

Management of urban solid waste in Mexico

Gestión de los residuos sólidos urbanos en México

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Abstract

The waste generated at the global level have increased significantly with the passage of the years, this due to the level of industrialization of each country as well as by globalization, which together directly impact on consumption is done from various products that cover the basic and recreational needs. This sustained increase, implies a greater volume and diversity of composition of the solid waste generated around the world, however, in particular, the main objective of this article is to make known the management of urban solid waste in Mexico, its characterization, regulation and the necessary regulations that permit the correct management of these wastes. Also the key components to carry out an efficient management of urban solid waste, considering various actions or activities including the generation of waste, collection, transfer, the use and final disposition are described. In addition, statics about recycling and utilization of urban solid waste are shown.

Management, Urban solid waste, Mexico

Resumen

Los residuos que se generan a nivel mundial se han incrementado significativamente con el paso de los años, esto debido al nivel de industrialización de cada país así como por la globalización, que en conjunto impactan directamente en el consumo que se realiza de diversos productos que cubren las necesidades básicas y de esparcimiento. Este aumento sostenido, implica un mayor volumen y diversidad de composición de los residuos sólidos que se generan, en particular este artículo tiene como objetivo general dar a conocer la gestión de los residuos sólidos urbanos que se realiza en México así como su caracterización y regulación, incluyendo además, la normativa necesaria que permita realizar la correcta administración de estos residuos. Se describen los componentes clave que se requieren para llevar a cabo una eficiente gestión de los residuos sólidos urbanos, considerando diversas acciones o actividades entre las cuales se encuentran listadas la generación de residuos, su recolección, la transferencia, el aprovechamiento y la disposición final. Además, se muestran cifras acerca del reciclaje y aprovechamiento de los residuos sólidos urbanos.

Gestión, Residuos sólidos urbanos, México

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Introduction

Over the years, the generation of waste has grown enormously due to economic development, industrialization and the implementation of Economic models (Naredo, 1994), which together imply a sustained increase in consumption in the diversity of products that exist, impacted significantly in the volume and composition of solid waste (SW) produced in the world and in Mexico (SEMARNAT, 2015).

The classification of these SRs is given by the source that generates the waste, so they can be domiciliary, commercial, hospital, public spaces, institutional and industrial. On the other hand, the general waste law mentions that urban solid waste (USW) are those produced in houses, offices or streets, special handling waste generated in some non-hazardous production processes and by large generators, and hazardous waste. , with characteristics of risk (SEMARNAT, 2015), being calculated by the Ministry of Social Development (SEDESOL) in accordance with the provisions of the standard NOM-AA-61-1985 on the Determination of the Generation of Solid Waste (NOM, 1985).

According to the General Law for the Prevention and Integral Management of Residues (LGPGIR), USW is considered more particularly "those generated in housing, resulting from the elimination of materials used in domestic activities, the products that are consumed and their packaging, packaging or packaging; the waste that comes from any other activity inside establishments or in the public road that generates waste with domiciliary characteristics, and the resulting ones of the cleaning of the routes and public places, whenever they are not considered by this Law as waste of another nature " (PROFEPA, 2016).

The management of the USW is considered one of the most neglected areas in urban development because, in general, in Mexico the lack of economic resources and inadequate planning, makes it difficult to properly carry out the management of the USW (Taboada et al, 2014), leaving aside extremely important information and making sustainable management means necessary (Mwanza y Mbohwa, 2017).

Therefore, for proper waste management, it is necessary to duly comply with the guidelines and activities that comprise it, which include the generation, collection and sweeping, transfer, use and final disposal of waste, according to the Official Standard Mexican NOM-083-SEMARNAT-2003 (DOF, 2004). Currently in Mexico, it is sought to increase the recycling of USW, based on public policies and the development of national technology.

This document focuses on publicizing the management of urban solid waste in Mexico and its characterization, including in it the necessary regulations to perform the proper management of this waste.

Background

To understand the management of the USW, it is necessary to have knowledge of the background corresponding to what has been shown in this document "Solid waste management in Mexico goes through three moments in its history: it began in 1964 under a predominantly sanitary regulation, later in 1988, after the creation of the national environmental legislation, a step towards the basic management of waste is taken, the last change in 2003 is due to the creation of the General Law for the Prevention and Integral Management of Waste " (Calva-Alejo y Rojas-Calderas, 2014).

In October 2004, the first Solid Waste Integral Management Program (PGIRS) 2004-2008 was published in the Official Gazette of the Federal District for Mexico City today, being the first document of its kind nationwide. (GODF, 2004). With the establishment of this program is that the separation of waste is established and it is proposed to align the scheme of provision of the service of cleaning and waste management (SEDEMA, 2016).

