

The problem of Municipal solid waste management in Algeria

إشكالية تسيير النفايات البلدية الصلبة في الجزائر

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Received: 31/8/2020

Accepted: 26/10/2020

Published: 15/1/2021

Abstract:(Not more than 10 lines) (size-12; Interline 1,15)

This study aims to shed light on the management of municipal solid waste in Algeria. As this sector knows many managerial problems, which lead to negative repercussions on the environment and public health in addition to wasting reusable and recyclable resources. The sector data, which is collected by the competent Ministry of Environment departments, is exploited at the level of 48 wilayas. The results show that there is a variation in the percentage of waste generation, as it is recorded that the southernmost regions are the least waste generation, in addition to the almost total dependence on the mechanism of technical waste filling.

Keywords: Municipal solid waste, waste generation, waste management, Algeria.

Jel Classification CodesQ01؛Q53

ملخص: تهدف هذه الدراسة إلى تسليط الضوء على مجال تسيير النفايات البلدية الصلبة في الجزائر. يعرف هذا القطاع مشاكل كثيرة في التسيير الأمر الذي أدى إلى انعكاسات سلبية على البيئة والصحة العمومية إضافة إلى هدر الموارد القابلة لإعادة الاستعمال والتدوير. تم استغلال معطيات القطاع على مستوى 48 ولاية التي تم جمعها لدى مصالح وزارة البيئة المختصة. تبين النتائج وجود تباين في نسبة توليد النفايات حيث تم تسجيل أن ولايات أقصى الجنوب هي الأقل توليدا للنفايات، إضافة إلى الاعتماد شبه الكلي على آلية الردم التقني للنفايات.

كلمات مفتاحية: النفايات البلدية الصلبة، توليد النفايات، تسيير النفايات، الجزائر.

تصنيف JEL : Q01؛Q53

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1.INTRODUCTION:

The world today is witnessing an increasing interest in the environment and the balance of its systems, so conferences are held to protect it from the specter of pollution and environmental degradation. Perhaps the most important risk is the excretion of the piles of waste that are disposed of daily in random discharges that are not prepared for this purpose. A study by the UNEP Governing Council (Monaco session) estimated that in 2004, the total household solid waste generated worldwide reached 1.84 billion tons, which is a 7% increase from the total in 2003.

These accumulated and growing daily waste, which is the result of a linear economy dependent on product consumption and disposal, which is of course unsustainable in a world whose slogan and orientation is the adoption of sustainable development, and sustainable solutions that preserve the environment and aim to change the way we live By reducing waste, preserving the environment and resources for future generations, in addition to reducing pressure on the environment and its protection.

The problem of managing solid waste in the urban areas must be seen in the wider context of problems caused by rapid urbanization, in Africa a growing number of cities face the challenge to provide their populations with adequate water supply, sanitation and solid waste services, because of the rapid rate of the urbanization process, United Nations projections estimate that the urbanization rate will increase from 24% in 2005 to 38% by 2030(Aisa Oberlin Solomon, 2011, p17).¹

Algeria, like other countries, has updated its laws and provided the necessary means to protect its environment from pollution by waste in general and solid municipal waste in particular, by adopting a national strategy to protect the environment within the framework of sustainable development, whether by eliminating random discharges of waste and building technical landfill centers.

First: the problem

There are many countries in the world that have made important strides in the field of municipal solid waste management and have taken the lead in preserving the environment, but at the Arab level, the process is still in its beginning, and among them Algeria, which is still dealing with this type of waste by means of technical backfill at the level of its conditions, except for Some centers which are working on sorting waste for recycle purposes, which is what we will address in this study, and shed light on the reality of managing solid municipal waste in Algeria.

In light of this, the problem is put into the following question:

What is the reality of municipal solid waste management in Algeria, and what are the prospects for this sector?

Second: the hypotheses

1. Municipal solid waste represents the household waste that is collected at the municipal level, in addition to similar waste.
2. Garbage recycling is the most important way to protect the environment from waste pollution.
3. The rate of waste generated by the Algerian individual is equal in all parts of the country.
4. Algeria adopts the best safe and sound methods for treating its waste

Third: the importance of the study

The issue is considered one of the new sensitive topics in the economic and environmental field. The waste sector is considered as one of the important sectors that deserves more attention, as it would develop environmental awareness among the urban citizen as the basic building block in the construction of an urban society. Economically speaking, the valuation of waste and its re-exploitation is an important source of providing the raw material, in addition to contributing to the national income.

