appropriate methods for solutions commensurate with the possibilities could even eliminate the problem of solid waste through the optimal use of the methods used to manage and thereby reduce their environmental impacts (Laurent, 1989)

Second: The Management of Solid Wastes

For the purpose of completing the process of solid waste management and benefit optimally from what we can benefit the largest possible proportion and get rid of the rest, we must identify the properties of waste. These properties include the installation physicist and the chemical composition and moisture content, density, and it should be noted that these characteristics

are different from one place to another, in the same place in different time, and by level of living of the population and per capita income and percentage of awareness and social and industrial development.

The management of solid waste through some of the vocabulary as:

a - the rate of generation:

One of the most important items of solid waste management can be defined as the quantity of waste posed by the person during a certain period of time in terms of weight or volume should be noted that the rate of regeneration change depending on many factors,

- 1- Geographic location
- 2-Seasons of year (autumn - Winter - - etc.)
- 3-Economic level
- 4- Social and cultural awareness
- 5-Local legislation and traditions of the people and their habits (Wilson,etc.2001).

Table (1) shows the rate of Solid waste regeneration in different countries of the world

The country	rate of generation Kg/person/day
Jordan	0.935
Lebanon	0.958
Saudi Arabia	1.25
Egypt	0.5
America	1.8
Germany	0.85
India	0.51
Nations of the world by the (WHO)	1.6

b - On Site Storage

The main purpose of storing solid waste is to protect public health from vector addition to the aesthetic side of the city. Estimating the appropriate size of the waste receptacles conservation depends on the rate of generation - the number of family members - the type and nature of waste before (P. Aarne, Jeffrey, 1982)

The stated main types of storage containers, namely:

- 1 - Receptacles capacities ranging from plastics (7-30) L
- 2 - Receptacles capacities ranging from tin (50-70) l
- 3 -Bags made of plastics and light used for once.
- 4 - Methods of mass storage.

c - means the collection of solid waste:

Different design of vehicles used for the purposes of collecting and transporting solid waste from one city to another depending on the requirements of health, and there are several types of vehicles used for this purpose (Al-Gemeili who, 1998)

- 1 -Hand-carts
- 2 - Horse-drawn wagons Aualbgal
- 3 - Drawer (tractors)
- 4 - Car Alcabsa
- 5 - Carriers, container
- 6 – Trucks

d - ways of dealing with solid waste:

_Process aims to deal with solid waste to reduce the size and weight initially as secondary to be done as quickly transformed into a form less damage (McDonald, 2001)
The most common means of dealing with solid waste are:

1 - Resource Recovery:

It is a way to recover some of the beneficial components of solid waste, rather than just dump them (al-Juburi, al wakeel, 1985)
There are three routes to recover resources:

***)Reuse**

The materials are used in the context of solid waste for the same purpose, which was used at the beginning again. The re-use waste in developing countries can not be so narrow, taking into consideration poverty due to the waste materials beneficial to the large Exhuming the capture, while in rich countries use Re-renowned because of the high cost (Jffrey, Ruth,1997)

****)Recycling**

Recycling is the use of solid waste as raw materials for the same purpose or for other purposes once again and this process a lot of interest, where reserves of natural materials and less need to import raw materials also reduces the risk of contamination, which generally require less energy than those required by the process of preparation of raw materials (McDougall, 2001)

*****)Utilization**

The use of some components of solid waste and find a new use to them. Where it could be placed in direct use, such example uses an alternative to Cement in concrete dams, roads and other installations, or for example, benefit from the remnants of buildings, facilities or materials to erase the spring and use other methods (Laurent,1989)

2 – Burning or Incineration:

A process which oxidize College (final) for each of the burning of combustible materials, with the recovery of thermal energy. This is the method of treatment is way more technical terms of percentage decline (85-90)% of the volume of waste. Not advised in case of waste containing a high percentage of organic materials moist and minerals to the low thermal value to them. It should also be noted that there must be accompanied by the

burning process of addressing air polluter output of vehicles posed by toxic air. The remaining waste is ash, glass, metal and other materials unburned raised at a landfill site dedicated to (Wilson,et.2001)

