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Assessment of Heavy Metals Contamination in Water, Soil and Plants around the Landfill in Khanewal Pakistan

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ABSTRACT

Solid waste has the developed into an issue of mounting environmental concern in emergent countries owing to improper management of waste. Landfills have been well-known like latent sources of heavy metals contamination in the environment. The community solid waste Kotallasingh landfill is the main landfills in Khanewal. This research was intended at the determined the values of different heavy metals present in water, soil and plants around the landfill site in Khanewal, Near the Fazal Park kotallasingh was investigated. Its contact on heavy metal contamination (Cadmium, Lead, Zinc, Copper, Arsenic and Chromium) of groundwater, plants and soil has been systematically determined. Samples were collected and digested with standard wet digestion method. Concentrations of six heavy metals, namely: (Cd, Cr, Pb, Cu, As and Zn in water, soil and plant (Spinaciaoleracea (spinach) and Capsicum annuam) samples were measured using atomic absorption spectrometry (AAS). The levels of the heavy metals contamination in the groundwater exceeded than the values traditional for water proposed for utilization. Lead observed the high levels, as the lowest were record for cadmium in every sample. The contamination of heavy metals namely: zinc, chromium, nickel, cobalt and lead in the soil samples of the landfill and around open ground were observed the elevated than the globally tolerable limits for the soil. Heavy metals contaminations were generally higher owed to leaching and increased airing and intensity of rainwater.

Investigation illustrates the total means the contamination of the heavy metals decreased by the profundity in the soil samples, and space from the landfill. Probable sources of the concentration also discussed. And notable investigation was that the contamination of the heavy metals in report exceeded highest acceptable levels. The recent research confirms that the marl is provisional authoritative obstacle, in the front of eternal rising contamination, generated through the decay of squander in the landfill of the Khanewal.

Keywords: *Utilization, Investigation, leaching, generally, Heavy metals, landfill*

INTRODUCTION

Environmental toxic waste via heavy metals is the mainly hazardous rudiments of pollution and is predominantly harmful for individual human being health. The community toxic waste dump places are latent sources of soil, drinking, surface waterand plant contamination through important metals(Pattnaik and Reddy, 2009). The chief causesof the various metals in landfills are the disposed manufacturing dump, burning process ashes, excavation dump and domestic toxic components like as electric-batteries, paint, dyes and ink (Baun *et al.*, 2004). Pollution of soil via heavy metals from dump disposal places is a severe dilemma in manufacturing and populated places (Mor *et al.*, 2006).The contamination rate of the groundwater water located near landfills is higher for the probable polluting sources that around. Many landfills lacking drainage systems lead to the occurrence of toxic and threatening metals involving heavy metals in groundwater tables(Erses and Onay2003).Wastes on dumpsite generally contain toxic metals that are alarm and cause hazards for the public in touch among the polluted soil and plants. The substance compositions of the solid waste materials frequently guide to alter in soil chemical and physical properties due to contaminations (Hazra and Goel,2009).Water is one of the basics that support all living things such as plants and animals. It is obtained as of both main natural mediums, surface water in which includes: fresh water, lakes, river, and stream and other than is ground water in which includes: well and borehole. In nature water does not exist as pure, has contaminants that

arise from immediate by human and animals(Papageorgiou,2006).

Soil contaminations through toxic heavy metals are enormous unease to community health. The toxic heavy metals are originated in nature in the uninterrupted soils, in detail, minute amounts of a lot of heavy metals are mandatory by vegetation to stay vigorous. Heavy metals originate in public waste found in different kinds also the uncontaminated toxic metals. The quality of heavy metals impairing of our surroundings appear commencing diverse sources that can be categorized into municipal manufacturing aerosols, fluid and solid wastes, from animals, manufacturing, farming, mining and agricultural substances(Seignez *et al.*, 2008).

Vegetables comprise the significant ingredient of the people's food because which has contains vitamins, carbohydrates, minerals and proteins like as trace elements. Heavy metals accumulations through vegetables are depend on plant variety with heavy metals concentration. Heavy metals are not rich in soil, other than accumulated during removal of sewage water. The effluents of sewage are measured not merely a wealthy cause of organic material with extra nutrients however as well they make higher the values of these metals like lead, copper, cadmium, arsenic and chromium in getting vegetable of soil (Bhattacharya 2012).

