Impact of Copper on Mining Industry Effluents and Soil Quality Parameters

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Abstract- *Metal pollution expanded when mining and industrial activities increased in the late 19th and early 20th centuries. The current world mine production for Cu, Cd, Pb and Hg is quite significant. They pose a risk to primary and secondary users and ultimately to humans. This study was conducted to investigate the effect of mining industrial effluents on soil properties. Field experiments were carried out in and around the mining industry in Ajmer in Rajasthan. Effluent and soil samples were collected for determination of pH, Ec, TDS, Organic Carbon and Cu. Waste from the explosives industry shows a difference in pH values of 7.9 to 8.5, electrical conductivity of 0.65 to 0.95 µs, TDS of 1825 to 2500 mg/l and heavy metals such as Cu 2.40 to 3.70 mg/l up to the allowable limit. Soil analysis showed a difference in pH value 8.0 to 8.7, electrical conductivity 0.25 to 0.40 µs, organic carbon 0.22% to 0.68% and heavy metals such as Cu 150 to 225 mg/kg, higher than the permitted limit.*

Keywords- Environmental pollution, industrial effluents, heavy metals, mining

I. INTRODUCTION

group of metals or metal-like elements that have a density of more than 5 g/cm3 and an atomic number of more than 20 are called heavy metals. Heavy metals cause toxic effects on human health and the environment, so the extraction of heavy metals from industrial wastes is very important. Release of heavy metals from various industries such as electroplating, mining and leather industries, pigments, metallurgical processes and textile industries. Industrial wastewater contains many metal ions such as cadmium, chromium, copper, lead, zinc, manganese and iron. Heavy metal recovery is carried out by many methods such as chemical precipitation, flocculation, filtration, chemical coagulation, reverse osmosis, ion exchange, solvent extraction, adsorption, and membrane technology [1-2]. Accumulation of heavy metals in soil is a concern in agricultural production due to adverse effects on food quality (safety and marketability) and plant growth (due to phytotoxicity). Ingestion of metals such as Pb, Cd, Hg, As and Cr can pose a greater risk to human health[3]. High concentrations of lead in the soil can reduce soil productivity and Very low concentrations of lead can suppress several vital processes, ie. Photosynthesis, wilted old leaves, stunted leaves [4]. Copper is one of the most important trace elements essential for plant growth[5]. It is a component of many enzymes and is actively involved in signification. The purpose of this study was to determine the physico-chemical parameters and heavy metal content in soil and water samples.

II. MATERIAL AND METHODS

Sampling and analysis:

A total of twenty samples of soil and water samples were collected from and around the mining industry in ajmer, Rajasthan. The samples of soil were collected in polythene bags and wastewater was collected in plastic bottles (1L). Soil and water samples were analysed for the following parameters-pH, Electrical conductivity, TDS, Organic carbon, and Heavy metals (Cu).

Preparation of water sample-water samples were digested with5 ml HNO3.Boil and evaporate a sample on hot plate, then coolit and make up the volume to 100 ml [6].

Preparation of Soilsample-2 gm air dried sieved soil sample were taken in 250 mlglass beakers and digested with 8 ml of aqua regia on a sandbath for 2 hr. after evaporation to near dryness, the samples were dissolved with 10 ml of 2 % HNO3 , filtered and then diluted to 50 ml with distilled water [7].

Analytical method- The determination was carried out on water and soil samples. The pH, Electrical conductivity, Total dissolved solids (TDS) were determined by digital meters, Organic carbon by walkley and black method, Heavy metals(Cu)by AAS method [8].

III. RESULTS AND DISCUSSION

The pH of different water samples ranged from 7.9 to 8.5.the minimum7.9 and maximum 8.5 were observed in w1 (far from source) and w10 (near source) water sample. Electrical conductivity of the samples ranged from 0.65 to0.95µs . Total dissolved solids ranged from 1825 to 2500

mg/ . The concentration of Cu ranged from 2.4 to 3.7 mg/l . All water samples contain high concentration than permissible limit.(table-1)

Table-1 Different parameters for different water samples

Sample	pH	Ec(µs)	TDS(mg/l)	Cu(mg/l)
W1	7.9	0.65	1825	2.4
W2	8.1	0.69	1965	2.54
W3	8	0.72	2054	2.58
W4	8.2	0.78	2198	2.6
W5	8.3	0.81	2245	2.8
W6	8.45	0.83	2328	2.9
W7	8	0.84	2375	3.1
W8	8.1	0.89	2422	3.2
W9	8.4	0.91	2480	3.5
W10	8.5	0.95	2500	3.7
Standard	6-9	-	3000-5000	<2.0

The pH of different soil samples ranged from 8 to 8.7. Sorption of heavy metals is strongly dependent. Sorption increase with increasing pH[9] . Electrical conductivity of soil samples ranged from 0.25 to 0.40µs. The organic carbon of soil also affects the mobility of heavy metals. The organic carbon of different soil samples varied from 0.22 to 0.68%. The concentration of Cu in soil samples ranged from 150 to 225mg/kg which are much higher than permissible limit (table-2).

Table-2Different parameters for different soil samples

Sample	pH	Ec(µs)	Organic carbon %	Cu(mg/kg)
S1	8	0.25	0.22	150
S2	8.1	0.27	0.28	164
S3	8.16	0.28	0.32	169
S4	8.21	0.3	0.37	172
S5	8.29	0.32	0.4	178
S6	8.3	0.31	0.44	185
S7	8.41	0.33	0.59	191
S8	8.46	0.35	0.61	198
s9	8.6	0.37	0.63	215
S10	8.7	0.4	0.68	225
Standard	7-9	-	-	190

IV. CONCLUSION

The study reveals that the physico chemical quality (pH, TDS)were within permissible limit. The heavy metal concentrationsin waste water samples were higher than permissible limits. The concentration of Cu in soil samples was also higher than standards. This shows that the long term application of wastewater deteriorate the soil production and accumulation of toxicmetals in plants cause severe health hazards in human being through food chain.

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