3 - Biodegradation Composting:

Which is the way biological (not a chemical) used bacteria and some microorganisms to convert waste into fertilizer dirty in the interests of agricultural production. That, this method is practiced widely in Europe jeopardy they have not exercised frequently in the United States of America. This is the way even though they use a few of the most appropriate method of developing countries in terms of cost and environmental protection. They need the way to large areas and to the effective control of vector and microbes (Laurent, 1989)

4 - Disposal Landfill :

The method of burial is the most common and used for the disposal of solid waste and it should be noted that this process be synonymous with all previous operations since the backward from these operations shall be buried in the earth (al-Juburi, the agent, 1985) There are two types of landfills:

***: The indiscriminate dumping.**

**** : Landfill drainage.**

Third: The Case Study and Research Objectives:

For the practical purposes, Qadaa AL-Musayyib had been selected as a case study, and for estimating the volume of solid waste generated at the goal year (2026) depending on the base year (2006), based on estimates of population size for the same period and within the requirements of environmental planning and management of the Qadaa.

The reasons for selecting this time period is to provide data on solid waste for the Qadaa AL-Musayyib in 2006 and the years before, are the environmental data base prepared by the Directorate of Environment in Babel Governorate, as well as estimates of population size in 2006 and the years before, from the Directorate of Statistics in the Babel Governorate.

So depending on the size of the Solid waste generated in the goal year in this case in 2026 (that is, after twenty years of the base year 2006), and the light of the results of appreciation, environmental policies will be required to deal with the situation.

a - Calculating the rate of generation of solid waste to Qadaa AL- Musayyib for the base year 2006:

The amount of solid wastes for Qadaa AL- Musayyib limits in 2006 to 237.75 tons / day (Database / 2006) and through knowledge of the size of the population of Qadaa AL-Musayyib of 325061 people (Statistics / Year 2006), the rate of solid waste generated per person during the day are calculated as follows:
Generation rate (kg / person / day) = quantity of waste generated (kg/day)/size of the population (people) = 237750 / 325061
= 0.73 kg / person / day

The link between population size for the Qadaa AL- Musayyib year 2004, 2005, 2006, with the amount of solid waste generated for the same year shows a relationship between them and written as shown in below:

Table (2) shows the population size and eliminate waste generated in Qadaa AL- Musayyib for the period (2004 - 2006)

Year	population	quantity of waste tons / day
2004	304624	138
2005	314430	202
2006	325061	237.75

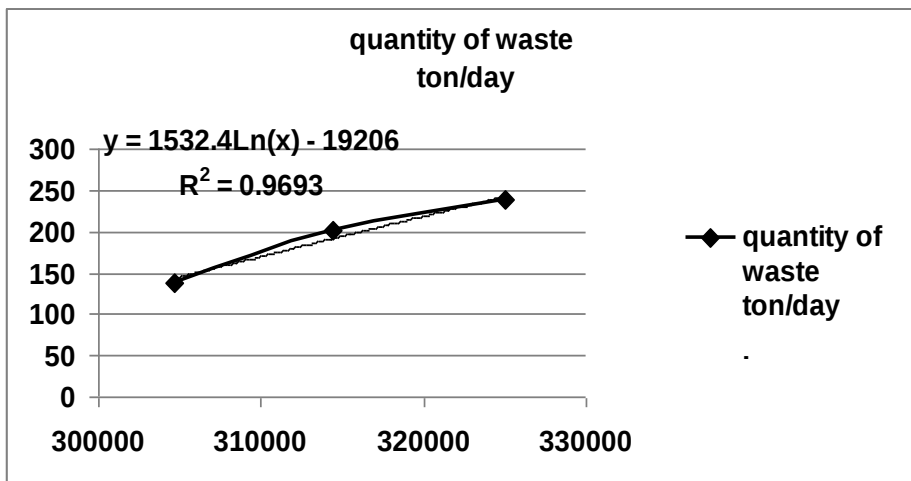
$$Y = 1532.Ln(x) - 19206$$

$$R^2 = 0.969$$

where as :

