Preface

Sustainable management of municipal solid waste (MSW) has become a big issue due to increasing population, unplanned urbanization, and rapid industrialization in recent times. This problem is more critical in developing countries, where economic, human, and other acute resources usually are limited. Pollution of air, water, and soil, because of unmanaged open dumping sites wastes results to risk for disease, disability, and serious health problem. The threat to the groundwater from the unlined and uncontrolled open dumping sites exists in many parts of the world, particularly in the underdeveloped and developing countries where the hazardous industrial waste is also co-disposed with municipal waste, and no provision of separate hazardous landfills exists.

Therefore a strong necessity is now being realized to take appropriate remedial measures to avoid contamination of the underlying soils and groundwater aquifers from the MSW leachate. At present municipal solid waste dumping sites in Varanasi city not lined and there is no establishment for the collection of leachate. Groundwater near the dumping areas is very prone to leachate contamination during the rainy season.

Therefore this work is a focus to assess the leachate characteristics and its impact on groundwater quality around the two major MSW dumping sites of Varanasi, city namely Karsara and Ramna.

Leachate pollution index (LPI) is a tool used to know the overall pollution potential of the MSW leachate.Water quality index (WQI) is an effective monitoring method used to assess the groundwater quality near the open dumping sites for drinking purpose. Spatial interpolation of WQI is performed in a

Geographical Information System (GIS) environment to estimate the status of groundwater quality in the study area. Visual MODFLOW software is used to know the groundwater flow direction and velocity in the study area that provides a link between leachate percolation and groundwater pollution.TDS and NITRATE contaminants transport modelingshow a distinct pollutant path line from MSW dumping site to nearest observed wells and its path are towards the groundwater flow direction.

The entire thesis has been divided into six chapters and their brief explanation was specified as follows:

The first chapter focuses on the general introduction of the total municipal solid waste generation, Leachate characteristic of landfills of different ages and groundwater pollution by leachate percolation. The secondchapter discussed the literature review part with information on various relevant aspects of the objectives of the research.

In the third chapter, location, geology and soil type of the study area around the selected Ramna and Karsara dumping sites were described in details with maps. The fourth chapter emphasizes the surveying of the study area data collection, flow chart of the methodology and the software used. Procedure and methodology of physico-chemical analyses of leachate and groundwater samples were described in details. The procedure of calculation of leachate pollution index (LPI) and water quality index (WQI) was explained with the equation. Groundwater flow modeling and contaminants transport modeling were discussed in this chapter with their required input data. Model governing equation and model calibration were also discussed.

Result and discussion of the leachate characteristic of Ramna and Karsara MSW leachate samples explained in the fifth chapter. The six chapter included the conclusion of the complete research work for assessment of groundwater quality around the open MSW dumpingsites of Varanasi city. Significant and nobility of the research work briefly explained. Some recommendation for groundwater contamination from leachate also discussed.

The LPI and WQI can be a very useful information method for landfill design makers and the public. This studied play an important role in protecting the groundwater from good water quality to become threatened water in a future perspective.

This study suggests an urgent need fordesigned engineered based landfill to control and minimize the impact of MSW leachate on groundwater quality around the dumping sites. This study is also helpful for the suitable landfill site selection to landfill strategy makers and the government authorities to safeguard groundwater pollution risk from the open dumping sites and act as a scientific method for spatial pollution monitoring program.

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