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A Glance at the World

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This column comprises notes and info not subjected to peer-review focusing on waste management issues in different corners of the world. Its aim is to open a window onto the solid waste management situation in any given country, major city or significant geographic area that may be of interest to the scientific and technical community.

Management of municipal solid waste in Mexico

Since the second half of the last century, Mexico has experienced a crescent industrialization process, with a higher demand of raw materials, necessary to meet the requirements of goods and services for a population in constant growing. As a result, waste generation has increased significantly, making difficult its collection, transport, management and final disposal. In Mexico, municipal governments, responsible for the public sanitation systems, often face several administrative problems and lack of adequate planning, which make the implementation of an efficient municipal solid waste management (SWM) program difficult.

According to the National System of Environmental Information and Natural Resources (2013), a 44% increased waste generation was recorded from 1997 to 2012 (Fig. 1).

In Mexico more than 91 million people live in cities and metropolitan areas, the rest of the population, near to 28 million people, live in rural areas. For these reason the metropolis and middle cities contributed to 80% of the total MSW generated in the whole Country.

The MSW composition is highly heterogeneous (Table 1). The main component, more than 50% of the total MSW, is the organic fraction, followed by paper and cardboard (14%).

In Mexico, the traditional SWM strategy was open dumping, however, in the last years, landfills have been put into operation to eliminate this practice. Nevertheless open dumps still prevail in rural areas, small and middle cities. Moreover, in most of the landfills, a great quantity of waste with the potential to be recycled is disposed. Because of that, many low income people collect recyclable materials from the landfills to sell them.

The combination of these factors has been promoting home-recycling, with a decrease in the amount of waste that need to be disposed both in open dumps and landfills. Further actions that are being explored in Mexico, such as composting of the organic fraction

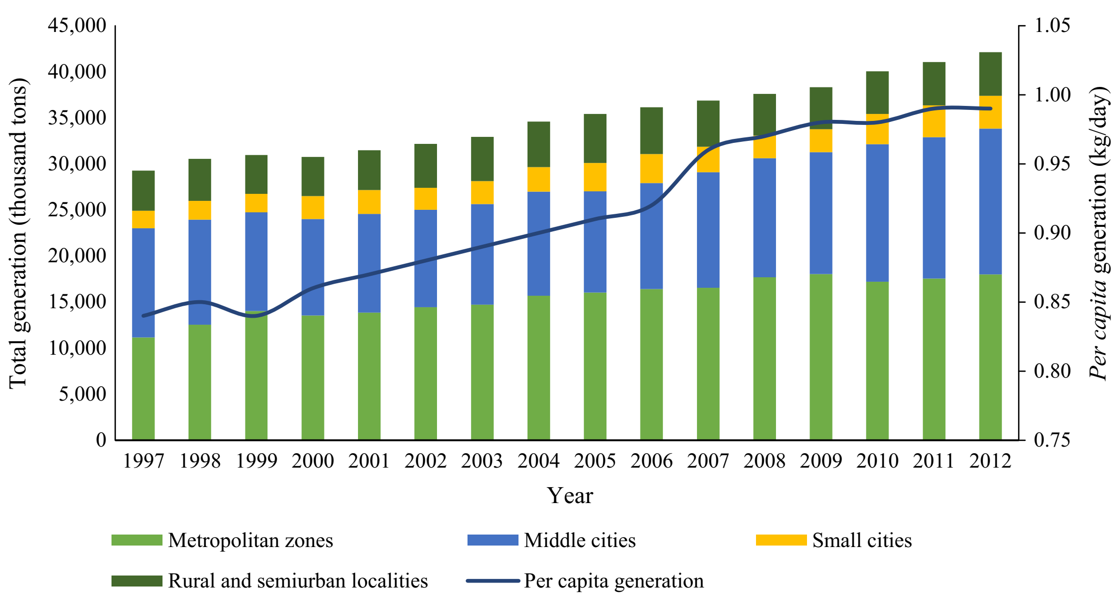

Fig. 1. MSW generation for the period 1997–2012. Generated with the information of SNIARN-SEMARNAT, 2013).

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Table 1
Generation and management of MSW in México.

