

[Home](#) > [Journal](#) > [Earth & Environmental Sciences](#) > [JEP](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[JEP](#) > Vol.2 No.10, December 2011



## Effect of Solid Wastes Composition and Confinement Time on Methane Production in a Dump

PDF (Size: 431KB) PP. 1310-1316 DOI: 10.4236/jep.2011.210151

### Author(s)

Carlos González, Otoniel Buenrostro, Lilitiana Marquez, Consuelo Hernández, Edgar Moreno, Fabián Robles

### ABSTRACT

In developing countries, illegal dump structures or even some landfills do not include methane collecting systems, even if local environmental laws exist. In this condition, the greenhouse gas escapes to the atmosphere uncontrolled and practical solutions to tackle this problem are not obvious. To make a solution approachable, first-hand reliable data from dump emissions are required as starting point. The methane production is not homogeneous throughout the dump, therefore to estimate its global methane emissions, various representative gas monitoring sites distributed along the dump becomes necessary. This research work presents the measures of biogas emissions collected in the final disposal site located at Morelia (Mexico), along with an evaluation of the organic fraction and confinement time participation on biogas production. Biogas emission data were taken with a portable analyzer from 49 ventilation pipes for 52 weeks. For the composition and degradability analysis of solid wastes, the required samples have been collected from 16 sites. The results show a heterogeneous composition of solid wastes: 38 separate components are present, from those, 19 belong to organic categories and 28 of total components accounts for almost 99% of the waste. The mean biogas concentration detected was: 45.5% CH<sub>4</sub>, 32.4% CO<sub>2</sub>, 3.1% O<sub>2</sub>, and 18.9% balance gas (i.e., N<sub>2</sub>, CO or H<sub>2</sub>S). The ANOVA procedure clearly corroborated the influence of composition, biodegradability and time of confinement of solid wastes on the production of methane, despite the deficiencies in the final soil layer cover in these sites.

### KEYWORDS

Mexico, Biodegradability, Emissions, Biogas, Methane

### Cite this paper

C. González, O. Buenrostro, L. Marquez, C. Hernández, E. Moreno and F. Robles, "Effect of Solid Wastes Composition and Confinement Time on Methane Production in a Dump," *Journal of Environmental Protection*, Vol. 2 No. 10, 2011, pp. 1310-1316. doi: 10.4236/jep.2011.210151.

### References

- [1] IPCC, " IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme," In: H. S. Eggleston, L. Buendia, K. Miwa, T. Ngara and K. Tanabe, Eds., Intergovernmental Panel on Climate Change, Waste IGES, Japan, Vol. 5, pp. 3.1-3.44.
- [2] C. Chiemchaisri, W. Chiemchaisri, S. Kumar and J. Hettiaratchi, " Solid Waste Characteristics and Their Relationship to Gas Production in Tropical Landfill," *Environmental Monitoring Assessment*, Vol. 135, No. 1-3, 2007, pp. 41-48. doi:10.1007/s10661-007-9706-2
- [3] S. E. Borglin, T. C Hazen, C. M. Oldenburg and P. T. Zawislanski, " Comparison of Aerobic and Anaerobic Biotreatment of Municipal Solid Waste," *Journal of the Air and Waste Management*, Vol. 54, 2004, pp. 815-822.
- [4] E. R. Fielding, D. B. Archer, E. C. Demacario and A. J. L. Macario, " Isolation and Characterization of Methanogenic Bacteria from Landfills," *Environmental Microbiology*, Vol. 54, No. 3, 1988, pp. 835-836.
- [5] J. H. Wilshusen, J. P. A. Hettiaratchi and V. B. Stein, " Long-Term Behavior of Passively Aerated Compost Methanotrophic Biofilter Columns," *Waste Management*, Vol. 24, No. 7, 2004, pp. 643-

- [Open Special Issues](#)
- [Published Special Issues](#)
- [Special Issues Guideline](#)

[JEP Subscription](#)
[Most popular papers in JEP](#)
[About JEP News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	301,519
Visits:	674,280

### Sponsors, Associates, and Links >>

- [The International Conference on Pollution and Treatment Technology \(PTT 2013\)](#)