Fourthly: research objectives

This research aims to shed light on the municipal solid waste sector in Algeria by studying and analyzing its reality, starting from the stage of its generation to the final treatment.

Fifth: methodology

The study relies on the descriptive and analytical approach, which enables an understanding of the problem, its causes, and the various possible ways to address.

2. Theoretical framework for municipal solid waste

2.1. Definition of waste and municipal solid waste:

According to the United Nations Environment Program ‘Wastes’ are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law (Stephen Burnley, 2014, p9).²

waste in the wider meaning of the term: the emission of pollutants as a result of energy usage related to production and consumption which waste is responsible(FumikazuYoshida,2002,p1).³

As for **municipal solid waste** which is mainly produced by households, though similar wastes from sources such as commerce, offices and public institutions are included. The amount of municipal waste generated consists of waste collected by or on behalf of municipal authorities and disposed of through the waste management system(EEA,2013,p7).⁴

2.2.Solid municipal waste in Algerian legislation:

The Algerian legislature defines **waste** in general as all the residues resulting from the processes of production, transformation or use, and more generally every material or product and every movable that the owner or possessor disposes of, or is required to dispose of or remove it(Law No. 01-19).⁵

As for **municipal solid waste**, it is termed as “household waste” and the like, i.e. similar waste that has the same characteristics and components, that is to conclude that municipal solid waste is household waste, in addition to its equivalent of waste that has the same components; physical and chemical characteristics, whether industrial or commercial. which are collected by the municipalities or at their order, and are treated with the same methods and mechanisms.

2.3.Types of waste in the Algerian legislation:

The types of waste differ according to their source, their physical and chemical properties, their size, their danger ... etc., and the Algerian legislature has divided it into(Law No. 01-19):⁶

❖ household and assimilated waste

It is all the waste resulting from household activities, and the similar waste resulting from industrial, commercial, craft and other activities, which by its nature and components are similar to household waste.

❖ Bulky waste:

All waste resulting from household activities, which due to their huge size, cannot be collected with household waste and the like.

❖ Special waste:

All waste resulting from industrial, agricultural, therapeutic activities, services and all other actions, which, due to their nature and the components of the

materials they contain, cannot be collected, transported and treated under the same conditions with household waste and the like and inert waste where a national plan is established for its management by a committee headed by the minister in charge of the environment or his representative for a period of 10 years, and can be reviewed whenever circumstances require, based on a proposal from the Minister in charge of the Environment or at the request of most of the members of the committee in charge of preparing the national plan for the management of private waste(Article 10 of Executive Decree No. 03-477).⁷

2.4.The life span of the waste:

The survival time of waste (that is, before its decomposition) varies according to the quality of each material and its chemical and physical properties, and the following table shows the life time of some waste materials that are left in nature without treatment or proper disposal.

Table 1. The life span of some waste components that are left untreated

Material (waste)	Average life span (before final decomposition)
Paper and newspapers	3-12 months
Matchstick (sulfur)	6 months
Aluminum products	200-500 years
Plastic bag	450 years old
Telephone card (payment card)	1,000 years

Source: AzimiDalal, SaeediWafa (June 2017), p 869, in Arabic

3. Methods and mechanisms of waste management in Algeria

Waste management is defined as the collection, transportation, processing, treatment, recycling or disposal, and monitoring of waste materials, and the term usually relates to materials produced by human activity and is generally undertaken to reduce their effect on health, the environment, or aesthetic. Solid waste is known as the third polluter after air and water pollution, and it consists of highly heterogeneous mass of discarded materials from the urban community(ZainulAkmar Zakaria,2018,p5).⁸

The success of management methods that are based on waste reduction, separate collection, reuse and recycling, depends largely on the contributions of citizens and families, and one of the most important scientific techniques in order to benefit and dispose of the waste presented at the level of the urban environment which is collected and classified, The valuation of these wastes in three ways, which is either physical valuation (recovery of materials, paper, and plastic) or biological valuation (production of organic fertilizers that are used in agriculture) or energy valuation (by burning waste and utilizing the thermal energy resulting from burn), which passes through several stages. Which are:

- **The process of collecting and transporting waste**

The waste collection process is the first link, so that the collection process is done by reaching the sources and sources of production and generation of waste, which may be in the following places: Production factories; Educational and educational institutions; Universities; Hospitals; Hotels; Vegetable and fruit markets; Platforms; Houses ... etc(Al-Qinai Abdel-Haq,2016,p445),⁹ and the collection process takes place in containers and bins, which are fixed or mobile, designated in specific places or by bags. The garbage is lifted and transported by agencies and institutions in charge by means of automatic compressor trucks or by ordinary trucks.