Vegetables have been introduced toward be central component for the human food since these are the particular part of the balanced food; vitamins, carbohydrates, minerals and protein (Birch *et al*., 2008). Further, liberate and succeeding statement of the toxic metals in food items similar to vegetables and fruits never emphasized (Dospatliev *etal.*, 2012). Toxic heavy metals are movable and effortlessly in use up through the plants in environment (Ddepoju-Bello *et al*., 2013). Accumulation of metals in vegetables might cause an express risk to public health. Many chemicals take place physically in the surroundings like significance of usual actions. Different diseases and health problems are caused through the incapability of the surroundings to carry the vitals mineral requirements of peoples, animals and plants(Benson and Ebong, 2005).

EXPERIMENTAL

Study Area

District khanewalis the district of the Punjab province. District khanewal is the host place of the 2nd biggest railway station in the Pakistan. Khanewal is situated at 30°18'0N to 72°56'0E through altitude of 129 meters (www.kwl.com).

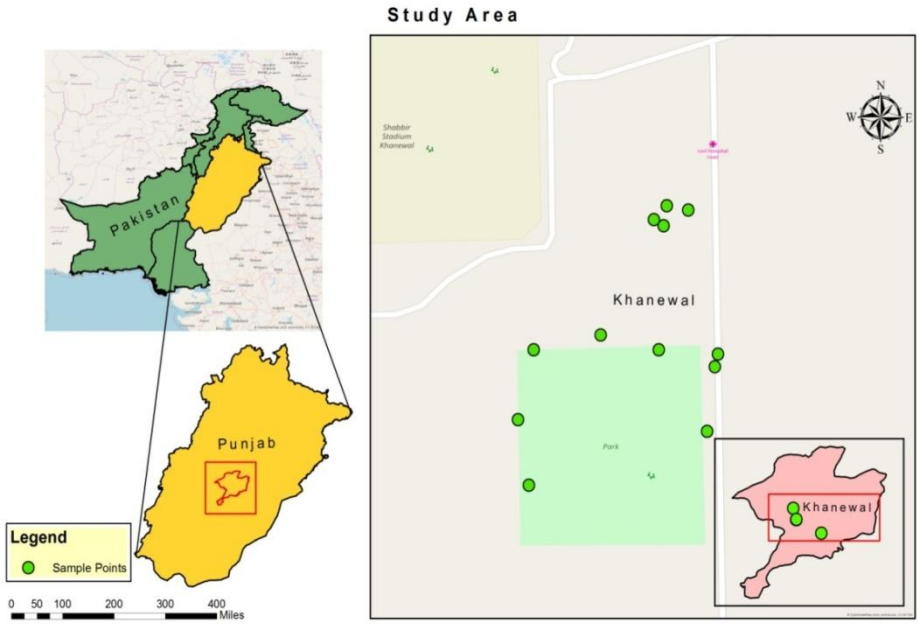

Figure 1. *Map of Sampling Place*

SAMPLING

Plants, water and soil samples were collected at several places on the Landfill near Fazal park kotallasinghKhanewal in July 2017. Combined samples were taken to offer an accurate illustration of the sites. The twelve samples

taken of each category like plants, water and soil and three sample of control for compare. The main soil forms in this area were recognized by a partially exhaustive soil plot of Khanewal. The soils samples were taken from the landfill and selected distances: have several meters from the landfill. The known soil forms were sampled taken by stainless steel soil picker equipment to collect center samples at 0 to 20 and 20 to 35 cm soil lowest point. Every soil sequence, 12 core samples, at random taken and were similar each other and compound samples were pickkept the sample in a polyethylene carrier and tagged them. Collected water by different motors from the houses water were sampled on the landfill and from residences 100m and 200m from the landfill, and composite samples were taken to present a proper demonstration of every point.

Spinaciaoleracea (spinach), *Capsicum annuam* (Chili Pepper), vegetables plants originate growing on the decline abandon be arbitrarily uprooted, packed into polythene bags and rinsed with distilled water to take away rubbish, debris and microorganisms, and partitioned into part eating portion fruit past to investigation in the laboratory. The entire collected samples were appropriately cataloged and brought to laboratory for preparation for further analysis.

Sample Preparation For Various Analyses

The entire systematic techniques worn in this project have various procedures of sample preparation. All mandatory that the samples are accessible in like a mode the apparatus used might be notice. Heavy metals in plants, water and plants were determined by atomic absorption spectrometer. Necessities for influential metals by atomic absorption spectrometer differ with metals in samples.

Instruments

The heavy metals were analyzed through FAAS. Determinations of heavy metals (lead, cadmium, copper, chromium, arsenic, and chromium) in all the studied samples were performed by the FAAS.