X = size of the population (people)

Y = quantity of solid waste generated (tons / day)



The Fig (1)) shows the population size and eliminate waste generated in Qadaa AL-Musayyib for the period (2004 - 2006)

b - Comparison with global rates:

The rate of regeneration of solid waste in Qadaa AL-Musayyib was the about (0.73) kg / person / day which is similar to rates of solid waste generated in Germany and less than the global rate set by the World Health Organization WHO (1.6) kg / person / day

c – Available supplies/machines to manage solid waste in Qadaa AL- Musayyib for the base year 2006:

Table (3) clarifies existing supplies/machines for solid waste management in Qadaa AL-Musayyib.

Year	population	quantity of waste tons / day	Worker/day	the number of different machines
2006	325061	237.75	478	580

Through the above table note that the number of workers was about (478) worker / day in addition to providing (580) mechanism of different kinds and types as shown in the table below: *

Table (4) clarifies the types and number of available supplies for the base year 2006

Type of supplies/ machines	Available for the 2006
Dunbar	1
Container crane	2
excavator	3
Grader	3
Laurie	4
service	4
Denies withdrawing water	4
Tug	9
large containers	20
Capstan	21
trucks	21
small containers	488
Total	580

d - Estimating the size of solid waste in Qadaa AL- Musayyib for the year 2026 goal

To estimate the volume of waste generated in the future and for a period (20) years starting from the base year (2006) until goal year (2026) , the following steps have been achieved :

1 - account the population growth rate = r

Estimated size of the population in Qadaa AL- Musayyib in 2004 = 304624 person

Estimated size of the population in Qadaa AL-Musayyib in 2006 = 325061 person

$P_{2006} = P_{2004} (1 + r)^n$

n = number of years.

P = population.

Population growth rate (r) = 3.3%

Using the growth rate above, population size for each year from 2006 until 2026, have been calculated, as illustrated in Table (5).

2 -Calculating the amount of solid waste for the goal year (2026):

According to the report of the size of the population, which reached its previous paragraph, and by using the mathematical model below

$Y = 1532.Ln(x) - 19206$

$R^2 = 0.969$

(which was derivative in this research), the quantities of solid waste generated in Qadaa AL- Musayyib for the years 2006 to 2026 can be calculated.

Table (5) shows the amount of solid waste to spend in Qadaa AL- Musayyib for the period from the base year 2006 to goal year 2026 :

Table (5) shows the amount of solid waste to spend Musayyib for the period from the base year 2006 to year end 2026

Year	population	the quantity of waste tons / day
2006	325061	237.75
2007	335788	287.53
2008	346869	337.27
2009	358316	387.01
2010	370140	436.75
2011	382355	486.49
2012	394972	536.23
2013	408007	585.97
2014	421471	635.71
2015	435379	685.45
2016	449747	735.19
2017	464588	784.93
2018	479920	834.67
2019	495757	884.41
2020	512117	934.15
2021	529017	983.88
2022	546475	1033.62
2023	564508	1083.36
2024	583137	1133.10
2025	602381	1182.84
2026	622259	1232.58

e – Required supplies/machines needed for solid waste management for the Qadaa AL-Musayyib for the year 2026 goal:

Supplies/machines required for the goal year 2026 in Qadaa AL-Musayyib, have been calculated by the ratio of proportionality and depending on the amount of solid waste generated which have been calculated. These requirements are in the situation to

continue using the landfill method of dealing with the health of waste generated. Table(6) shows these required supplies/machines.

