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Research Article

COMPARATIVE STUDY ON HEAVY METAL CHARACTERISTICS OF LEACHATE FROM MUNICIPAL SOLID WASTE IN CENTRAL INDIA

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ABSTRACT

Rapid urbanization and population growth are largely responsible for very high increasing rate of solid waste in the urban areas, its proper management and recycling is major problems of Municipal Corporation. The analytical analysis revealed that the leachate show high concentration of heavy metals viz., Pb, Zn, Fe, Mn and Cu. However, their high concentration in municipal solid waste leachate may cause contaminants for environmental pollution. Therefore, present investigation deals with analyze the heavy metals concentration in municipal solid waste leachate.

Keywords: Municipal solid waste, Leachate, Heavy metals.

INTRODUCTION

The population of India has increased fivefold over the last fifty years undergoing. Population explosion in its urban areas mainly due to rural migration. Municipal solid waste comprises all the wastes arising from human and animal activities. According to WHO (World Health Organization) solid waste can be defined as useless, unwanted or discarded materials arising from domestic, trade, commercial, industrial, and agricultural as well as from public services. Recently MSW management has become a serious environmental problems and one of the major growing concerns for urban areas all over the world (Adamety et al., **2009**; Gautam et al., **2010a**; Chu et al., **1994**; Tatsi and Zouboulis, **2002**; Zhang et al., **2008**). In India approximately 70% of municipal solid waste is disposed on open dump site (Ludwig and Black, **1968**; Apaydin and Gonullu, **2007**; De Rosa et al., **1996**). This open dumping of MSW is generated leachate by excess rainwater percolating through the waste layers in a landfill. It contains a large amount of contaminants such large number of hazardous compounds, including aromatics, halogenated compounds, phenols, pesticides, heavy metals, and ammonium, which can be assumed to be hazardous even in small amounts and their detrimental effects are often caused by multiple and synergistic effects (Christensen et al., **2001**; Oman and Rosqvist, **1999**; Lu, et al., **1985**; Flyhammar, **1995**; **1997**; Varank et al., **2011**, Filip, et al., **1985**; Feng, et al., **2007**; Fan, et al., **2006**; Le et al., **2012**) which likely to pollutes surface and groundwater (Ellis, **1980**). Variety of metals like Cr, Cd, Cu, Mn, , Pb, Zn and Fe are (Abu Rukh et al., **2001**; Yanful et al., **1988**) harmful pollutants always associated with municipal solid waste leachate and contaminate the surrounding environment (Zygard et al., **2007**; Nagao et al., **2002**; Umar et al., **2010**; Kjeldsen and Christophersen**2001**; Baun and Christensen, **2004**; Wang and Wang **2013**). The characterization of heavy metals in landfills leachate has given rise to a number of studies in recent years by several researchers (Abu-Rukah and Al-Kofahi**2001**; Saarela, **2003**). Although numerous studies in literature (Foose et al., **2002**; Kalbe et al., **2002**; Edil, **2003**; Lo et. al., **2004**; Haijain et al., **2009**; Chalermtanant et al., **2009**; Lu et al., **2011**) have been conducted to investigate the heavy metals in landfill leachate. However, This research work studied the contributions of selected municipal refuse dumps to heavy metals concentrations in leachate samples in Jabalpur city. Therefore present study deals with to compare the measured values with established standards from CPCB and WHO guidelines make conclusions and propose recommendations to guide towards ensuring a safer environment through better management of refuse generated from city.