RESULTS AND DISCUSSION

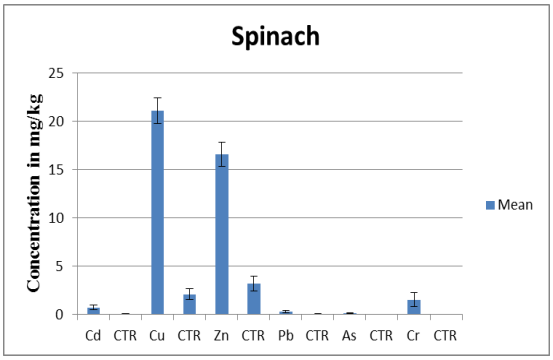

Figure2. *Heavy metals concentration in Spinach*

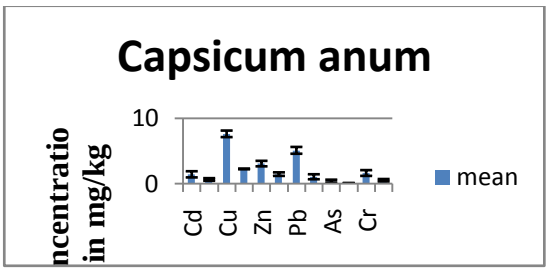

Figure3. *Heavy metals concentration in Spinach*

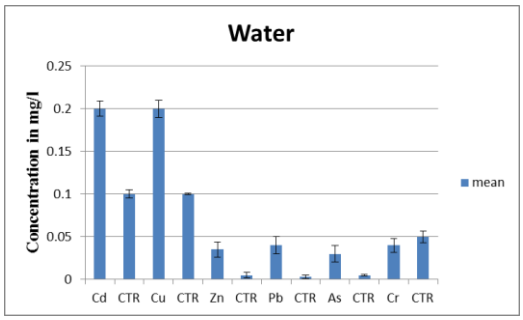

Figure4. *Heavy metals concentration in water*

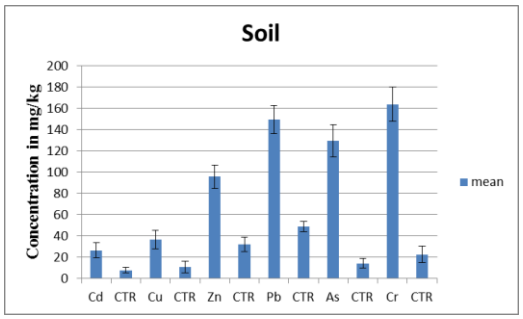

Figure5. *Heavy metals concentration in Soil*

Table 1. *Average concentration of each metal given with its Control in Water samples mg/l*

	Cd	CTR	Cu	CTR	Zn	CTR	Pb	CTR	As	CTR	Cr	CTR
mean	0.2	0.1	0.2	0.1	0.035	0.005	0.04	0.003	0.03	0.005	0.04	0.05
SD	0.01	0.005	0.01	0.001	0.009	0.003	0.01	0.002	0.01	0.001	0.008	0.007

Table 2. *Average concentration of each metal given with its Control in Soil samples mg/kg*

	Cd	CTR	Cu	CTR	Zn	CTR	Pb	CTR	As	CTR	Cr	CTR
mean	26.5	7.79	36.6	10.85	95.9	32	149.4	49	129.6	14.3	163.9	22.6

SD	7.12	2.43	8.5	5.5	11	6.62	13	4.97	15	4.42	16	7.62

Table 3. *Average concentration of each metal given with its Control in Capsicum anumsamples mg/kg*

	Cd	**CTR**	**Cu**	**CTR**	**Zn**	**CTR**	**Pb**	**CTR**	**As**	**CTR**	**Cr**	**CTR**
mean	1.4	0.61	7.58	2.22	3.04	1.43	5.06	1.03	0.36	0.05	1.6	0.49
SD	0.47	0.2	0.5	0.05	0.42	0.27	0.52	0.38	0.22	0.03	0.44	0.19

Table 4. *Average concentration of each metal given with its Control in spinach samples mg/kg*

	Cd	CTR	Cu	CTR	Zn	CTR	Pb	CTR	As	CTR	Cr	CTR
Mean	0.75	0.1	21.1	2.12	16.6	3.21	0.32	0.05	0.14	0.04	1.53	0.05
SD	0.22	0.01	1.31	0.55	1.22	0.75	0.1	0.02	0.06	0.01	0.73	0.01

DISCUSSION OF RESULTS

Water

Concentrations of heavy metals in the water were shownin Figure 3 and Table 1.The average concentrations (mg/l) of cadmium, Lead, Zinc and Arsenic in the water at residences near by to the land fill were mostly higher. The higher level of metal in the water additional involves the magnitude of the metal input from lea chates consequential from community waste that leached from the land fill. In the detail, significant levels of Arsenic and lead were found in the water at the landfill site, while the heavy metals concentration in the sample reduced when the sampling distances from the land fill amplified. Lead concentration level in this research is high and is demand for concern. More than 60%water samples some meters from the landfill exceeded WHO maximum acceptable limits for the heavy metals in water (WHO2015).