Generation[a]	Year	MSW type							Total
		Organic materials	Paper products	Plastics	Glass	Metals	Textiles	Others[b]	
	2012	22070.27	5822.82	4584.99	2475.66	1448.25	602.06	5098.70	42102.75

Collection[c]	Year	Number of			Kind of collection			Cover population
		collection vehicles	Transfer stations	Collection centers	Selective	Non selective	Total collection	
	2012	14,959	113	841	ND	ND	99,770,725	108,521,344

Recovery[c]	Year	Kind of material							
		Aluminium	Copper/bronze/lead	Electronics/electro domestics	Iron	Paper/cardboard	PET/Plastics	Glass	Others
	2012	6129	5709	22,842	21,868	143,187	111,913	62,051	74,364

Final disposal[a]	Year	Disposal				Source of the generated waste			
		Landfills	Controlled open dumps	Uncontrolled open dumps	Recovery	Metropolis	Medium cities	Small cities	Rural/semi-urban
	2012	27979.45	3343.93	8679.45	2099.91	18004.14	15824.48	3548.13	4726.00

ND No data.
Generated with the information of SNIARN-SEMARNAT, 2013).
[a] Thousand tons.
[b] This category includes disposable diapers.
[c] Daily average, Kg.

of MSW, could also help to minimize the negative environmental impacts of the generated waste. Environmental education and linkage between Government and inhabitants are fundamental.

Reference

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Biomass energy conversion park: Case study of the Alegria sewage treatment plant in Rio de Janeiro City

A synergetic, multi-dimensional biomass conversion site with a highly integrated set of conversion technologies in which a multitude of regionally available residue (biomass) sources are converted into energy and materials (Van Dael et al., 2013) or the transformation of multiple primary energy sources to multiple energy outputs (EU, 2015) seems to have many advantages like residue streams reduction, environmental, sanitary and land-filling policies contribution, more efficient end-products use, reduction of logistic and regional costs, and increased available energy outputs from the overall system (Guisson and Van Dael, 2013).

The Alegria Sewage Treatment Plant (ASTP), owned by the Rio de Janeiro State Water and Sewage Company (CEDAE) is an example of Energy Park with many installed conversion technologies: anaerobic digester, biogas, pyrolysis and esterification plants, with many end-products: biogas, clean biogas (70% CH4), natural gas vehicle (NGV), biodiesel, bio-oil and bio-coal. The ASTP (Fig. 1) includes primary and secondary sewage treatment processes and uses the activated sludge technology, anaerobic digesters and a sludge condenser via mechanical centrifugation.

Currently, the Energy Conversion Park (ECP) works with 40% (1.8–2.5 m^3/s) of its designed average capacity (5 m^3/s) due to sewage collection system connection delays.

During the park development, the end-products have had many regulatory issues and many challenges to overcome. A national resolution prevents the landfill and sewage biogas retail sales, due to the concern regarding how to determine the siloxane limits. With this determination, the ASTP expects to increase co-generation, and it is studying the use of the biogas in its own fleet of vehicles. Besides, the grease traps, raw material of biodiesel plant is not recognised as the frying oil itself requiring esterification. Tests conducted with the pyrolysis products showed that the bio-oil has a calorific value of 9500 kcal/kg, but bio-coal only reaches 2300 kcal/kg due to ashes presence.

CO, CO_2 and NOx emission tests were performed for diesel, biodiesel, and several blended fuels: diesel/NGV, biodiesel/bio-methane, and biodiesel/NGV in the biogas plant dual-fuel reciprocating engine (NAPRO gas Analyser). The CO tests results showed that biofuels blends emissions are lower than the emissions of the diesel and GNV blends, depending on the fuel load. The NOx electronic and balloon tests indicated that biodiesel emits less than diesel. Despite all blends emitting more HC than diesel oil, those with the presence of bio-methane emitted less than those with vehicle natural gas (NGV), although the fossil gas with biodiesel mixture produced only a small difference with the purely fossil fuel mixture. In the case of the mixture with bio-methane, it is always better to use biodiesel and diesel oil to reduce the HC content.

The study suggests that a strong regulatory environment, government programs and economic instruments are necessary to support a continued and sophisticated waste management solution, such as an Energy Conversion Park. Considering the electricity consumption avoided and the respective shadow price, the ASTP is operationally and economically feasible.