

Household Waste Management Challenges

The Case of M'sila, Algeria

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Abstract—Household waste and uncontrolled urbanization management are considered major problems in African countries. In the Hodna region, the phenomenon seems to be more important in urban centers because of the huge amount of household waste generated by domestic and commercial activities. In most Algerian cities, solid waste is piled up in huge quantities in dumps and is dumped indiscriminately in waterways and public spaces. Uncontrolled urbanization, industrial development, and the evolution of lifestyle lead to increased production of waste, whereas the waste management techniques used in urban areas should be reconsidered. From this perspective, this paper studies and analyses in a spatio-temporal approach, the practices of household waste management in the city of M'sila in order to evaluate the state of such management and identify the key elements of integrated planning of waste management.

Keywords—M'sila; household waste; environment; urbanization; living environment

I. INTRODUCTION

All Algerian cities are undergoing an accelerated urbanization process [1]. The strong demographic growth and the economic, social, and political upheavals directly impact the constantly increasing volume of household waste produced daily [2]. These problems common to all the Algerian cities, are characterized by uncontrolled urbanization, i.e. poor functioning of public services following a strong urbanization (organized or informal) consuming space, and with the lack of materials and human means, this leads to difficulties of waste management (transport, collection, elimination) [1, 5]. The authorities have difficulty in containing and eliminating waste, as evidenced by the spectacle of garbage covering the roadsides and the piling up of waste in illegal dumps [4]. According to a survey conducted by the Ministry of Land Management and Environment services, more than 3000 illegal dumps have been identified. Waste management remains one of the weak stages of Algeria's urban management and urban services [5, 6]. All

urban actors must be involved, first the population, then the municipality, and finally the State to solve the waste problem. However, when it comes to the environment, specifically waste management, it is a matter of using existing management methods and responding to increasingly complex issues by constantly reinventing them. In addition, there are limitations to the national waste disposal policy. This policy remains fundamentally archaic and is characterized by the inefficiency of public intervention [6]. Indeed, the operational strategy of waste management is limited only to the collection, transport, and dumping. So far, this strategy lacks any complementary disposal and treatment structure [6]. The material and human resources of collection companies must be adapted to the rate of population growth. It is necessary to organize landfills in order to overcome the problem of saturation, and finally, it is necessary to revalorize the waste for possible reuse [7]. The research that has been done so far on household waste in M'sila remains insufficient. Generally speaking, the available literature on household waste focuses on the technical and organizational aspects of the public waste service and the threats posed by waste. However, there are themes in recovery/recycling that need to be explored in greater depth in order to understand better the multiple facets of waste in M'sila. Thus, this paper presents an inventory of waste management in M'sila. In particular, this study aims to contribute to the problem of solid waste management for better strategies to fight against insalubrity in urban areas [8].

II. WASTE DEFINITION ACCORDING TO THE ALGERIAN REGULATIONS

Waste consists of three main categories [8, 14-15]: household and similar waste, special waste (industrial, agricultural, care, services, etc.), and inert waste. The definition of the different types of waste and treatment methods may vary from one country to another [8]. According to the regulations in force, household waste is defined by Article 2 of Decree No. 84-378 of December 15, 1984, setting the conditions for

cleaning and removing household waste, which are domestic waste and assimilable by nature volume. It is in particular:

- Industrial or collective household waste.
- Products resulting from cleaning such as sweeping, sewer cleaning.
- Bulky waste, bulky objects, scrap metal, rubble, etc.
- Anatomical or infectious waste from hospitals, chemical or other care facilities.
- Slaughterhouse waste and offal.
- Commercial waste, packaging, and other residues generated by commercial activities.

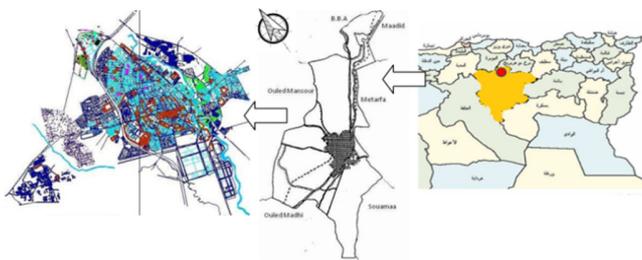


Fig. 1. Location of the city of M'sila in its regional context.

