

Landfill Gases at an Abandoned Open Dump: A Case Study from Udapalatha/Gampola Site in the Central Province of Sri Lanka

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Haphazard dumping of the municipal solid waste mostly observed in developing countries, where the waste is dumped in an uncontrolled manner. Although landfill gas is an important factor which causes odor and indicates stability of the waste, there are very limited studies on the uncontrolled open dumps. In this study, landfill gas samples at 1 m depth from an abandoned open dump in Udapalatha (N 7° 09', E 80° 35') in the Central Province of Sri Lanka were collected on the end of November 2011 and the typical landfill gas composition such as O₂, N₂, CH₄, CO₂, H₂, H₂S, and N₂O were measured. Buried waste samples at 1 m depth were also taken from the site and organic carbon and nitrogen contents in the residue (smaller than 2 mm) were measured. The samples were taken from some marked plots inside the dump with waste ages of around 0.5 and 7 years (AOD_{0.5} and AOD₇) and outside intact. For comparison, landfill gas samples were also taken from another open dumping, Gohagoda (N 7° 19', E 80° 37') and an engineered landfill in Nuwara-Eliya (N 6° 58', E 80° 48'), those are under operation, in the same province.

Measured CH₄ concentration for AOD_{0.5} and AOD₇ ranged in 19-58 % and 0-12 %, respectively, suggesting that the dumped waste at 1 m depth was in the process to be the 'stabilization phase', where the CH₄ concentration is normally less than 45 %, at least 7 years after dumping. This is likely to be a much shorter time period to reach the phase after dumping than those in mid-latitude regions (typically in several decades). Measured CH₄ concentration for both Gohagoda and Nuwara-Eliya ranged in 56-57 %, suggesting that the waste inside were not stabilized. The carbon contents in the waste residue in AOD_{0.5} and AOD₇ were 151 and 29 mg g⁻¹, respectively, implying that high waste decomposition and leaching of organic compounds might be enhanced due to high temperature and precipitation at the site. A further study for the landfill gas and waste quality in the deeper layer is required to judge whether whole of the dumpsite had reached the stabilization phase rapidly. Besides, relatively high values of N₂O concentration were observed in some plots at AOD₇ (95 and 39 ppmv), suggesting that nitrification was stimulated due to time-dependent aerobic conditioning in the 1 m depth (measured O₂ concentration for the plots ranged in 13-18%). This indicates that nutrient leaching through runoff and surface water might give an impact to groundwater environment at open dump sites even in the stabilization phase.

Keywords: landfill gas, nutrient leaching, open dump, organic carbon, Sri Lanka, waste decomposition