MATERIALS AND METHODS

Survey and Sample Collection:

The study was conducted in July- October 2011 in Jabalpur city located Center of the country. The total land area of city is 22 km^2, which included 2 km^2 urban and 20 km^2 rural areas. It had a population of above the 21 lack people comprising 3,379 households (Gautam et al., **2010**). The study covered with

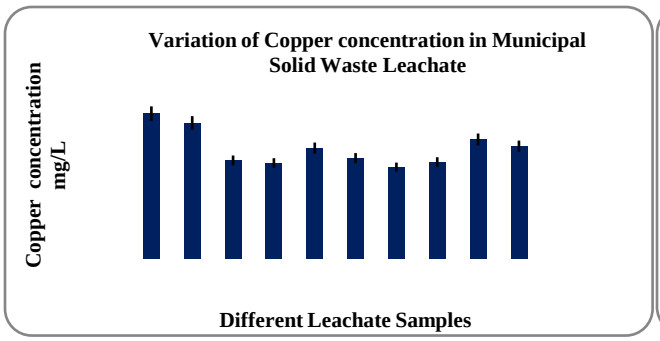
different MSW dumping area. A systemic survey was conducted in rainy season of year 2011from different MSW dumpsites. All leachate samples were collected from MSW dumping sites. A composite surface leachate sample scooped from the landfill. Samples were stored at 4^{o}C for until used for analysis.

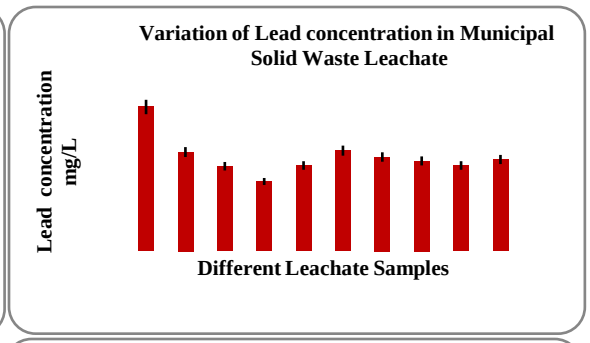
Analysis of Heavy Metals:

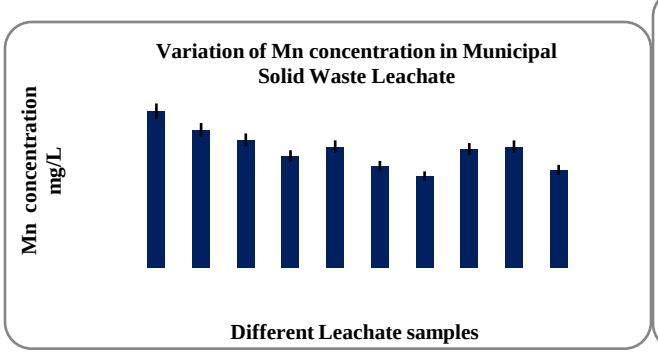
All the collected samples were analyzed for heavy metals (Pb, Zn, Fe, Mn and Cu) were analyzed and determined by Inductive Coupled Plasma-mass spectrometer (ICP-MS) as per standards method (APHA, **2005**).