- **Screening process**

The sorting process aims to exploit the materials that can be utilized. Also, the materials that have been previously sorted at the source are re-sorted to separate the paper from cardboard and metal boxes into tin and aluminum, then the sorted materials are pressed to separate the size, and the sorted materials can also be chopped into small pieces with choppers and crushers.

- **Recycling process**

It is the recycling of waste. After sorting the waste, each according to its nature, compressing plastic bottles and cardboard, and collecting glass and aluminum, it is directed to the factories for the process of recycle (extracting new products from old materials), meaning that the waste takes the place of the raw material.

- **Final disposal process**

It is the last stage of waste management, through which we can get rid of waste that cannot be reused or recycled, and it is disposed of directly and directed to the technical backfill.

3.1. Institutional framework for waste management in Algeria:

The Ministry of Interior, through local (municipal) groups, is responsible for the field and operational management of waste in addition to the financial coverage for this process, which is obliged to establish a municipal waste management plan, and prepared by the head of the Municipal Council, which must include all the municipality's territory . Algeria has also established, at the level of each state, public institutions tasked with treating waste, which includes technical landfill centers, sorting centers, and controlled dumpers, whose board of directors is presided over by the state governor, and the Ministry of Environment and Renewable Energies through the concerned institutions (the National Agency for Waste It was established by decree 02-175 of May 20, 2002, and it is a public institution of an industrial and commercial nature, whose tasks include providing assistance to local groups in the field of waste management, processing data and information on waste, and establishing and updating a national bank of information on waste.) And its public administrations (state environmental directorates), provide the necessary technical support for this process.

3.2. The legal framework for waste management in Algeria:

Law No. 01-19 related to waste management, control and removal is considered a starting point for the new policy of waste management in Algeria, by eliminating random dumps scattered across the national territory and moving towards controlled dumps and technical landfill centers, in addition to organizing the collection, transportation and treatment of waste in Algeria. Conditions that preserve the cleanliness of the environment, as this law is based on five principles(Article 2 of Law 19-01):¹⁰

- Prevention and reduction of waste production and damage at the source.
- Organize waste sorting, collection, transportation and treatment.
- Valuation of waste by re-using it, or recycle it, or in every way that enables the use of those wastes to obtain reusable materials or obtain cleanliness.
- Environmental rational treatment of waste.
- Informing and sensitizing citizens about the dangers arising from waste and its effects on health and the environment.

3.3. National programs and policies in the field of waste management:

A. The National Program for Integrated Waste Management (PROGRAM):

Which aims to(AND,2015,p13):¹¹

- Strengthening the capacities to collect and transfer municipal services;
- Opening a public waste management service to private investment;
- Implementation of a training and technical assistance program;
- Placement of collection equipment.

B. The new national strategy for integrated waste management:

As part of improving the living environment and preserving the resource, a national strategy for integrated waste management was developed and evaluated in the year 2035 (SNGID 2035) strategy, in which representatives of ministries, states, municipalities, the private sector, civil society, media and representatives of the United Nations system contributed.

This project, which is co-financed by the European Union for the benefit of the Ministry of Environment and Renewable Energies represented in the (Environmental Sector Policy Support Program), aims to develop a national strategy to enhance the economic potential of waste, especially through screening, recycling and waste recovery.

Which aims to(<http://www.meer.gov.dz>):¹²

Objective 1 - prevent waste

Objective 2 - encourage selective screening

Objective 3 - reduce the health and environmental risks of final waste

Objective 4 - apply the polluter pays principle

Objective 5 - Enhance the role of the private sector

3.4. Prospects for waste management in Algeria:

The most important results expected in the horizon of 2035 are(<http://www.meer.gov.dz>):¹³

1. Reduce waste generation by 10%.
2. Valuation of waste: Contribution to the national economy in the amount of 80 billion dinars.
3. Disposal of land dumps: disposal by 2024.

