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Impact of flyash on soil quality due to heavy metals of the surrounding area of Feroze Gandhi thermal power station (Unchahar)

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Abstract
Present study was conducted around to the Feroze Gandhi thermal power station, Unchahar for the speciation of heavy metals contamination of soil. The presence of fly ash, particularly unweather ones, shows a tendency of accumulating elements like Zn (2.42- 3.45 $mgkg^{-1}$), Cu (1.41- 1.72 $mgkg^{-1}$), Fe (39.48 - 54.76 $mgkg^{-1}$) and Pb (1.35- 1.87 $mgkg^{-1}$). All heavy metals were increased in 500 m distance in all direction. So there was high amount of fly ash present and the region of heavy metal presence at near of power station. Due to Fumigation and Looping plume behavior. So the heavy metals Zn Cu, Fe and Pb were presence in soil, the soil is not suitable for agricultural crops

Keywords: Fly ash, Direction, Distance, Depth

Introduction
Environmental pollution in recent years has increases manifolds due to rapid growth of industries and anthropogenic pressure worldwide (Su *et al.*, 2014) [5].
Fly ash coming from thermal power plants are also important sources. Huge amount of flyash is generated in India from the coal fired thermal power plants leading to environmental pollution (TERI, 2000) [6]. The fly ash contains several heavy metals/metalloids such as As, Mo, Se, Cd and Zn (el-Mogazi *et al.*, 1988) [2]. Presence of these metals/metalloids and other components may make the fly ash toxic which may have deleterious impacts on flora and fauna surrounding the power plants. Environmentally released metals are mainly deposited in soils and are mobilized either by leaching or by uptake into plants (Prajapati *et al.*, 2012) [4].
Combustion of coal at thermal power plants emits mainly carbon dioxide (CO2), sulphur oxides (SOx), nitrogen oxides (NOx); CFCs other trace gases and air borne inorganic particulates, such as fly ash and suspended particulate matter. All the heavy metals (Ni, Cd, Sb, As, Cr, Pb, etc.) generally found in fly ash are toxic in nature.
Fly ash conyais a high concentration of toxic heavy mwtals duch as Cu, Zn, Cd, Pb, Ni, Crs, etc. Concentrations of heavy metals in various ecosystems has increased in recent decades. Heavy metal can bioaccumulate in the environment and may have toxic effects on human helth. Heavy metal accumulation in agriculture is a great concern with respect to environmental and food safty. Fly ash contains toxic heavy metals that may accumulate in plant bodies and may enter the food chain.
Trace metals levels are important for human health metal like Fe Cu Zn and Mn are essential metal, since they have animportant role in biological systems. The essential metals can also produce toxic effect, when the metal intake is excessively elevated. In the current era electric power is the most required need of human beings. (Cui *et al.*, 2004) [1]. Particulate matter considered as a source of air pollution constitutes fly ash. The fine particles of fly ash reach the pulmonary region of the lungs and remain there for long periods of time; they behave like cumulative poisons. The submicron particles enter deeper into the lungs and are deposited on the alveolar walls where the metals could be transferred to the blood plasma across the cell membrane. Out of above to study the effect of heavy metals (Zn, Cu, Fe, Pb) in soil due to fly ash around the Feroze Gandhi Thermal Power Station, Unchahar.

Material and methods

Sampling Sites

Two samples of soils will be collected from each of the 4 sampling directions and 4 sampling sites which is located at distance of about 500 m. in each direction with respect to the emission source by digging layer thickness of 15 cm and 30 cm. These samples will be collected in polyethylene bags to minimize sample contamination. Soils intended for mercury determination, however, will be not stored in polyethylene bags since any elemental mercury formed by reduction process in the soil escapes through polyethylene. This not only invalidates the analysis but can also contaminate the other samples stored in the vicinity. For sampling, materials made up of carbon steel will be used because this does not contaminate the soil sample with the element of interest. In order to compare the toxicity of the polluted soil with respect to unpolluted soil situated at greater distance, two soil samples will be collected from the areas having similar geochemical characteristics by digging layers thickness of 0 - 15 cm and 15 - 30 cm at each of the locations.

Heavy metels presence in fly ash

S. N.	Parameters	Concentration
1.	Zn	0.77 – 2.09
2.	Cu	0.92 – 2.17
3.	Fe	5.90 – 62.70
4.	Pb	0.06 – 3.10

Murugan and Vijayarangam, (2013)

Results and discussion

Direction	Depth of soil (cm)	Heavy Metals (mgkg^{-1})			
		Zinc (Zn)	Copper (Cu)	Iron (Fe)	Lead (Pb)
EAST	0 – 15	3.45	1.72	54.76	1.87
	15 - 30	3.27	1.62	41.41	1.62
WEST	0 – 15	2.84	1.61	53.64	1.67
	15 - 30	2.65	1.51	42.99	1.47
NORTH	0 – 15	3.26	1.63	52.78	1.60
	15 - 30	3.05	1.48	39.48	1.35
SOUTH	0 – 15	2.71	1.56	52.84	1.78
	15 - 30	2.42	1.41	44.42	1.51

In the all sites soil samples Zincvalues ranges from 2.42 mgkg^{-1} to 3.45mgkg^{-1} the minimum Zn (2.42mgkg^{-1}) was observed in South direction at 15 – 30 cm depth. The maximum Zn (3.45mgkg^{-1}) was observed In East direction at 0-15 cm depth. The same results also discussed that the fly ash emitted from the thermal power plant is the main cause of presence of heavy metals in the surrounding Prajapati and Meravi (2014) [3]

The Copper values ranges from1.41mgkg^{-1}to 1.72mgkg^{-1} the minimum Cu (1.41mgkg^{-1}) was observed in South direction at 15 – 30 cm depth. The maximum Zn (1.72mgkg^{-1}) was observed in East direction at 0 – 15 cm depth. The same results also discussed that the fly ash emitted from the thermal power plant is the main cause of presence of heavy metals in the surrounding Prajapati and Meravi (2014) [3]

The Iron values ranges from 25.29mgkg^{-1} to 54.76mgkg^{-1}the minimum Fe (39.48mgKg^{-1})was observed in North direction at 15 – 30 cm depth. The maximum Fe (54.76mgkg^{-1}) was observed in East direction at 0 – 15 cm depth. The same results also discussed that the fly ash emitted from the thermal power plant is the main cause of presence of heavy metals in the surrounding Prajapati and Meravi (2014) [3]

The Lead values ranges from 1.35 mgkg^{-1} to 1.87 mgkg^{-1}the minimum Pb (1.35mgkg^{-1}) was observed in North direction at 15 – 30 cm depth. The maximum Pb (1.87mgkg^{-1}) was observed in East direction at 0 – 15 cm depth. The same results also discussed that the fly ash emitted from the thermal power plant is the main cause of presence of heavy metals in the surrounding Prajapati and Meravi (2014) [3]

Conclusion

It is concluded that the presence of fly ash, particularly unweathered ones, shows a tendency of accumulating elements like Zn, Cu, Fe, and Pb. The presence of heavy metel in the soil is mainly found at 500 m distance from the T.P.S. The formation of fumigation and looping plume is the resion of high amount of heavy metals present in the soil near by the T.P.S.

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