III. SOURCES AND METHODS

The methodology adopted is based on literature research and field surveys. The documentary literature review allowed us to consult memoirs, books, theses, and articles in libraries and on the internet. It allowed us to have information concerning the urban dynamics and the waste management plan. The field observation allowed us to discover the garbage deposits, the state of the environment, the infrastructures, and the urban space's evolution. Simple field observation indicates a low collection rate of 152 tons/inhabitant of solid waste produced in the commune of M'sila [26]. The questionnaire was administered on 3 samples in 3 different sectors (collective housing, individual housing "allotment", and traditional housing). In addition to the residential areas, there are also predominantly commercial areas. The method of the household waste characterization was carried out in applying the sampling protocol in respect of the standards NF X30-408 and NF X30-413 relating to the characterization of waste (sampling and sorting). CARADEME is the new guide introduced by ADEME (French Environment and Energy Management Agency) for local campaigns of household waste characterization [11-13].

A. The Study Area

A medium-sized city, M'sila is located on the northern edge of the steppe of the Hodna region. It is located 250km from the capital Algiers, covering an area of 233km² having 224,991 inhabitants [27]. It is characterized by a strategic geographical position. Crossed by the RN40 (connecting M'sila to Batna, Biskra, and Setif), the RN60 (connecting M'sila to Algiers), and the RN45 (connecting M'sila to BordjBou-Argeridj and Bou-Saada), it is an ideal crossroads connecting the North of

the country to the South and the East to the West. It is limited, in the North by the commune of El Ache (Wilaya of Bordj-Bou-Argeridj), in the South by the commune of Ouled Madhi, in the East by the commune of Metarfa, and in the West by the commune of Ouled Mansour.

B. Situation of Waste Management in Algeria

In Algeria, waste management is carried out by public service, the National Program for the Integrated Management of Household Waste (Programme national pour la gestion intégrée des déchets ménagers, PROGDEM), and by the National Waste Agency (Agence Nationale des Déchets, AND) created by Executive Decree No. 02-175 of May 20, 2002 [9]. The NGOs working in Algeria on the management of DSU are grouped in an association called Coordination des entreprises de gestion des déchets (CEGED). The public administration supports the CEGED's actions, which requires inhabitants to join to get rid of DSU [6, 9]. Since the Johannesburg Summit in 2002, Algeria has intensified its environmental protection and sustainable development actions, thus giving a prominent place to social and ecological aspects in its choice of society model. The Algerian Government has implemented a National Strategy for the Environment and a National Action Plan for the Environment and Sustainable Development (Stratégie Nationale de l'Environnement et un Plan National d'actions pour l'environnement et le développement durable, PNAE-DD) which:

- Involves all the ministries and decentralized services, local authorities, and civil society, whose role is to be a force for proposals;
- Aims to integrate environmental sustainability into the country's development strategy (to induce sustainable growth and reduce poverty);
- Puts in place effective public policies to address the environmental externalities of growth connected to activities increasingly initiated by the private sector. This strategy, whose main objectives are: improving health and quality of life, conserving and improving the productivity of natural capital, reducing economic losses and improving competitiveness, and protecting the regional and global environment, has resulted in: the development of the legislative and regulatory framework, institutional capacity building, and the introduction of economic and financial instruments, and the mobilization of significant investments, through the start-up of the first environmental projects, to halt the degradation of the environment and even reverse certain negative trends observed.

The law 01-19 of December 12, 2001, relating to the management, the control, and the elimination of waste constitutes in this respect the starting point and the reference of this new strategy. Thus, two particular programs which constitute the continuation of this law are carried out and have obtained encouraging results:

- PROGDEM (National Program of Municipal Waste Management).

