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Assessment of Groundwater Quality in and around the Jawaharnagar Municipal Solid Waste Dumping Site at Greater Hyderabad, Southern India

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Abstract

Rapid urbanization and population growth are largely responsible for exponentially increasing rate of solid waste in the urban areas. The proper management and recycling is a major problem of Municipal Corporation which is great concern of human health and environment. The purpose of this study is to assess groundwater contamination in and around of Jawaharnagar Municipal Solid Waste (MSW) dumping site due to heavy metals and its relationship between hydrochemical data. Groundwater samples were collected from the wells located in the vicinity of the dumping site and its surrounds in a watershed. The samples were analyzed for physicochemical properties as well as for major ion concentrations such as Ca^{2+} , Mg^{2+} , Na^+ , K^+ , CO_3^{2-} , HCO_3^- , Cl^- , NO_3^- , F^- and SO_4^{2-} using ion chromatograph. Results suggest the high concentrations of major ions such as Ca^{2+} , Mg^{2+} , and F^- is observed in groundwater indicating differential weathering of minerals present in granite rocks in the study area. A good number of samples are showing higher values for NO_3^- than that of World Health Organization (WHO) drinking water guideline values. This demonstrates the oxidation of ammonia and similar sources from leachates originating from municipal solid waste of the study area. Further, heavy metals such as Cd, Cr, Cu, Fe, Mn, Pb and Zn are analyzed using Inductively Coupled Plasma-Mass Spectrometer. The data revealed elevated concentrations of Arsenic (0.04-0.36 ppb), Cadmium (0.00-0.09 ppb), Chromium (24.0–28.0 ppb), Copper (0.61–2.9 ppb), Iron (11.99-35.26 ppb), Manganese (1.04-107.2 ppb), Lead (0.19-1.32 ppb) and Zinc (1.49 –49.59 ppb). The present study demands proper management of landfill site and municipal solid waste to reduce further groundwater contamination via percolation of toxic substances.

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1. Introduction

The generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in the developing countries. The rapid expansions of urban, industrial and commercial activities prompted by rapid population growth are the major cause for producing huge amounts of solid wastes. The quality of the municipal solid waste (MSW) depends on various factors such change in the life style, food habit, standard of living and cultural tradition of inhabitants and climate. The quantities of MSW generation rate both in terms of per day and per capita basis for the seven most important metros cities as shown in Fig.1 in accordance with CPCB report [1]. Further, Indian Ministry of Urban Development has estimated waste generation is about 100,000 MT in its manual on solid waste management. It is observed in most of the Indian cities dispose off their waste simply by open dumping and only few (94) landfill sites have been constructed/operational in the country out of which 34 new landfills have been constructed during 2014 that exhibits the threat on environment [2]. Lack of appropriate MSW management leads to significant soil, water, air and aesthetic pollution which is associated human health problems, as well as an increase in greenhouse gas emissions [3]. Further, if the solid waste disposal facilities are not properly designed these landfill sites has further contributed to environmental degradation especially the groundwater resources. Landfills have been identified as one of the major threats to groundwater resources areas near landfills have a greater possibility of groundwater contamination because of the potential pollution source of leachates originating from nearby sites [4-7]. It has been observed few studies reported impact of landfill on groundwater quality and no detailed report on the present site to the best of our knowledge. The present study made an attempt to evaluate impact of groundwater contamination due to heavy metals and its relationship between hydrochemical data in and around of Jawaharnagar Municipal Solid Waste (MSW) dumping site.

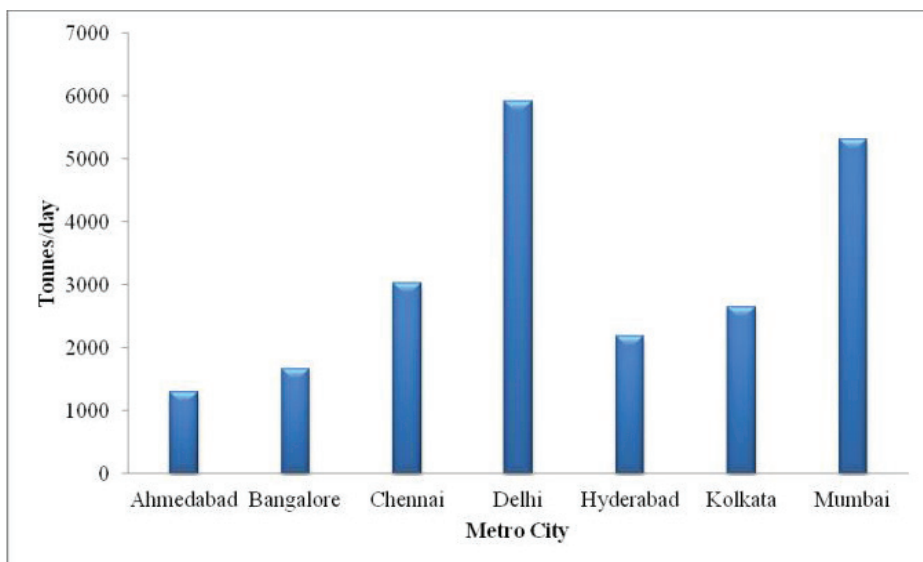


Fig. 1.MSW generation rate per day for the seven major metro cities of India

2. Materials and methods

2.1 Study area:

2.1.1 Description of the study area

The Jawaharnagar municipal solid waste dumping site and its surroundings is under urban local body called

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