Table (6) shows estimates of population size and solid waste generated and required supplies/machines for the target year 2026 in Qadaa AL-Musayyib

Year	Worker/day	Dunbar	Container crane	excavator	Grader	Laurie	service	Denies withdrawing water	Tug	large containers	Capstan	trucks	small containers	Total
2006	478	1	2	3	3	4	4	4	9	20	21	21	488	580
2007	494	1	2	3	3	4	4	4	9	21	22	22	504	599
2008	510	1	2	3	3	4	4	4	10	21	22	22	521	619
2009	527	1	2	3	3	4	4	4	10	22	23	23	538	639
2010	544	1	2	3	3	5	5	5	10	23	24	24	556	660
2011	562	1	2	4	4	5	5	5	11	24	25	25	574	682
2012	581	1	2	4	4	5	5	5	11	24	26	26	593	705
2013	600	1	3	4	4	5	5	5	11	25	26	26	613	728
2014	620	1	3	4	4	5	5	5	12	26	27	27	633	752
2015	640	1	3	4	4	5	5	5	12	27	28	28	654	777
2016	661	1	3	4	4	6	6	6	12	28	29	29	675	802
2017	683	1	3	4	4	6	6	6	13	29	30	30	697	829
2018	706	1	3	4	4	6	6	6	13	30	31	31	720	856
2019	729	2	3	5	5	6	6	6	14	31	32	32	744	885
2020	753	2	3	5	5	6	6	6	14	32	33	33	769	914
2021	778	2	3	5	5	7	7	7	15	33	34	34	794	944
2022	804	2	3	5	5	7	7	7	15	34	35	35	820	975
2023	830	2	3	5	5	7	7	7	16	35	36	36	847	1007
2024	857	2	4	5	5	7	7	7	16	36	38	38	875	1040
2025	886	2	4	6	6	7	7	7	17	37	39	39	904	1075
2026	915	2	4	6	6	8	8	8	17	38	40	40	934	1111