- PNAGDES (Plan National de Gestion des Déchets Spéciaux, National Plan for Special Waste Management).

These programs are characterized in particular by the elaboration, in collaboration with the authorities and local communities, of master plans of integrated management and treatment of waste, and the realization of concrete projects and adapted to the local specificities, like the realization of the Technical Landfill Centers (Centres d'Enfouissement Technique, CET).

C. Evaluation of the Household Waste Management Process

Waste management in all its ramifications is simply a planned system to effectively control the generation, storage, collection, transportation, treatment, and disposal of waste. Waste management is an important element of environmental protection. Its purpose is to provide a hygienic, economical, and efficient solid waste storage, collection, transportation, and treatment or disposal without polluting the atmosphere, soil, or water. The various stages of solid waste management, from generation to sanitary disposal, are considered a solid waste chain. So, the solid waste chain is the pathway through the solid waste from generation to the point of final disposal [3, 5-6].

D. Current Household Waste Management in M'sila

Municipal waste management is generally organized in 3 sectors [8]: the public sector, which has responsibility for monitoring and enforcing the provisions of certain urban services including solid waste management, the formal private sector engaged in waste management, including collection and recycling, and the informal private sector engaged in the reuse of certain types of waste [10, 21, 23].

1) Public Sector

a) At the National Level

The Ministry of Land Management and Environment (MATE) has primary the responsibility for national environmental policy. It was created at the end of the 1980s with a name that varied over time. In the 1970s, the environmental task was attached to the Ministry of Hydraulics and then to the Secretariat of State for Forestry. The Law on Waste Management, Control, and Disposal provides for the creation of three intermediate national bodies:

- AND was created by Executive Decree No. 02-175 of May 20, 2002, and placed under the supervision of the MATE. It provides an adequate instrument to assist local authorities in implementing the national waste policy.
- The National Observatory for the Environment and Sustainable Development (Observatoire national de l'environnement et du développement durable, ONEDD) was created on April 3, 2002. It is a public establishment of an industrial and commercial nature (EPIC), with legal personality and financial autonomy.
- The National Conservatory for Environmental Training (Conservatoire national des formations à l'environnement, CNFE) was created in August 2002. It has the status of EPIC and has two main missions: the training of various

public or private actors in the field of the environment, and environmental education for the public, especially schools.

b) At the Regional Level

At the regional level, the local public service of waste management is under the responsibility of:

- The Regional Environmental Inspectorates (Inspections Régionales de l'Environnement) are decentralized bodies of the State, founded by the Decree No. 88-227 of November 5, 1988 [29]. They were created on the power, organization, and functioning of the bodies of inspectors responsible for environmental protection. The mission of these inspectorates is to ensure compliance with the legislation and regulations in environmental protection to note and investigate violations in this area. At the level of the wilayas, the State has created decentralized services in charge of the environment.
- The Wilaya Environmental Departments (Directions de l'Environnement de Wilaya, DEW), were created by the Executive Decree No. 96-60 of January 27, 1996 [30], and succeeded the 15 wilaya environmental inspectorates. The wilaya directorates have 3 main areas of activity: coordination, control, and information. Coordination requires good communication and organization between the bodies of the State, the wilayas, and the communes to establish an environmental protection program for the entire territory and take measures to prevent all forms of environmental degradation (pollution, nuisances, soil erosion, etc.).

c) At the Local Level

The local level in this study refers to two structures responsible for local waste services: the communes and the groupings of communes. Article 7 of the communal code provides that the commune is responsible for preserving hygiene and public health, particularly the evacuation and treatment of wastewater and household waste.

2) Private Sector

Private sector participation in solid waste management in Algeria is very limited. The 2001 law made municipal waste management public service available to private investment and concessions to promote this participation.