- [6] S. Kalyuzhny, M. Gladchenko and E. Eпов, " Combined Anaerobic-Aerobic Treatment of Landfill Leachates Under Mesophilic, Submesophilic and Psychrophilic Conditions," *Water Science and Technology*, Vol. 48, No. 6, 2003, pp. 311-318.
- [7] R. Rajasekaran, R. Muragesan and A. Palanisamy, " Influence of Temperature on Microbiological Numbers and Biogas Production of Some Anaerobically Digested Waste," *Agricultural Wastes*, Vol. 17, No. 2, 1986, pp. 83-89. doi:10.1016/0141-4607(86)90047-8
- [8] F. L. Wang and J. R. Bettany, " Methane Emissions from Canadian Prairie and Forest Soils under Short Term Flooding Conditions," *Nutrient Cycling in Agroecosystems*, Vol. 49, 1997, pp. 197-202. doi:10.1023/A:1009758308457
- [9] R. Munasinghe, " Effect Hydraulic Retention Time on Landfill Leachate and Gas Characteristics," Ph.D. Thesis, University of British Columbia, Vancouver, 2003.
- [10] M. T. Orta, R. R. Cruz, V. N. Rojas, R. I. Monje and G. J. Sánchez, " Determination of Field Capacity of Municipal Solid Waste with Surcharge Simulation," *Waste Management & Research*, Vol. 21, No. 2, 2003, pp. 137-144. doi:10.1177/0734242X0302100207
- [11] C. Zeiss and W. Major, " Moisture Flow through Municipal Solid Waste: Patterns and Characteristics," *Journal Environmental Systems*, Vol. 22, No. 3, 1993, pp. 211- 231.
- [12] M. S. Hossain, M. A. Gabr, F. Asce and M. A. Barlaz, " Relationship of Compressibility Parameters to Municipal Solid Waste Decomposition," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 129, No. 12, 2003, pp. 151-1158. doi:10.1061/(ASCE)1090-0241(2003)129:12(1151)
- [13] I. Bergman, M. Klarqvist, and M. Nilsson, " Seasonal Variation in Rates of Methane Production from Peat of Various Botanical Origins: Effects of Temperature and Substrate Quality," *Microbiology Ecology*, Vol. 33, No. 3, 2000, pp. 181-189. doi:10.1111/j.1574-6941.2000.tb00740.x
- [14] C. Bernard and G. Merlin, " The Contribution of Ammonia and Alkalinity to Landfill Leachate Toxicity to Duckweed," *The Science of the Total Environment*, Vol. 170, No. 1-2, 1995, pp.71-79. doi:10.1016/0048-9697(95)04563-G
- [15] L. Márquez and C. I. Watson, " Effect of Intermediate Soil Cover on Municipal Solid Waste Decomposition," *Water Science Technology*, Vol. 48, No. 4, 2003, pp. 245-248.
- [16] N. R. E. Méndez, S. R. Cachón, R. M. Sauri and B. Castillo, " Influencia del Material de Cobertura en la Composición de Lixiviados de un Relleno Sanitario," *Revista de Ingeniería*, Vol. 6, No. 2, 2002, pp. 7-12.
- [17] R. E. Klink and R. K. Ham, " Effects of Moisture Movement on Methane Production in Solid Waste Landfill Samples," *Resource Recovery and Conservation*, Vol. 8, No. 1, 1982, pp. 29-41.
- [18] G. P. Korfiatis, A. C. Demetracopoulos, E. Bourodimos and E. G. Nawy, " Moisture Transport in a Solid Waste Column," *Journal of Environmental Engineering*, Vol. 110, No. 4, 1984, pp. 780-796. doi:10.1061/(ASCE)0733-9372(1984)110:4(780)
- [19] V. Francois, G. Feuillade, G. Matejka, T. Lagier and N. Skhiri, " Leachate Recirculation Effects on Waste Degradation: Study on Columns," *Waste Management and Research*, Vol. 27, No. 9, 2007, pp. 1259-1272. doi:10.1016/j.wasman.2006.07.028
- [20] M. Swati, J. Kurgan and R. Nagendran, " Bioreactor Landfill Lysimeter Studies on Indian Urban Refuse," *Proceedings of the Tenth International Waste Management and Landfill Symposium*, Sardinia, 3-7 October 2005, pp. 229- 237.
- [21] G. T. Ellis, J. Park, E. Debik and S. Smith, " Evaluation of Leachate Treatment and Recycle Options at the Boone County Landfill," *Proceedings of the Twenty International Conference on Solid Waste Technology and Management*, Philadelphia, 3-6 April 2005, pp.102-156.
- [22] N. Sanphoti, S. Towprayoon, P. Chairprasert and A. Nopharatana, " The Effects of Leachate Recirculation with Supplemental Water Addition on Methane Production and Waste Decomposition in a Simulated Tropical Landfill," *Journal of Environmental Management*, Vol. 81, No. 1, 2006, pp. 27-35. doi:10.1016/j.jenvman.2005.10.015
- [23] S. S. Chung and C. S. Poon, " Characterization of Municipal Solid Waste and Its Recyclable Contents of Guangzhou," *Waste Management & Research*, Vol. 19, No. 6, 2001, pp. 473-485. doi:10.1177/0734242X0101900603

