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STUDIES ON TRACE METAL LEVELS IN SOIL AND WATER OF TIPONG, TIRAP AND TIKAK COLLIERIES OF MAKUM COAL FIELD, TINSUKIA, ASSAM

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ABSTRACT

The trace metal levels were studied in soil and water of Tipong, Tirap and Tikak Collieries of Makum Coal Field, Tinsukia, Assam. The toxic trace metals viz Cadmium (Cd), Copper (Cu), Lead (Pb) and Zinc (Zn) were analyzed using Atomic Absorption Spectrophotometer (AAS). Pb was found to be below detectable level (BDL) in both the soil and water samples. The metals Cd, Cu and Zn were found in water samples while Cd and Zn were found in the soil samples. The highest amount of Cd (0.127ppm) & Zn (0.157ppm) were detected in water samples of Tipong colliery and the concentration of both the metals were found to be present above the permissible level while other two metals (Pb and Cu) were under the permissible level as recommended by WHO (1985). The highest amount of Cd (44 ppm) & Zn (249ppm) in soil samples were detected in Tirap and Tipong colliery. On the basis of results obtained, it is clear that continuous mining operation have left permanent scars in the coalfield environmental scenario to a large extent.

KEY WORDS : Trace metals, Collieries, below detectable level

INTRODUCTION

In the NE Region, coalfields are confined particularly in the Tinsukia district of upper Assam. Coal mining activities in these areas has been in operation since 1882. Continuous coal mining activity has posed a great threat to the environment by generating huge amount of hazardous wastes. The coal mining wastes causes not only an immediate and a very serious danger but also causes a long-term disaster to the ecosystem. Assam coalfields have been in operation from a long time and continuous mining activities resulted in soil disturbances due to release of enormous amounts of toxic substances. The environmental degradation affects the flora and fauna of the region to a large extent. Due to lack of proper planning and negligence of regulations, an appreciable amount of environmental degradation and ecological damage to water, air & soil occurs (Dhar, 1993).

Most of the Coal Fields have, now, been closed down due to declining production while the collieries of Tikak, Borgolai, Ledo, Tipang and Namdang of Makum Coal Field have so far produced more than 25m tones of coal out of the total reserve estimated at 130 m tonnes upto a depth of 300m. These fields are still under operation in full swing and open cast mining has also been in practice. The main collieries of Makum Coal field namely Tipong, Tirap and Tikak collieries lies between the rivers Namdang and Tipong. The Tipong, Tirap and Tikak Coal Field are facing serious environmental problems due to the presence of excessive toxic substances in soil & water of the surrounding areas. When such toxic substances and heavy metals move to different environment, which result in heavy destruction of microbial flora. Rimmer, (1982) reported toxicity problem in reclaimed mine sites that were usually associated with acidity, nutrient deficiency and physical conditions. Water-soluble Boron, Cu, Fe, and Li. Sr & Zn contents were greater in mine spoils compared to unmined sites (Wali 1975). Heavy metals like Iron (Fe), Manganese (Mn), Copper (Cu), Lead (Pb), Cadmium (Cd), Chromium (Cr), Cobalt (Co) etc of which many are known as essential elements for plant growth, but almost all become phytotoxic at higher concentration. Dulka *et al.* (1976) reported that heavy metals associated with mining are known to have toxic properties if present in above certain levels. The present study was undertaken to study the trace metal levels in the soil and water of Tipong,

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Tirap and Tikak Collieries of Makum Coal Field in Tinsukia district of Upper Assam, India.

MATERIALS AND METHODS

Study Area: The Tipong, Tirap and Tikak collieries of the Makum Coal Field were selected for the study. Benchmark sites were selected with or without spars vegetation. Both rhizosphere and non-rhizosphere soils were collected randomly in sterile polythene bags from selected sites and aseptically carried to the laboratory for further investigation.

The water samples were collected separately into 1-litre plastic cans and brought to the laboratory and stored in a cold room for further investigations.