3) Informal Sector

The third sector involved in waste recovery in Algeria is the informal sector, which constitutes an important economic activity. It is relatively structured in two dimensions: the first is vertical from the recovery in garbage cans and landfills to the recycling industry, and the second is horizontal and based on channels by the type of recovered waste (paper, plastic, metals). This sector allows to:

- valorize a large amount of waste,
- reduce transportation and collection costs for communities,
- provide income to many people,
- increase the capacity of landfills,

- ensure the raw material for some companies,
- situation of the pre-collection of waste.

IV. MODE OF COLLECTION, DELIMITATION, AND WASTE TREATMENT

Is provided mainly by the CET of M'sila. The management of household waste has two essential stages: removal and elimination. The removal of waste includes the pre-collection and the collection itself. The elimination refers to landfills and burials in pits.

A. Collection and Pre-collection

1) Pre-collection

The concept of pre-collection implies all operations that precede the actual collection of waste. It aims to collect, gather, and store waste by the inhabitants of a dwelling, building, housing, or company, then deposit them in places dedicated to waste. In Algeria, it takes various forms according to the type of housing and the accessibility of the equipment:

- The metal boxes: the pre-collection by the box is more used at the level of local center agglomeration (Agglomeration Centre Local, ACL) and secondary agglomerations (Agglomerations Secondaires, AS). These are metal caissons with a capacity of 2 to 2.7T installed in housing estates, districts, and in front of establishments that are major waste generators. The frequency of removal of these boxes varies between 2 to 3 times per week.
- The hard niches: are designed in the form of a construction delimited by a low masonry wall surrounding a base in hard material. The low wall has an opening allowing the deposit of waste by the users and their removal by the waste collectors. They are generally implanted in the villages without any preliminary study, with no protection against the attraction of various animals, and without any measure of treatment of leachates.
- Individual garbage cans: These are individual plastic garbage cans. This method of pre-collection is used more by the inhabitants of city centers and shopkeepers. The waste is put in these garbage cans, which the residents take back once emptied by the collection service.
- Plastic bags: This type of pre-collection is the most common in the city centers and individual housing estates. Before the collection trucks pass by, the residents deposit their waste in bags or cardboard boxes in front of their homes or on the sidewalks of the streets, in the form of piles that the APC truck collects for the public dump.



Fig. 2. Pre-collection of waste.

2) Collection

The collection operation is located at the heart of the waste management process. It is a public order operation that falls within the framework of protecting the population's health and ensuring a better quality of life. It consists of the collection and grouping of waste for transportation. At present, there are two methods of removal in Algeria: (1) door to door, in which the collection service ensures a regular passage for the waste evacuation, (2) involuntary contribution, in which the generator ensures the waste transfer towards a point of regrouping so that they are transported by the service in charge of the operation towards a place of elimination or treatment. This collection mode is very suitable for the selective sorting operation [31].



Fig. 3. Means of transporting waste to the landfill.

B. Waste Disposal

In Algeria, municipal solid waste management services have traditionally focused on "cleaning" only, with little attention paid to waste disposal resources. This had significant negative economic, environmental, and social impacts and the household waste sector was experiencing difficulties in almost all areas.

1) Dumping Sites

In Algeria, the elimination of household and similar waste by the setting in wild dumps is the most used mode, with a rate of 87%. Despite an environmental policy and regulations on waste disposal, such waste is constantly increasing. According to a survey conducted by the MATE services, more than 3000 illegal dumps have been identified in the 48 wilayas with an area of about 4552.5ha. An almost similar geographical location characterizes the majority of these dumps.

2) Technical Landfills

Since 2001, the Algerian government has chosen to eliminate urban waste by burying it in landfills and has launched an ambitious program of technical landfills throughout the country. One of the objectives of PROGDEM is to abandon the traditional method of waste disposal by landfilling [27].



Fig. 4. Burial and sorting of waste at the CET of M'sila.