The Integral Management of Urban Solid Waste, is basically the choice and application of multiple techniques, technologies and management programs analyzed to be suitable in the scope of specific objectives in waste management, where it is managed to reduce, reuse, recycle, transformation and dumping.

It also contemplates the administration of functional elements such as generation, handling, collection, separation, processing, transformation, transfer, transport, landfill and recovery of landfill postclosure (Márquez-Benavides, 2011).

Later in Mexico, the LGPGIR was enacted since 2006, which establishes that it is the faculty of the regular federation on waste. (PROFEPA, 2016). The LGPGIR also establishes that the federal environmental authority must promote, together with the state and municipal governments, the participation of investors and the social sector; as well as the research, development and application of new technologies, equipment, systems and processes that eliminate, reduce or minimize environmental pollution by the integral management of waste; At the same time, control measures, financial incentives, financial and market incentives are imposed to prevent or avoid the generation of waste, as well as sanctions for non-compliance with regulations. For this, the official Mexican standards (NOM) were issued to carry out the integral management of the USW, of special and dangerous handling. According to this law, the states must submit to the Secretary of Environment and Resources (SEMARNAT) the construction and operation of sanitary landfills to receive technical assistance from the Federal Government for this purpose and the collection for the integral management of the USW.

Regulation

With the increase of industrialization and generation of products in the whole world, processes are being implemented to take advantage of the USW in Mexico, recovering paper, cardboard, textiles, metals, plastic and glass with the purpose of being recycled and reused after an industrial process and consumption. This type of processes as well as the use of the resulting materials are regulated by laws and regulations established by the Federal Government, in charge of elaborating the applicable legal and institutional framework for the management of the USW, which are reflected for example in the General Law of the Ecological Balance and the Protection of the Environment (CDHCU, 2018), the Law for the Prevention and Integral Management of Wastes (PROFEPA, 2016) or the standard NMX-AA-61-1985 on the Determination of the Generation of Solid Residues (NOM, 1985).

This document characterizes only the USW which are the responsibility of the municipality, being separated from the special handling waste (RME), which are of state competence; and hazardous waste (RP), federal competition (PROFEPA, 2016)

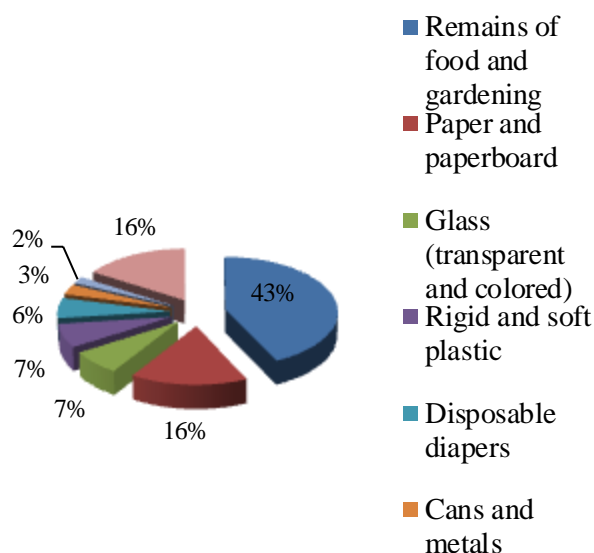
According to the provisions of Article 115 of the Political Constitution of the United Mexican States, municipalities are responsible for providing the services of cleaning, collection, transfer, treatment and final disposal of waste. Currently, both the large urban areas of the country and most municipalities of intermediate size have a regulation that establishes the responsibilities of both service providers and users (CPEUM, 2017).

Characterization of USW in Mexico

In developed countries the processing of the USW has become an industry, in Mexico the activity is recently regulated, especially in the final disposal stage, as permanent deposit or confinement in adequate facilities to avoid affecting the health of the population and the nearby ecosystems. In the country there are two types of disposal sites: sanitary landfills and controlled landfills, it should be noted that 36% of solid waste is not managed properly, although in 2011 there were 88 landfills and 21 landfills. controlled sites (SEDESOL, 2012).