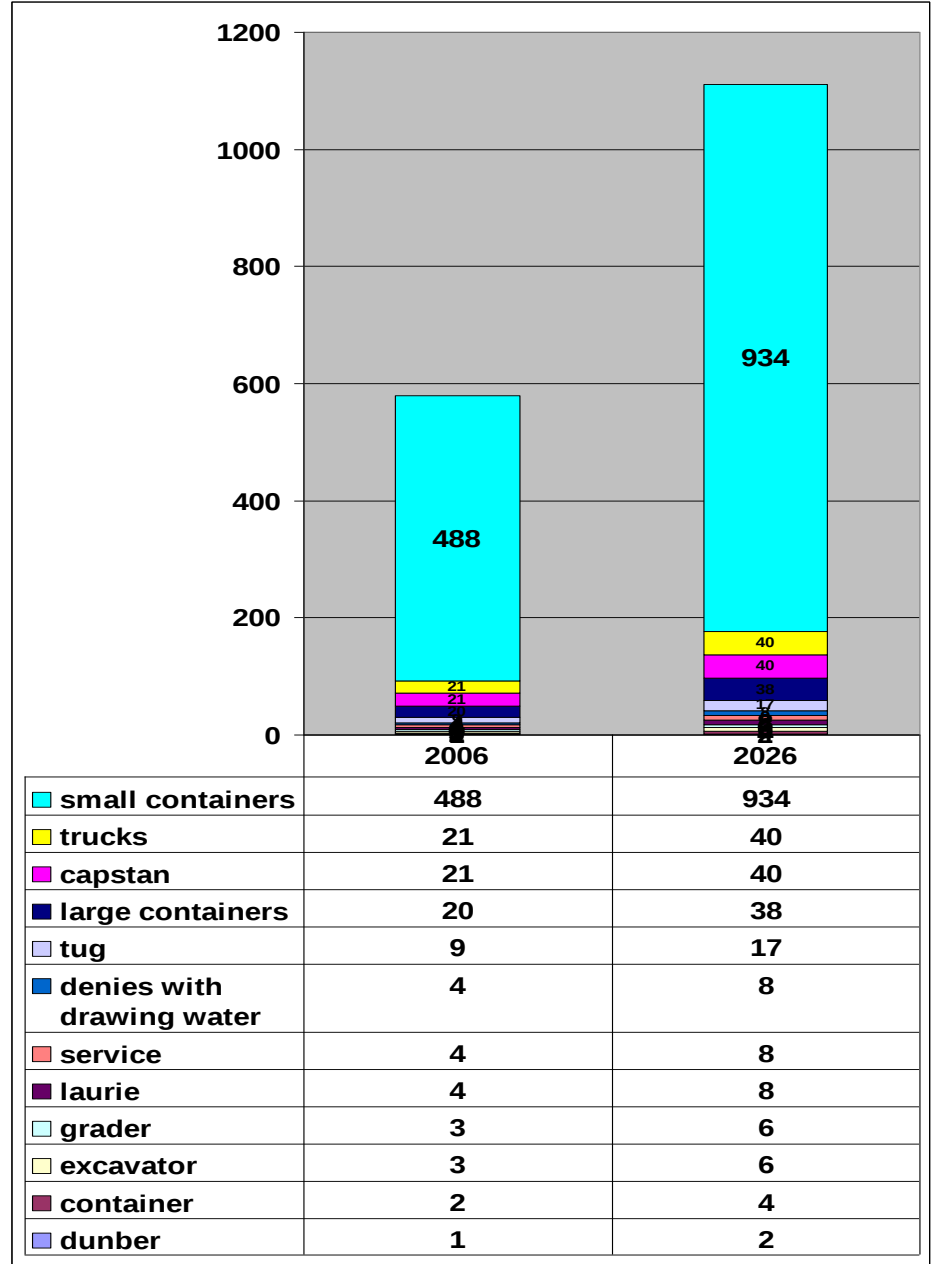


Fig (2) shows the different types of supplies/machines for the base year (2006) and the goal year (2026)

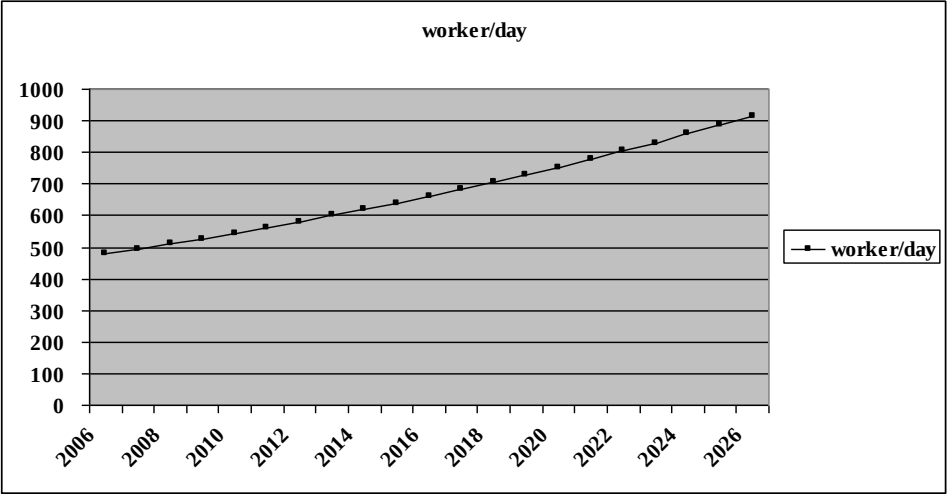


Fig (3) shows an increase in the number of workers from the base year (2006) until goal year (2026)