V. EVOLUTION OF THE POPULATION OF M'SILA AS A FACTOR GENERATING HOUSEHOLD WASTE

Recent research has shown that the population grows by more than 30% annually in developing countries. This growth is most evident in urban areas, accompanied by increased waste generation [11, 24-25]. The waste problem is getting worse every year as the population increases. Table I shows a significant evolution of the amount of waste in the commune of M'sila. The amount of solid waste generated is equivalent to 85 t/d [26], which requires considerable efforts from the public authorities. This continuous increase in quantity can be explained by the population growth, the lack of recycling infrastructure, the failing collection system, and finally, the

TABLE I. EVOLUTION OF THE QUANTITY OF WASTE GENERATED IN M'SILA [27]

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of inhabitants	161647	167480	175080	183803	194735	203822	214661	216788	224991
Quantity (t/year)	15621	18934	20688	33318	37280	46428	53274	55393	57902

VI. MANAGEMENT SYSTEM-THE COLLECTION OF HOUSEHOLD WASTE IN M'SILA

The management of household waste in the city is a complex problem that the municipality must face in order to better protect the environment and the public health. However, this management requires the participation of all the city actors (social, economic, administrative). The collection is one of the main operations of waste management and forms the cornerstone of the whole operation. It requires material and human means to evacuate the waste from the city.

A. Sector Delimitation

According to the various formal interviews carried out on several occasions with the services concerned and [31], we were able to know that to collect the waste of the city of M'sila, the technical service of the municipality has delimited 19 sectors of intervention based on two criteria:

- Existing material and human resources.
- Structural roads of the city.

B. Existing Material and Human Resources

1) Material Resources

The means implemented for the disposal of the city's household waste are wheeled collection vehicles and fixed collection means (caissons).

The wheeled collection vehicles are:

- 19 tipper trucks,
- 8 regular dump trucks,
- 2 dumpers,
- 3 agricultural tractors,
- 2 bulls and chargers,
- 1 amp truck.

For the rolling collection means mobilized for this operation, we noted that:

change in the socio-economic behavior of households where the standard of living has become acceptable even though the purchasing power has been decreasing in recent years. This evolution is also very remarkable according to the urban structure:

- The quantities of waste produced by collective housing are greater than those of individual housing.
- The collection systems used to receive these quantities of waste also differ according to the types of housing (for collective housing: there are boxes used for 500, 600, etc. houses).

- Some non-specialized collection vehicles directly affect the organization of the collection.
- There often temporary breakdowns.
- The number of specialized collection vehicles (tippers) represents the 15% of the total number of vehicles in the municipal fleet. The breakdowns of these means are explained by this low percentage and the age of the existing vehicles (14 and 20 years). Suppose we allocate the vehicles according to the number of inhabitants of M'sila. In that case, it can be noted that each specialized vehicle for 10,000 inhabitants is higher than the national average (1 vehicle/7500 inhabitants), while the international average is 1 vehicle/4000 inhabitants.

Therefore, the fleet of vehicles of the municipality shows a deficit of 4 to 5 vehicles to ensure a regular and average organization in terms of waste collection of the city and following financial means

There are two types of caissons:

- 3.5-ton boxes,
- 2.5-ton boxes,
- 240L and 120L wheeled bins.

The boxes are intended for collective housing and city facilities (hospitals, universities, etc.).

2) Human Resources

Currently, the commune of M'sila mobilizes for the collection of household waste of the city, a workforce of 70 workers including:

- 19 drivers,
- 44 waste collectors,
- 16 sweepers,
- the rest are agents of different categories (office, sorting, press, security),
- additional agents of private companies.

This workforce represents 1 employee for every 2500 inhabitants, which is much higher than the national average of 1 employee/1500 inhabitants, so the human resources show a deficit of 36 workers (waste collectors and sweepers). We note that the staff has no training in the field and that many waste collectors and sweepers are illiterate.