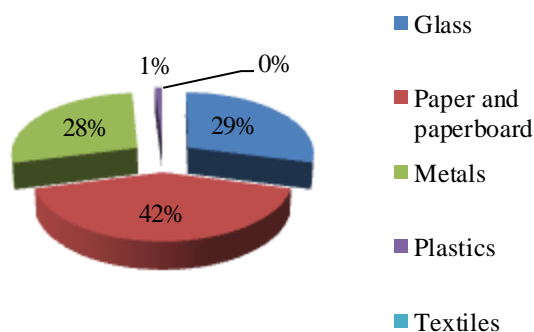
Solid waste in Mexico lacks a homogeneous composition, even in the same city, since on average, they are composed of 43.5% of food waste and gardening, 15.9% paper and cardboard, 7.4% glass (transparent and colored), 6.7% of rigid and soft plastic, 6.3% of disposable diapers, 2.9% of cans and metals, 1.5% of textiles and 15.8% of other waste, as shown in graph 1, where it can be seen that 43% are organic waste, 28% correspond to potentially usable waste and 29% to unusable waste (SEMARNAT, 2014).

Of the total of 2,445 Mexican municipalities, only 5% of the waste is properly handled, although 87% of the waste generated is collected and only 64% of the collected waste is confined in 88 sanitary landfills and 21 controlled sites; and 36% of waste is deposited in the open (SEMARNAT, 2015).



Gráfica 1. Average composition of garbage in Mexico
Source: Elaborated with data from (SEMARNAT, 2014)

In general, in Mexico the amount of recycled waste has increased, glass (28.6%), paper and cardboard (42.2%), metals (27.8%), plastics (1.2%) and textiles (0.2%) are recovered, as appreciates in graph 2 (SEMARNAT, 2014).



Gráfica 2. Composition of recycled waste in Mexico
Source: Elaborated with data from (SEMARNAT, 2014)

Landfills are the best solution in Mexico for the final disposal of USW; this type of infrastructure involves engineering methods and works to control leachate leaks and the generation of biogas.

On the other hand, controlled landfills, although they share the specifications of landfills in terms of infrastructure and operation, do not meet waterproofing specifications for the control of leachates. (SEMARNAT, 2015). The environmental effects caused by the improper handling of waste are contamination of soil, air (by the production of gases produced by the decomposition of garbage and its burning), interruption of water channels causing flooding or damage to the drainage system, contamination of lakes, lagoons, rivers and seas, contamination of groundwater and death of organisms by strangulation when trapped in elastic and fibrous materials.

USW processing

An efficient USW management considers various actions or activities to be carried out. These are considered from the generation source to the final disposal. The actions or basic activities that should be taken into account according to the following are listed below (Calva-Alejoy Rojas-Calderas, 2014):

- Generation
- Harvest
- Transfer
- Exploitation
- Final disposition

Generation

The generation of urban solid waste starts from the waste generated in the houses, which result from the elimination of the materials used in their domestic activities, the products they consume and their packaging, packaging or packaging; the waste that comes from any other activity inside establishments or in the public road that generates waste with domiciliary characteristics, and the resulting ones of the cleaning of the routes and public places, always that they are not considered like residues of another nature (PROFEPA, 2016).

Harvest

The collection of waste is the action and effect of collecting and removing solid waste from one or more generators, carried out by the person providing the service from the point indicated to the user for transfer (Pinzón Casas, 2016).

Transfer

It is the activity of moving the solid waste from the point indicated to the user of the cleaning system to the place of transfer, if it exists, or to the final disposal site through a vehicle avoiding the scattering of waste in an inappropriate manner (Pinzón Casas, 2016).

Exploitation

Other important activities within the management of the USW are the separation and use for recycling activities or reuse (Jiménez Martínez, 2015).

It is the process through which, through an integral management of solid waste, recovered materials are reincorporated into the economic and productive cycle in an efficient way, through reuse, recycling, incineration with the purpose of generating energy, composting or any other modality that entails health, environmental, social and / or economic benefits (Pinzón Casas, 2016).

Final disposition

It is the process of isolating and confining solid waste, especially non-useable waste, in a definitive manner, in places specially selected and designed to avoid contamination, and damage or risks to human health and the environment (Pinzón Casas, 2016).

In any of the two types of disposal sites: landfills or controlled landfills. With the above, if the points are properly fulfilled, USW management will not have any problem to conclude successfully.

Conclusions

Mexico is a country which has the capacity to achieve an adequate management of USW provided that the necessary financial support is given for the fulfillment and development of a rigorous national program of control and management of waste, which is capable of providing the information necessary for society to be aware of the damage caused to the environment due to poor waste management.

It is important to clarify that with the population participating in it and the government complying with the economic part, USW management will be adequately achieved and may lead to a greater and better use of waste, since from the generation will be separated and used for a more specific collection achieving a smaller amount in the deposition of waste; that is, a decrease in unnecessary waste or that can be recycled.