- [24] D. R. Reinhart and A. B. Al-Yousfi, " The Impact of Leachate Recirculation on Municipal Solid Waste Landfill Operating Characteristics," *Waste Management & Research*, Vol. 14, No. 4, 1996, pp. 337-346.
- [25] B. M. Sinan, A. Demir and B. Ozkaya, " Influence of Leachate Recirculation on Aerobic and Anaerobic Decomposition of Solid Wastes," *Journal of Hazardous Materials*, Vol. 143, No. 2, 2007, pp. 177-183. doi: 10.1016/j.jhazmat.2006.09.012
- [26] D. T. Sponza and O. N. Agdag, " Impact of Leachate Recirculation and Recirculation Volume on Stabilization of Municipal Solid Wastes in Simulated Anaerobic Bioreactors," *Process Biochemistry*, Vol. 39, No. 12, 2004, pp. 2157-2165. doi: 10.1016/j.procbio.2003.11.012
- [27] M. A. Barlaz, " Microbiology of Solid Waste Landfills," In: A. C. Palmisano and M. A. Barlaz, Eds., *Microbiology of Solid Waste*, CRC Press, Boca Raton, 1996, pp. 541- 557.
- [28] D. R. Reinhart, P. T. McCreanor and T. G. Townsend, " The Bioreactor Landfill: Its Status and Future," *Waste Management and Research*, Vol. 20, No. 2, 2002, pp. 172- 186. doi: 10.1177/0734242X0202000209
- [29] A. Gendebien, M. Constant, E. Ledrut-Damanet, H. Nyns, J. Willumsen, R. Butson, G. Fabry and Ferrero, " Lanfill Gas from Environment to Energy," Commission of the European Communities, Luxembourg, 1992.
- [30] H. Scharff and J. Jacobs, " Applying Guidance for Methane Emission Estimation for Landfills," *Waste Management*, Vol. 26, No. 4, 2006, pp. 417-429.
- [31] G. Hernández and C. Duran, " Biogas Production in a Closed- Down Sanitary Landfill," *Ingeniería y Ciencias Ambientales: Investigación, Desarrollo y Práctica*, Vol. 1, No. 1, 2006, pp. 1-15.
- [32] K. Wang-Yao, S. Towprayoon and S. Jaroenpoj, " Estimation of Landfill Gas Production Using Pumping Test," *Proceedings of the Joint International Conference on Sustainable Energy and Environment (SEE)*, Hua Hin, 1-3 December 2004, pp. 340-343.
- [33] T. Tolaymat, R. Green, G. Hater, M. Barlaz, P. Black, D. Bronson and J. Powell, " Evaluation of Landfill Gas Decay Constant for Municipal Solid Waste Landfills Operated as Bioreactors," *Journal of the Air and Waste Management Association*, Vol. 60, No. 1, 2010, pp. 91-97. doi:10.3155/1047-3289.60.1.91
- [34] I. Israde, O. Buenrostro and A. Carrillo, " Geological Characterization and Environmental Implications of the Placement of the Morelia Landfill, Michoacán, Central México," *Journal of the Air and Waste Management Association*, Vol. 55, No. 6, 2005, pp. 755-764.
- [35] Secretaría de Comercio y Fomento Industrial, " Mexican Norm NMX-AA-022-1985. Environmental Protection-Soil Pollution-Municipal Solid Residues by-Products Selection and Quantification," San Ysidro, 1985, pp. 1-5.
- [36] Secretaría de Comercio y Fomento Industrial, " Mexican Norm NMX-AA-025-1984. Environmental