VII. QUANTITY OF WASTE GENERATED IN M'SILA

From 2011 to 2016, the amount of waste generated by the city has increased continuously. The annual production of the accumulation has increased from 33318 t/year to 57902 t/year [26, 27] (Table I), which is equivalent to an annual growth rate of 11%. If this growth rate continues, by the end of 2025, the quantity will reach 83795.97 t/year. The average waste quantity per capita ratio is 0.8kg/capita/day. This ratio is 0.41kg/capita/day in the slum areas and 1.23kg/capita/day in the residential areas. The ratio for the areas is higher than the estimated average for the major metropolitan areas of developing countries. Algeria's average annual per capita rate increased from 202kg in 1980 to 360kg in 2006. In urban areas, the ratio is 0.7kg/inhabitant/day. This correspondence of weight between M'sila and the rest of the country's cities is mainly related to the composition, which is in the majority made of fermentable but also of the low rate of humidity of the region. Indeed, the city of M'sila is under the influence of a dry semi-arid climate. It receives low rainfall, which is the case for the whole country. The latter influences the waste and makes it more or less light, especially as it is composed of 74.5% of organic matter [26].

VIII. COMPOSITION OF HOUSEHOLD WASTE IN M'SILA

The study of waste composition is an essential step for good management. Authors in [32, 33] cite several reasons for this, including the need to estimate the number of materials produced, identify the source of generation, facilitate the design of treatment equipment, define the physical, chemical, and thermal properties of waste, and ensure compliance with legislations. The waste of the city M'sila is composed of 74.5% of biodegradable materials, 33.1% of recyclable materials (paper, cardboard, plastic, glass, and metals), and 17% of inert materials in the form of construction debris. If we proceed to a finer classification, we obtain 13 categories in compliance with the NF X30-408 standards: putrescible waste (fermentable), plastic, metals, glass, paper, cardboard, textiles, sanitary textiles, combustible, composites, incombustible (inert), hazardous waste, fines (sand and ash). However, the content of waste varies according to the standard of living of the populations of the areas (Table II). A typological study allows us to classify the habitat in three categories:

- High standard of living settlements (generally in housing estates) where households have substantial financial resources enabling them to consume manufactured goods. These are populations belonging to the upper socio-professional class. A relatively high rate 76.2% of putrescible waste is composed essentially of organic matter despite the low concentration of its population.
- Medium standing habitats where households with a medium standard of living reside (these are the inhabitants of

collective housing), which partly explains the rate (75.3%) of putrescible waste composed essentially of organic matter; this is certainly due to the high concentration of population, translated by the important quantity of waste generated by the inhabitants of this sector whose collective housing is predominant.

- Low standard of living habitats of economic, evolutionary, and spontaneous type, highly populated with very little infrastructure (traditional or precarious habitat). There, the rate of putrescible waste is 75.9%, which corresponds to the lifestyles and standards of living of the inhabitants. To these habitat zones, it is necessary to add those of the commercial and business centers and the industrial zones that have a rate of 70.8%. The rate of cardboard and paper is the highest (13.7%) against 5.3% in the collective habitat, 5.2% in the individual, and 3.6% in the precarious one, because of the packaging activities of consumable products. The waste can be grouped into 2 main categories according to the composition obtained: household waste produced by households of different types on the one hand and waste from industrial and commercial areas on the other. This differentiation of the residential regions from industrial and commercial sites allows better waste management planning, especially for a possible recycling program.

TABLE II. PHYSICAL COMPOSITION OF HOUSEHOLD WASTE BY TYPE OF HABITAT AND ACTIVITY IN M'SILA IN 2016 [26]

Materials	Sector 8 (CET) Mostly collective housing (%)	Sector 2 (APC) Mostly individual housing (%)	Sector 4 (CET) Mostly precarious housing (%)	Sector 1 (APC) Mostly commercial use (%)
Putrescible waste	76.2	75.3	75.9	70.8
Papers	3.7	3.2	1.9	3.9
Cardboard	1.6	2.0	1.7	9.8
Textile	0.1	0.2	0.4	0.2
Sanitary textile	1.5	1.2	1.2	1.3
Plastics	6.6	8.5	6.6	6.4
Fuels	0.8	1.3	1.4	1.1
Glass	0.9	0.5	0.6	0.6
Composites	0.1	0.7	1.3	0.6
Metals	0.2	0.1	1.9	0.2
Fuels	1.7	0.9	1.3	1.5
Hazardous waste	0.1	0.8	0.9	0.7
Fines ≤ 20 mm	6.5	5.3	4.9	2.9
Total	100%	100%	100%	100%

