(130)

Estimation of Methane and Carbon Dioxide Gas Emissions from a Municipal Solid Waste (MSW) Open Dumpsite in the Tropical Climate

Herath P.L.*, Jayawardana D.T., Bandara N.J.G.J.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**priyathpriyara@gmail.com*

Abstract

Rapid urbanisation and economic growth have led to accelerating the municipal solid waste generation. Open solid waste dumpsites are a primary anthropogenic source of greenhouse gases, mainly Carbon dioxide (CO_2) and methane (CH_4). However, minimal studies are available on quantification of the emissions, particularly in Sri Lanka. Therefore the present study aims to estimate CH_4 and CO_2 flux rate from the open dumpsite in Karadiyana, Sri Lanka which has been functioning for over 30 years. The dumpsite under study was split into eight different cells according to the surface variations. The gas emissions are estimated using the standard static flux chamber technique. Chamber volume and surface coverages were 0.1 m^3 and 0.2 m^2, respectively. The total sample size is 140, with three replicates at each sample location. Moisture and organic content of the surface layer were measured, and necessary surrounding environmental conditions such as atmospheric pressure, temperature, and relative humidity were measured with the sampling. Results indicate that the flux rates are highest in trench areas where leachate is flowing (36,854 and 139,657 mg m^{-2} h^{-1}) while it is lowest in the cell of mixed waste covered with a layer of compacted soil (110 and 400 mg m^{-2} h^{-1}). High values were also reported from the cell of old mixed waste saturated with water/vegetation grow on the waste (14,659 and 58,817 mg m^{-2} h^{-1}) and the cell with slightly degraded organic waste/ wet (9,864 and 60,716 mg m^{-2} h^{-1}). Low values were reported from cells of New wet organic waste (6,687 and 52,652 mg m^{-2} h^{-1}), highly thick (around 5 m) organic waste covering the old mixed waste (5,627 and 2,433 mg m^{-2} h^{-1}), Old mixed waste covered by vegetation (2,382 and 4,943 mg m^{-2} h^{-1}) and Old mixed waste/ recently mixed (656 and 400 mg m^{-2} h^{-1}). The flux rate of CH_4 and CO_2 of each cell were mentioned, respectively. The moisture content of the surface layer has shown a positive correlation with both CH_4 (0.82) and CO_2 (0.66) flux rate. Meanwhile, Organic content is also positively correlated with CH_4 (0.59) and CO_2 (0.49). Wet conditions create an anaerobic environment and lead to fermentation, acetogenesis, and methanogenesis. These processes produced a considerable amount of both types of gases, and the results obtained in this study showed a positive correlation (0.85) between CH_4 and CO_2 emission rates. Compacted soil layers trap the gases and decrease the emission rate.

Keywords: Emission, Greenhouse gases, Calculation, Waste