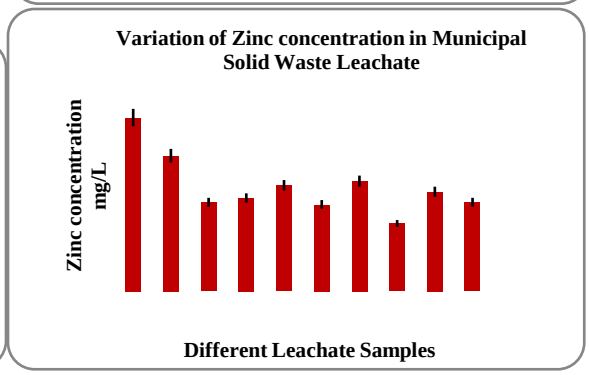
RESULT AND DISCUSSION

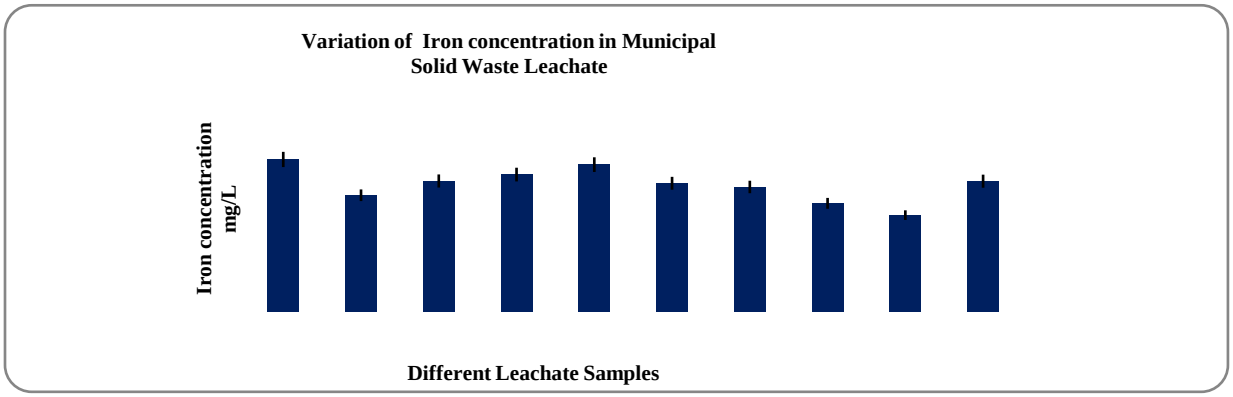
Many studies have shown that MSW leachate receive loads of contaminants that are usually greater than in the surrounding sub-urban or rural areas due to the concentration of anthropogenic activities of urban settlements (Charlesworth et al., **2003**; Kormanicki, **2005**; Othman and Ghandour, **2005**; Lee et al., **2006**; Yang et al., **2006**; Srivastava and Jain, **2007**). The high level of Fe (46.7±0.2 to 73.6±0.3 mgL^{-1}) in the leachate sample indicates that Fe and steel scrap are also dumped in the landfill. The dark brown color of the leachate is mainly attributed to the oxidation of ferrous to ferric form and the formation of ferric hydroxide colloids and complexes with fulvic/humic substance (Chu, et. al., **1994**). The presence of Zn (2.8±0.2 to 3.2±0.2 mgL^{-1}) in the leachate shows that the landfill receives waste from batteries and fluorescent lamps. The presence of Pb (9.1±0.2 to 19.2±0.2 mgL^{-1}) in the leachate samples indicates the disposal of Pb batteries, chemicals for photograph processing, Pb-based paints and pipes at the landfill site (Moturi et al., **2004**; Mor et al., **2005**). Cu concentration range from 62.3±0.3 to 39.3±0.2 mgL^{-1} were present in the leachate samples. A variety of waste is dumped in different landfill site of the city, which likely indicate the origin of Zn, Pb, Cu, Mn and Fe in leachate. Similar results also reported by other researchers the presence of excess concentration of these heavy metals in leachate (Christensen et al., **2001**; Baun and Christensen, **2004**; **1998**; Kjeldsen and Christophersen. **2001**). Many authors contributed that the leachate characteristics demonstrate high variation and which range of physical, chemical and biological parameters may vary (Umar et al., **2010**). These heavy metals such as Pb, Cu, Cd, and Zn are generally found to be present to a large degree as particulate or colloidal matter in leachate, and thus accumulate in leachate sediments (Zygard et al., **2007**; Cadee, **1985**, Klinkhammer and Palmer, **1991**; Ribera et al., **1996**; Nagao et al., **2002**). A study conducted by several researchers and it was revealed that high levels of heavy metals particularly Pb, Cd,Cu and Cr in soil near MSW dumping sites (Kimani, **2010**; Awokunmi et al., **2010**; Adelekan and Alawode, **2011**). It was also found that the people living and schooling near the dump sites indicated a high incidence of diseases that are associated with high exposure levels to these metal pollutants (Begun et al., **2009**; Amusan et al., **2005**). These kinds of findings indicate that the several risk associated with municipal waste dump.











CONCLUSION

The present investigation revealed that the leachate contain high concentration of heavy metals. In addition, most of the heavy metals concentration in leachate is exceed the maximum permissible limit into the natural environment of materials hazardous to the aquatic environment. Earlier works revealed that various heavy metals found in high concentration in municipal solid waste leachate. These findings will be of immense help to researchers and environmental regulators working in related research work.

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