Lead was found higher due to leaching lead producing waste material like oil and battery acids and electronic equipment around the landfill have a lot of auto workshops. These workshops waste like batteries acid, oil and electric goods are dumped in this landfill. Iqbal and Gupta (2009) have well-known discarding of community rubbishes into water bodies as a significant cradle of water contamination by these metals. They noticed that water by this time there in the remaining or the water produced by putrefaction to gether with rain-water can source leachate to impart the waste-yards into water bodies and containing ground-water.

The study presentedreliability in Cu and Cr concentrations in water found at lower. Though, Cu and chromium concentrations in all water samples all within the WHO permissible limits for water which used drinking. The concentration of cadmium and Arsenic were usually higher in water examined on the landfill. Cadmiummay be found in infrared detectors, chip resistors and semiconductors. Long-standing monitors comprise around 10to 15g of cadmiumand several batteries are prepared of cadmium. Exposure of cadmium generally arises when Cd enters in the surroundings concluded various electric components (CIL 2008).

Another monitored heavy metal was zinc. The limits for Zn stipulated by legislation were exceeded due to waste leaching and human activates around the landfill like chemical manufacturing and domestic sewage. Gazso(2001) noticed that the dense-metals such as zinc come from a variability of cradles buthuman monetary actions for example chemical-manufacturing, coal and metal oremining, melting and metal purifying, gasoline mining and purifying, metal-electroplating, electric power generation, and to some amount of housing sewerage are mostly accountable.

Soil

Soil is the strategic component of the Earth structure alsoit controls the biological, erosion, geochemical and hydrological cycles. The soil structure also offers services, things and assets to human-being (Berandse2016). That is why, it is essential to study how soils are struck by the utilization by human societies and anthropogenic activities. Defilement is one of those detrimental human actions and we call for further info and evaluation of land contamination.

Figure 4 and Table 2 summarize the mean of heavy metals concentration (Cd, Pb, Zn, Cu, As and Cr) in the soil on the several depths from the landfill. The heavy metals concentrations were found generally higher which could be attributed to the percolating of the cation's down the profile by precipitation and rainfall (Chinwe *et al.,* 2010).High concentrations of Pb due to Soils contiguous to hefty traffic volume area in

Khanewal city and hectic road-ways have the peak absorptions of lead. The other main cradle of lead in housing soils is leaded-paints. The absorption of these lethal components in soils maybe resultant from different cradles, as well as anthropogenetic contamination, weathering of natural eminent rocks and metal wedges and due e-waste dump may be due to the disposals of cathode ray tubes, computer monitor glass, printed wiring boards, and lead-acid batteries (Asaah and Abimbola, 2006).

The result showed significant differences in the distribution of zinc and copper in the soil. This could be attributed to percolating conforming to report of recent investigation by (Chinwe *et al.*, 2010). Heavy metals (Zn and Cu) contamination of soil can take place as a consequence of anthropogenic activities for instance agriculture, mining, manufacturing, melting techniques and along with natural-activities (Navarro 2008).

For the arsenic, some analyzed soil samples surpassed the limits particular in the order, as displayed by the graphs listed in Figure 4. Several of the poised soil samples surpassed the limits traditional in the applicable legislating increase due to arsenic is mainly utilized as an pesticide, weed killer, additive for timber because of its disinfectant ability and fight to decomposing and disintegration, in this landfill correspondingly. Municipal developing of gardening puts that comprised lethal levels of metals like Pb, Cu and As in soils ensuing from too much utilization of herbicides and fungicides which are opulent in these metals (Pieterzak and Uren 2014).

Chromium concentration analyzed in the soil is higher the acceptable limits for chromium in soil. Chromium and its oxides are broadly used since of their high anti-corrosive and conductivity properties. Chromiumin the soils could be because of waste containing of lead and chromium-plate batteries, abandoned paint-boxes, castoff plastic-things and colored polyethylene-bags (Umohand Etim 2013).The limits for cadmium stipulated by legislation were exceeded at all the sampling points. Concentration of cadmium increased due to migration of leachate in this landfill. Because of relocation of leachate, soilhas been polluted with dense-metals like cadmium, chromium, copper, lead, iron, manganese, zinc and these hefty-metals in compacted rubbishes lead to severe glitches because they can't be bio-moldered (Hongg2012).