A. Physical Characteristics

The physical waste composition is largely determined by the nature of the products, the packaging, and the consumption practices of the population. Knowing the waste composition is essential because it allows determining waste management methods and promoting treatment and recovery channels [13, 23]. The sampling results (Table III) allowed us to collect essential information to identify the waste. This sampling shows that the composition of household waste is very diverse. The composition of household waste during the random sampling of the 19 sectors of M'sila and the random selection of the contents of the weighing of a quantity of 10kg of each

sector allowed us to note that 74.8% of the waste is organic materials. The remaining 25.2% are distributed mainly on plastics, paper, and cardboard. Their percentages are higher than those of the metal and the glass. The share of paper and cardboard remains dominant due to collecting part of the waste from commercial activities such as packaging with household waste.

B. Chemical Characteristics

Several studies have focused on waste chemical characterization. Some aim to evaluate the polluting potential of these wastes [13] or demonstrate harmful effects on human health and the environment. Table IV gives examples of the elemental chemical composition of the waste in M'sila. Control of the nature and the volume of solid household waste produced in M'sila is necessary for better waste management. Also, the determination of the production of the different waste elements aims to facilitate the choice of the technology for the recovery of the pre-collected waste and support the development of the recovery and recycling channels. Table IV indicates the chemical composition of the household waste in M'sila.

TABLE III. COMPOSITION OF HOUSEHOLD WASTE IN M'SILA (2011-2016) [26]

Category	Subcategories	%	%
Putrescible waste	Food waste/Green waste	74.5	74.8
	Other putrescible waste	0.2	
Paper	Newspapers/Recyclable papers	1.4	3.3
	Other	1.9	
Cardboard	Flat cardboard packaging	0.1	2.9
	Corrugated packaging	2.2	
	Other	0.6	
Textiles	Textiles	0.5	0.5
Sanitary textiles	Sanitary textiles	1.3	1.6
Plastic	Flexible plastics	4.2	6.3
	Recyclable bottles/flasks	1.1	
	Other	1.0	
Fuel	Unclassified fuels	1.1	1.1
Glass	Recyclable glass	0.2	0.3
	Other	0.1	
Composites	Food cartons	0.2	0.7
	Other	0.5	
Metals	Ferrous metals	0.1	0.6
	Non-ferrous metals	0.2	
	Other metals	0.3	
Fuel	Unclassified fuels	1.8	1.8
Hazardous waste	Household hazardous waste	0.6	0.6
Fines	Fine less than 20mm	5.5	5.5
Total		100	100

TABLE IV. CHEMICAL CHARACTERISTICS OF HOUSEHOLD WASTE [34]

Features	Values
Density	0.28
Humidity level	60%
Carbon to nitrogen ratio	38
Calorific value	1000kcal/g

IX. CONCLUSION

Household waste management is a daily and very concrete problem for which local authorities and city residents have

often believed it to be simple and linear: collect and dump. Instead, it has become more complex with the demographic and spatial growth of cities, changes in nutrition habits, and new environmental challenges to the point of surprising urban actors. Seasonal results show that organic matter increases to more than 77% in summer, which is justified by the consumption of fruits and vegetables. In comparison, paper and cardboard drop to 3.5% in periods of high vacations. It can also be noted that the volumes of waste and the composition are not the same in each group of households. They depend on the standard of living, habits, and morals of the population to which we can add that the production of waste tends to increase with the standard of living. For example, residential areas differ from other areas. The current situation of household waste management in the city of M'sila highlights that the latter has difficulty in assuming the management of its waste, and this occurs due to the following reasons:

- The lack of material and human resources.
- Organizational issues.
- The lack of training of the staff in charge of these tasks is also a hindrance to good management of household waste.
- The inhabitants' involvement is deficient due to their lack of awareness and information.

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