4. Increase private sector participation: a potential public-private partnership of 54 billion dinars.
5. Job creation: 100,000 jobs (30,000 direct and 70,000 indirect).
6. Environmental gains: Reducing net greenhouse gas emissions per year from 45 million tons, equivalent to 150 billion \$.

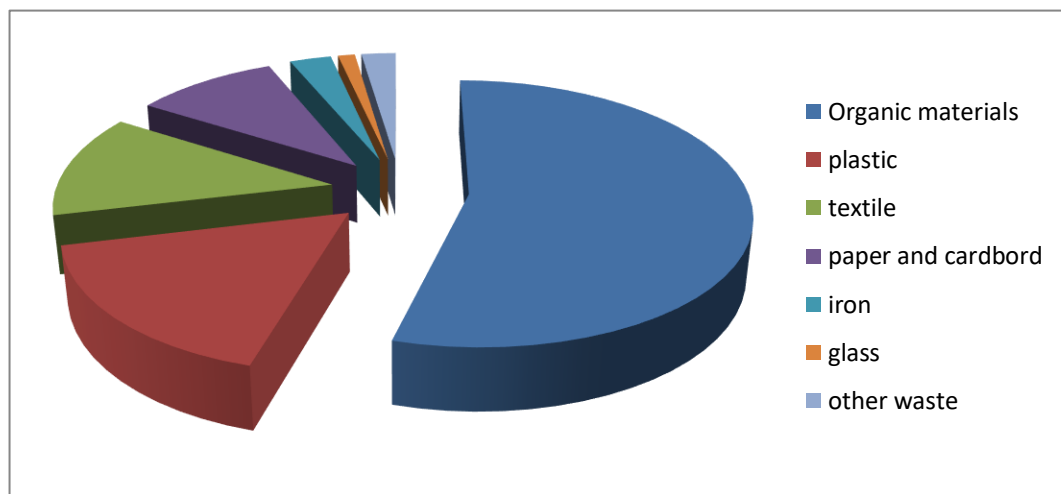
3. Results and discussion

The exploitation of the data base of the National Waste Agency made it possible to conclude several observations about the components of municipal solid waste and what is related to the production of waste per capita, as well as the methods of treating these wastes through their evaluation (recycle) or technical backfilling.

3.1.The components of municipal solid waste in Algeria:

The diversity and abundance of waste allowed thinking about identifying the prevailing components in municipal solid waste in order to search for ways of recycling and exploitation, or to search for export opportunities. The components of municipal solid waste in Algeria can be illustrated in the following figure:

Fig.1.The components of municipal solid waste in Algeria during the year 2018



Source:Prepared by researchers, using data from the National Waste Agency

In the latest statistics for the year 2018 of the National Waste Agency, the components of household waste were more than half of the organic materials, reaching 54.40%, plastic by 16.88%, textile by 12.62%, paper and cardboard by 9.75%, iron by 9.75%. 2.84%, glass by 1.16%, and other waste by 2.35%

3.2. Generating municipal solid waste in Algeria:

As local studies confirmed in 2018 that the percentage of municipal solid waste production in Algeria amounted to more than 13 million tons, while it was estimated that the per capita generation of waste per day was 0.85 kg, but this percentage remained different from one state to another, so we find the states in the far south of the per capita generation Per day, do not exceed 0.5 kg, and this is what we explain in the following table

Table 2. Generating municipal solid waste in the southern states

the states	Ratio (kg / person / day)	2014		2015		2016	
		Quantity produced (tons)	Quantity collected (tons)	Quantity produced (tons)	Quantity collected (tons)	Quantity produced (tons)	Quantity collected (tons)
ADRAR	0.5	85 518	11 213	87 860	10 740	90 279	14 228
TESSEMSILT	0.5	37 744	8 464	38 758	10 308	39 803	10 617
ILISI	0.5	12 454	28 880	13 020	-	13 614	30 613
TENDOUF	0.5	12 921	11 152	13 732	17 259	14 593	-
ELOUED	0.5	138 078	32 113	141 742	40 656	145 514	46 046
NAAMA	0.5	47 099	28 455	49 621	31 636	52 342	31 906

Source: Prepared by researchers, based on 2017 data from the National Waste Agency.

A descriptive analysis of the statistical data shows that the states of the South in general have a moderate rate of waste generation per capita, which we may refer to the consumption behavior of the population of the region in addition to the vastness of the ocean, as it is known that the local population in these areas

provides many daily requirements of self-production, whether It is related to agricultural products or sheep raising and milk production due to the distance between the regions and the difficulty of investing in them.