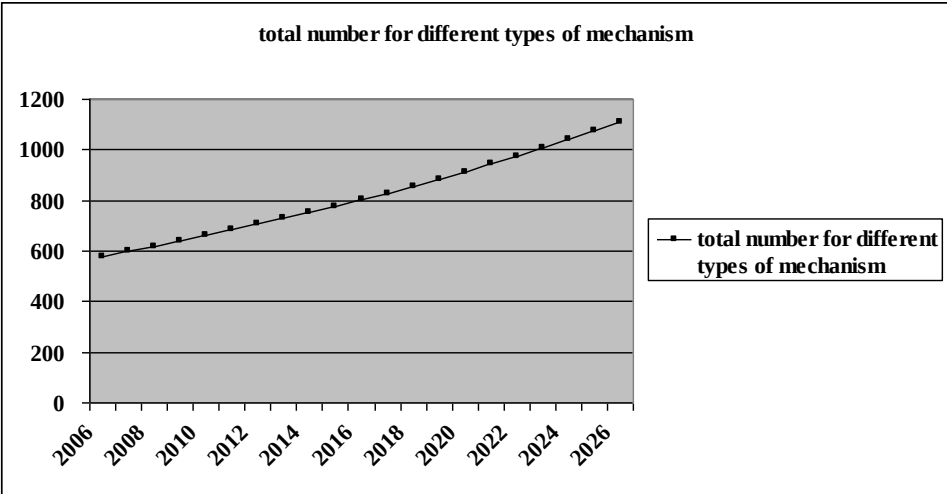


Fig (4) shows the increase in the number of different supplies/machines of the base year (2006) until goal year (2026)

Fourth: The Required Environmental Management Policies:

The decision came on what is stated in paragraphs Previous, it can use two types of environmental policies for the management of solid waste in AL-Musayib for the future, as follows:

a – Use Hierarchy of Different Methods of Dealing with Solid Wastes generated (McDougall, 2002):

- 1-Method of Waste Prevention
- 2-Method of Reduce waste Minimization
- 3-Method of Reuse
- 4-Method of recycling
- 5-Method of Energy Recover
- 6-Method of Landfill or Disposal

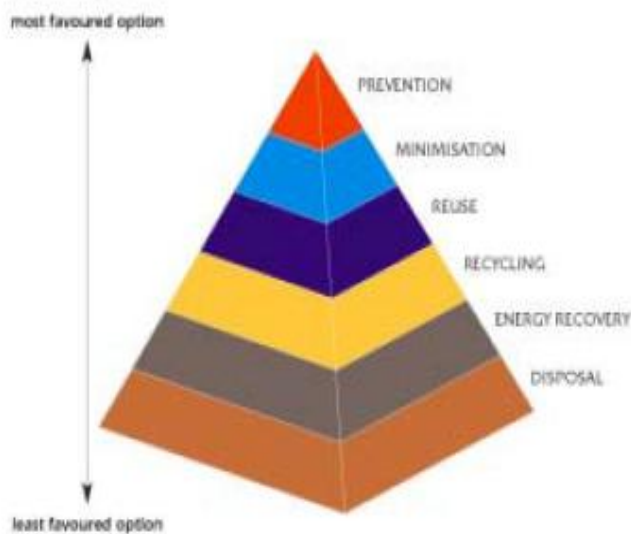


Fig (5) shows the hierarchy of different ways of dealing with solid waste generated

b - The Integrated Management of Solid Wastes:

This method can be illustrated by Figure No. (6), as follows:
That the material involved have yet human consumption, may be remnants of Solid Wastes or in the form of Energy or Other materials (Wilson, etc. 2001)

↑ By using biological treatment or by using thermal treatment or may re-use of new materials into a Secondary or New products being processed or thermally or buried in the earth into a Fertilizer or used it in the form of Useful energy (Jeffrey, Ruth, 1997) And may be caused by solid waste Emissions in the air or water or in the form of Rigid materials not be used (WHO, 1968)

↑ All these operations were done in an Integrated system (McDougall, 2001)

