Quantifying the Generated and Percolated Leachate through a Landfill’s Lining System in Gaza Strip, Palestine

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Abstract

Landfills are one of the main soil and groundwater pollution sources in Gaza Strip/Palestine. By addressing Deir Al Balah landfill, this study aims to quantify the generated and percolated leachate quantities through the landfill’s lining system toward the groundwater aquifer. Leachate volumes have been quantified using two different approaches, namely the hydraulic evaluation of landfill performance (HELP) model and the water balance method (WBM), and then compared with the measured quantities by the landfill’s management. Results of the HELP model showed that the average annual generated leachate volumes were 8,087 m³ from 1997 to 2014, while the average annual percolated leachate volumes were 717 m³, which represented 8.9% of the generated leachate amounts. However, WBM results for the average annual leachate during the same period were 7,568 m³. The landfill’s leachate was mainly originated from the moisture content of the dumped wastes, whereas the rest came from the infiltration of the rainfall and re-circulated leachate. The cumulative modelled leachate amounts by HELP model and WBM were close, and with a difference percentage of 6.6%. However, both methods’ results were higher than the measured leachate amounts. In conclusion, suitable mitigation measures are required to minimise the potential threats on to groundwater due to leachate percolation.

Keywords: landfill leachate, HELP model, water balance method (WBM), soil and groundwater pollution, Deir Al Balah landfill

Introduction

Waste landfilling is still the most dominant and viable method for waste disposal all over the world. Due to its economic advantages, it has been used for disposal of nearly all waste types, especially in developing countries.

As a consequence of the waste degradation process in landfills, highly polluted leachate and gases are produced in huge quantities, which may gradually be released to surrounding ecosystems.

Even the development of landfilling technologies from uncontrolled dumpsites to sanitary landfills still represents potential threats to the environment [1]. In recent decades, numerous studies have highlighted the associated social and environmental risks imposed by landfill leachate,