References

- Calva-Alejo, C. L. y Rojas-Calderas, R. I (2014). Diagnóstico de la Gestión de Residuos Sólidos Urbanos en el Municipio de Mexicali, México: Retos para el Logro de una Planeación Sustentable. *Información Tecnológica*, Vol. 25 (3), 59-72.
- CDHCU. (2018). Cámara de Diputados del H. Congreso de la Unión. Ley General de Equilibrio Ecológico y la Protección al Ambiente, 1–135. Recuperado de http://www.diputados.gob.mx/LeyesBiblio/pdf/148_050618.pdf Acceso: 30 de julio 2018
- CPEUM (2017). Constitución Política de los Estados Unidos Mexicanos. Artículo 115- III-C. Recuperado de http://www.diputados.gob.mx/LeyesBiblio/pdf/1_150917.pdf Acceso 30 de julio 2018
- DOF (2004). Diario Oficial de la Federación. Norma Oficial Mexicana NOM-083-SEMARNAT-2003. Recuperada de http://www.dof.gob.mx/nota_detalle.php?codigo=658648&fecha=20/10/2004 Acceso: 30 de julio 2018.
- GODF. (2004). Gaceta Oficial Del Distrito Federal 101-BIS, 7–107. Recuperado de http://www.paot.org.mx/centro/gaceta/2004/octubre04/01octubre04_bis.pdf Acceso: 30 de julio 2018
- Jiménez Martínez, N. M. (2015). La gestión integral de residuos sólidos urbanos en México: entre la intención y la realidad. *Letras Verdes. Revista Latinoamericana de Estudios Socioeconómicos*. No. 17, pp. 29-56.
- Márquez-Benavidez, L. (2011). Residuos sólidos: un enfoque multidisciplinario. Volumen 1. Libros en red.

Mwanza, B. G., and Mbohwa, C. (2017). Factores para un reciclaje sostenible de residuos sólidos plásticos: Una revisión. *Procedia Manufacturing*, 8, 649–656.

Naredo, J. M. (1994). Fundamentos de la economía ecológica. De La Economía Ambiental a La Economía Ecológica, 231–252. Recuperado de <http://www.fuhem.es/media/eco-social/File/Actualidad/2011/Naredo.pdf>
Acceso: 30 de julio 2018

NOM. (1985). NMX-AA-61-1985 Protección al ambiente - Contaminación del suelo - Residuos Sólidos Municipales- Determinación de la generación. Control. Recuperado de <http://biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/DOFsr/DO3986.pdf>
Acceso: 30 de julio 2018

Pinzón Casas, R. D. (2016). Producción, recolección y disposición de residuos sólidos urbanos, análisis del sistema de gestión en el municipio de Puerto Asís Putumayo (Tesis de Maestría) Universidad de Manizales, Colombia. Recuperada de <http://ridum.umanizales.edu.co:8080/xmlui/handle/6789/2829> Acceso: 30 de julio 2018.

PROFEPA (2016). Procuraduría Federal de Protección al Ambiente. Reglamento de la Ley General para la Prevención y Gestión Integral de los Residuos. Recuperada de <https://www.gob.mx/profepa/documentos/reglamento-de-la-ley-general-para-la-prevencion-y-gestion-integral-de-los-residuos> Acceso: 30 de julio 2018

SEDEMA (2016) Programa de Gestión Integral de Residuos Sólidos. CDMX 2016-1020. Recuperado de <http://www.sedema.cdmx.gob.mx/storage/app/media/programas/residuos-solidos/pgirs.pdf> Acceso: 30 de julio 2017

SEMARNAT (2014). Secretaría de Medio Ambiente y Recursos Naturales. Indicadores Básicos del Desempeño Ambiental de México Apartado: Residuos. Recuperado de http://apps1.semarnat.gob.mx/dgeia/indicadores14/conjuntob/04_res_solidos/04_introduccion.html Acceso: 30 de Julio 2018.

SEMARNAT. (2015). Secretaría de Medio Ambiente y Recursos Naturales. Informe de la Situación del Medio Ambiente en México. Compendio de Estadísticas Ambientales. Indicadores Clave, de Desempeño Ambiental y de Crecimiento Verde. Cap. 7. Residuos. pp. 431–470. Recuperado de <http://apps1.semarnat.gob.mx/dgeia/informe15/index.html> Acceso: 30 de julio 2018

Taboada P., Aguilar Q., Ojeda S., and Cruz S. (2014). Aplicación del proceso de jerarquía analítica en una evaluación de tecnología de tratamiento de residuos en México. Springer International Publishing Switzerland, 186, 5777-5795.