The states of Adrar, Tamanrasset, Illizi, Tindouf, El oued, and Naama are the states where the waste generation rate does not exceed 0.5 kg per capita per day.

Table 2.Generating municipal solid waste in the northern states

the states	Ratio (kg / person / day)	2014		2015		2016	
		Quantity produced (tons)	Quantity collected (tons)	Quantity produced (tons)	Quantity collected (tons)	Quantity produced (tons)	Quantity collected (tons)
ALGERS	0,95	1 178 774	993 222	1 207 530	995 708	1 237 874	997 493
SETIF	0,85	503 028	160 199	510 389	174 624	517 922	189 341
ANNABA	0,85	199 893	202 855	201 771	204 044	203 673	199 965
ORAN	0,85	521 188	360 359	535 445	376 905	550 549	442 353

Source: Prepared by researchers, based on 2017 data from the National Waste Agency.

While Algiers remains the only state where the per capita generation of waste per day reached 0.95%, a rate that is considered high if compared to other states, each of the states of Setif, Annaba, and Oran has reached a daily per capita generation rate of 0.85%.

The differences between states can be attributed to the degree of urbanization, population density in addition to the high standard of living in addition to consumption behavior and food footprint. These behaviours contribute greatly to tarnishing the image of cities, and the decline in conditions of hygiene and a healthy life in them.

3.2. Treatment of municipal solid waste in Algeria:

The management of municipal solid waste in Algeria has witnessed a remarkable development in recent years, and this has been since the issuance of the United Nations Millennium Program for the Environment and Sustainable Development, and the waste management process in Algeria can be divided into two stages:

Before 2002

After the launch of the integrated waste management program in 2002, the municipal solid waste management sector knew a rupture with previous practices, which were characterized by the spread of random discharges at the level of all states of the country.

After 2002

After Algeria adopted the Millennium Program for Environment and Sustainable Development, it moved from waste incineration to technical backfilling, and it was the first center built in 2003, and the government continued its efforts, as in 2018 the number reached 95 centers.

Despite this development made by the authorities in the construction of these centers, there are many landfill ponds that are known to be closed due to filling them before the specified deadlines, in addition to the absence of the majority of the basins for treatment plants for the sap produced by the waste, which causes an environmental disaster.

Algeria also counts 8 sorting centers nationally level. This small number did not encourage the development of the Recycling process, which does not exceed 7%.

4. CONCLUSION:

The municipal solid waste management sector in Algeria has undergone a major transformation in the last two decades. After the spread of random discharges and random disposal of waste by incineration, the government moved to safe technical backfill operations, in order to ensure a safe environment and in line with the United Nations development goals. Sustainable, and perhaps the most important results that were reached:

- That municipal solid waste includes both household and its equivalent waste, whether by components or characteristics. It is collected at the level the municipality. Recycling is not the best way to get rid of waste and protect the environment from pollution, so we find that the process of reuse is better than the process of recycling.
- There is a variation in the percentage of waste generation per capita between the different states of the country.
- Algeria depends on the method of technical dumping of waste in addition to incineration, but the process remains modest despite the financial wealth that the country has known since the beginning of the millennium.
- The study of waste-related behaviors and their understanding has become increasingly relevant in the field of waste management.

It is also possible to suggest a set of recommendations:

- ✚ Raising environmental awareness among the citizen through schools, mosques, universities, societies and clubs, in order to reduce the amount of waste from the source in addition to participating in the management process through selective sorting.
- ✚ Reviving a circular economy, especially the added value that this sector brings, which is an important source of wealth creation.
- ✚ Benefiting from the pioneering international experiences in this field, in order to reduce the risks of environmental degradation, like Germany and Sweden.

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⁶Law No. 01-19, passed on 27 Ramadan 1422 corresponding to 12 December 2001, related to **waste management, control and management**.

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¹⁰Article 2 of Law 19-01 issued on December 12, 2001 related to **waste management, control and removal**.

¹¹Characterization of household and similar waste in the northern, semi-arid and arid areas of Algeria 2014, AND Report, Algiers 2015, p13.

¹²The official website of the Ministry of Environment, <http://www.meer.gov.dz>, consulted on 01/05/2020.

¹³The official website of the Ministry of Environment, <http://www.meer.gov.dz>, consulted on 01/05/2020.