

**Impact of Plastic Waste Disposal
on
Soil and Water Quality
at
Lucknow Dumpsites)**



CENTRAL POLLUTION CONTROL BOARD
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EXECUTIVE SUMMARY

Impact of Plastic Waste Disposal on Soil and Water Quality

Solid waste management is an integral part of urban environment and planning of the urban infrastructure planning to ensure safe & healthy environment. While considering the promotion of sustainable economic growth, the rapid & unplanned industrialisation, urbanisation and population growth have resulted in proliferation of consumer articles vis-à-vis generation of waste. Plastic products have become an integral part in our daily life as a basic need. Plastics are non-biodegradable material, synthetic polymers derived primarily from petro-fossil feedstock and made-up of long chain hydrocarbons. Various additives and chemicals are added during manufacturing process to give plastic desired properties. These additives are not chemically bonded and have tendency to leach out during usage, storage and disposal. Plastics impose huge risk to Environment, Human Health and Ecology. Disposal of plastic waste is becoming a serious concern in India

Acknowledging rampant usage of Plastics, thereby increased generation of plastic waste in Municipal Solid Waste (MSW) and anticipating the threat plastics impose, CPCB –Central Pollution Control Board, sponsored a study to Indian Institute of Toxicological Research (IITR), Lucknow on “Impact of Plastic Waste Disposal on Soil and Water Quality” at Lucknow dumpsites to validate the effect of plastic waste dumps on soil and underground water.

IITR Lucknow is a constituent organization with the CSIR -Council of Scientific and Industrial Research, under the Department of Science and Technology Government of India, founded in 1965 with a NABL accredited laboratory for biological and chemical testing. It is multidisciplinary research institute with the motto of "Safety to Environment and Health and Service to Industry".

CPCB & IITR selected two dumpsites were selected in Lucknow City, i.e., Ghaila at Hardoi Road and Dudauli at Sitapur Road for extensive study. Detailed Study was conducted for 18 months at dumpsites. Control samples, were collected near (within 200 meters residential area) municipal waste dumpsite area from tube well or hand pump, used by local people. Also, Extensive soil and water sampling done up to 36 meter depth in Pre and post monsoon seasons and results were analyzed. This study has been conducted to validate the leachability of heavy metal – Cadmium, Cobalt, Chromium, Copper, Lead, Molybdenum, Titanium and Zinc (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn) and Phthalates ester (DMP, DEP, DBP, DEHP & DOP) from plastic waste into Soil and Water. Phthalates esters are esters of phthalic acid and are mainly used as plasticizers. Plasticizers are added to plastics to increase their flexibility, transparency, durability, and longevity

The soil and water quality testing data revealed that chemical moieties like Heavy Metals, Chloride, Phthalates etc. migrate from plastic waste into the surrounding Medium because these plastic additives are not chemically bonded to the polymeric chain and remain present as freely mobile and leachable phase. These additives migrate from plastic to the environment during landfill conditions due to physico-chemical exertion and microbial degradation.

The leachate cause considerable pollution problems by contaminating the surrounding soil, ground and surface waters. Data obtained from TCLP-Toxicity Characteristic Leaching Procedure of dumpsite samples contained significant amount of analytes indicating migration of chemical moieties from plastic waste. Concentrations of these Phthalates Esters were far more than limits prescribed by USEPA and WHO in both Control water samples and experimental water and soil samples.

Control Water Sample	Mean concentration (SD) of phthalates (mg/l)				
	DMP	DEP	DBP	DEHP **	DOP
Pre--Monsoon	BDL	0.958 ±0.258	0.747 ±2.12	1.005 ±2.46	0.462 ±1.35
Post--Monsoon	BDL	1.033 ±2.95	0.832 ±2.37	1.358 ±3.45	0.517 ±1.51

- *The permissible limit for DEHP is 0.006 mg/ litre as per USEPA & 0.008 mg/ litre as per WHO.*
- *DEHP is more than 100 times than the limits & spells extreme danger to the environment & living beings.*
- *These values revealed that DEHP were found to be present in 52.0% of the total phthalate concentration, while the*
- *DMP was the least detected phthalate.*
- *Detected phthalate concentration was found in the order DEHP > DEP > DBP > DOP > DMP*

Heavy metals in water samples mainly Cadmium, Cobalt, Chromium, Copper, Lead, Molybdenum, Titanium and Zinc (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn) were analysed in control water samples and experimental water samples. The analytical data revealed that Cd, Co and Ti were found below detection limit (BDL). However Cu & Zn were found to be present in significant concentration.

Avg. concentration(mg/l)	Control		Experimental	
	Pre monsoon	Post monsoon	Pre monsoon	Post monsoon
Copper (Cu)	0.084	0.244	0.047	0.062
Zinc (Zn)	0.699	0.624	1.413	0.841

The extent of leachability of inorganic pollutants depends upon the pH of the landfill matrix. As the landfill age increased, the consequent increase in pH values caused a certain decrease in metal solubility. Accumulated dumped waste contained high plastic contents as well as hard soil profile of low infiltration capacity caused water logging. Availability of phosphorous and potassium was found to be higher in control soil samples than dumpsite samples indicating the depletion of nutritional quality of dumpsite soil due to dumping of plastics waste.

This study clearly validates the hazardous nature of Plastics waste and its threat to Environment, Human health and ecology. Plastic wastes leach Phthalates Esters to Soil and Ground water during landfill conditions due to physic-chemical exertion and microbial degradation. Plastics waste also depletes the nutritional quality of Soil and makes it unfertile.