Vegetables

Usually, the study of heavy metals the evaluates in the plants on the soil of KotAlla Singh land fill showed the succeeding tendencies (Table 3 and 4). The concentrations of heavy metals in vegetables were higher when compared to the control samples and as well as WHO permissible limits. Lead showed the highest concentration in *Capsicum anum* high than WHO and EU acceptable limits and Lead also noted in *Spinaciaolerace a*(Spinach) is in control limits (Figure 1 and 2). The cadmium increase due to sage of pho phosphate fertilisers, existence in sewerage slurry and different industrialized utilizations for instance Ni and Cd plastics, pigments, plating and batteries around the landfill and near the fields.

The level of Arsenic in samples from the landfill sites varied widely green pepper and observed in spinach correspondingly determined high concentrations in some samples due to the maximum concentrations of total arsenic and cadmium (possibly due to soil contamination on the leaves). Wang *et al.* (2008) shows concentration of Arsenic 0.34 to 0.137 mg/kg in green pepper and 0.089 to 0.251 mg/kg that is greater than the present research.

The levels of chromium higher than acceptable limits by WHO correspondingly. Their existence in the samplings shows the dumping of extensive sums of steel in the site. Although chromium may come from a large number of sources of domiciliary substances, microchip technology and even from vegetal tissues ashes (Adeolu *et al.*, 2016).

From there sults totally plant samples investigated had higher concentrations of the heavy metals. The nutritive suggestion is that users may be exposed to heavy metals harmfulness if bioaccumulation outcomes due to system aticutilization (Asemave *et al.*, 2012).

CONCLUSIONS

Heavy-metal contamination is an issue related with the zones of exhaustive industry. Though, road-ways zones of land fills and vehicles now are regarded to be one of the major bases of hefty-metals. Human presence on Earth is nearly incredible without the dense-metal. Even although significant to human kind revelation to them throughout manufacture, utilization and their uncontrolled expulsion into environ has induced last of threats to human and other creatures and the environment it self diverse

dense-metals utilized by human are conserved to show the noxious consequences on lives.

This research demonstrated that he veggies under the research might rise a health hazard to the persons who deplete them as they were originate to be scarce of important metals like as arsenic, chromium, copper, cadmium, lead and zinc. Moreover, they were retrieved to have greater than tolerable levels of metals such as copper, zinc and chromium. Moreover, the veggies were also noticed to have eminent levels of lethal metals like cadmium and lead.

The soil samplings were analyzed to originate to have greater than acceptable levels of cadmium, chromium, copper, zinc, arsenic, and lead than is permissible for agricultural soil. This study hereby concludes that the landfill studied in this thesis heavily contaminated with lead and copper owing to the anthropogenic activities by automobile lead battery producer. This therefore has made the study area unsafe for humans and agricultural activities.

Analysis of water samples revealed that cadmium, copper, lead and arsenic metals were higher than permissible limit. Dense-metals such as Cr, Cd, Pb, arsenic and zinc were enormously enriched were anthropogenic ally enriched in the Khanewal. Lead and cadmium were very sternly enriched that connotes these metals coined from divergent sources of defilement. Chromium and zinc also ruthless to very sternly enriched in diverse sites of landfill.

RECOMMENDATIONS

Dumpsites have been utilized from long time as depositories for municipal, commercial and industrial wastes. Pakistan,is a emerging state with non-sufficient waste dumping, reutilizing methods is at a threat of metal and organometallic pollution of its plants, water and soil bodies, that arises health-risk and soil declension for agronomic-purposes.

- That the soil was detected to have deficit in a few important minerals, nimieties in several necessary metals, and elevated levels of inessential dense-metals thanis acceptable for agronomic-soils. As such the agriculturalists farming comestible crops nearby the location should beredid to check doing so.
- As the consequence of the overhead, the administration should set in place assured watching methodsand authorize NEMA and the pertinent institutes like the department of local managements which compact with dump clearance management at the town committee and municipality levels, to be able to evaluate dense remaining dumping practices and obtrude consequences if upright commits aren't complied in the dumping of dense remaining.
- Ground-water checking-system must have to install to examine impurity level. For municipal water supply purification plants should in stall in entire region and also instruct populace concerning precaution mensuration like chlorination and boiling-water.

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