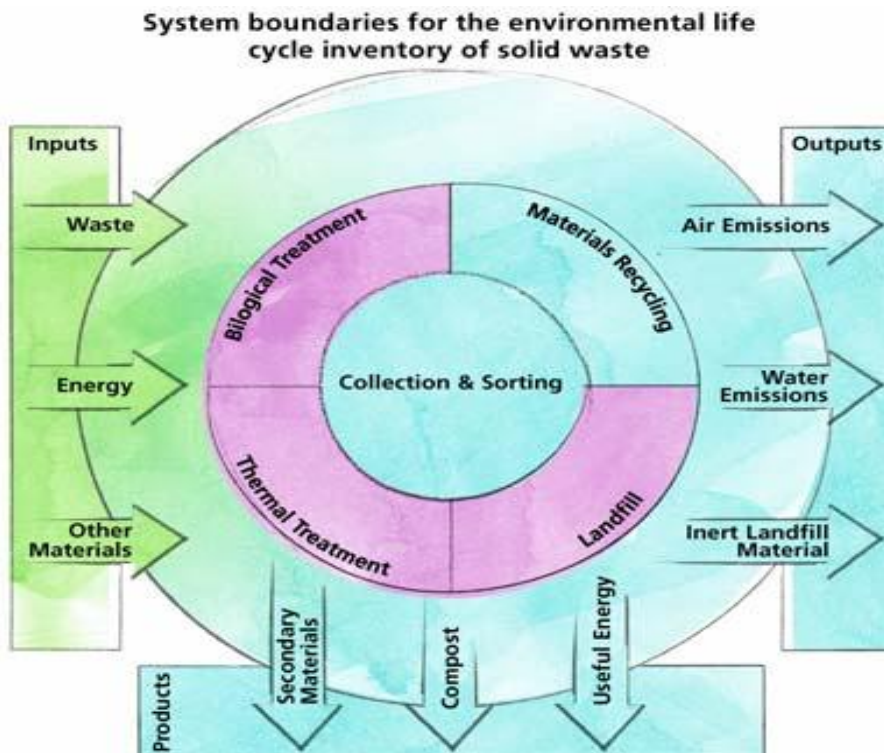


Fig (6) explains how to use the integrated management of solid waste

Fifth: Conclusions and Recommendations:

a)Conclusions:

It may be obvious to conclude that:

1) The rate of generation of the solid wastes in Qadaa AL-Musayyib limits 0.73kg / person / day which less than the global average estimated by the World Health Organization (WHO), that is estimated at 1.6 kg / person / day.

2) The Logarithmic relationship between population size and the amount of solid waste generated was as follows:

$$Y = 1532.Ln(x) - 19206$$

$$R^2 = 0.969$$

3)The estimated population size Qadaa AL-Musayyib in 2026 Limits (622259) people.

4) The estimated solid waste was generated in Qadaa AL-Musayyib to the limits in 2026 (1232.58) tons / day.

5) In the case of continuing use of the landfill method of dealing with solid waste, workers and different supplies/machines be required to manage solid waste in Qadaa AL-Musayyib in 2026 are as shown in the following table:

Year	population	quantity of waste Tons / day	number of workers	number of different supplies/machines
2026	622259	1232.58	915	3007

b)Recommendations:

1-It may be useful to recommend using different ways to manage solid waste, especially the way the integrated management of solid waste in addition to the attention of environmental awareness among the citizens, which will help to use methods of order and healthy in the management of such waste, and facilitate

the process of environmental planning and management of the Qadaa.

2-It may also be useful to recommend detailed studies on the quality of waste generated and its relationship to the level of income.

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الخلاصة :

يتضمن هذا البحث ،القيام بتقدير كمية المخلفات الصلبة المتولدة في مدن قضاء المسيب لعام 2026 اعتمادا على عامل حجم السكان (المولد الرئيسي للمخلفات) وذلك ضمن متطلبات التخطيط والإدارة البيئية في القضاء.حيث تم دراسة العلاقة بين حجم السكان وكمية المخلفات الصلبة المتولدة للسنوات السابقة 2004 ، 2005 ، 2006 وبالتالي إيجاد العلاقة التي تربط بين المتغيرين (حجم السكان وكمية المخلفات الصلبة) وهي علاقة لوغاريتمية لاستخدامها في تقدير كمية المخلفات الصلبة لسنة الهدف 2026 ،وبناء على ذلك تم التوصية بسياسات الإدارة البيئية المطلوبة .