The collected soil samples were sieved through 2mm mesh screen and allowed to air dry and mixed thoroughly. The soil and water samples were then analyzed with the help of Atomic Absorption Spectrophotometer (Varian model spectra 220 FS) by the standard method described by (Pinta 1975).

Digestion of the Soil and Water samples

The sampling, preservation, digestion and preparation of samples for the analysis of trace metal levels were made as pre respective procedures described by Pinta (1975) using Atomic Absorption Spectrophotometer (Varian model spectra 220 FS) and the results were presented in Table 2 and 3 while Table 1 presents the analytical conditions of AAS.

RESULTS AND DISCUSSIONB

It was observed (Table 2) that Pb was detected below detectable level in water samples of all the 3 collieries under study while Cd and Zn were detected in variable amounts. The highest (0.127 ppm) and the lowest (0.057 ppm) amount of Cd was detected in Tipong & Tikak colliery while the highest (0.157 ppm) and the lowest (0.129 ppm) amount of Zn was detected in Tipong and Tikak respectively. Copper (Cu) was below detectable level (BDL) in the water samples of the 2 collieries except in Tirap where it was found to be 0.033 ppm.

It was observed (Table 3) that Cu and Pb were present below detectable level (BDL) in soil samples

Table 1. Analytical conditions of atomic absorption spectrophotometer (AAS).

Elements	Wave length (nm)	Silt width (nm)	Operating working range (ppm)	HC lamp current (mA)	Type of flame	Fuel gas flow rate (L/min)	Air flow rate (L/min)
Cd	228.8	0.5	0.02-3.00	4	Air – C_2H_2	1	3.5
Cu	324.7	0.5	0.03-10	4	Air – C_2H_2	1	3.5
Zn	213.9	1.0	0.01-2	5	Air – C_2H_2	1	3.5
Pb	217.0	1.0	0.1-30.00	5	Air – C_2H_2	1	3.5

Table 2: Metal estimation in water samples of 3 collieries of Makum Coal Field of Upper Assam.

Collieries	Cadmium (Cd) (ppm)	Copper (Cu) (ppm)	Zinc (Zn) (ppm)	Lead (Pb) (ppm)
Tipong	0.127*	BDL	0.157	BDL
Tirap	0.08	0.033	0.138	BDL
Tikak	0.057	BDL	0.129	BDL
P.L**	0.05	0.05	0.10	0.05

*= Mean of 3 replications
**= Permissible limits (Source WHO, 1985)
BDL: Below Detectable Level

Table 3: Metal estimation in soil samples of 3 collieries of Makum Coal Field of Upper Assam.

Collieries	Cadmium (Cd) (ppm)	Copper (Cu) (ppm)	Zinc (Zn) (ppm)	Lead (Pb) (ppm)
Tipong	15*	BDL	249	BDL
Tirap	44	BDL	13.5	BDL
Tikak	13.5	BDL	BDL	BDL

*= Mean of 3 replications
BDL=Below Detectable Level

of all the 3 collieries under study while Zn and Cd were traced in all the 3 collieries except in Tikak colliery where Zn was below detactable level. The highest amount of Cd (44 ppm) and Zn (249ppm) was detected in Tirap and Tipong colliery while the lowest amount of Cd (13.5 ppm) and Zn (13.5ppm) was detected in the soils of Tikak and Tirap colliery respectively.

The values obtained in the study showed that in water samples the concentration of Zn & Cd were found to be present above permissible limit while other 2 metals were under the permissible level as recommended by WHO (1985). However some of these trace elements may cause serious health hazards to the mankind even in very low concentrations.

Heavy metals are easily assimilable and accumulate in ecological materials (Numberg, 1984) & eventually they get into the bodies of inhabitants, over long period they retain in harmful concentrations. The biological systems accumulate these materials by factors as high as 1000 times or more (Lucus, 1974). So from the above study it is clear that the haphazard and unscientific coal mining activities in Makum Coal Field have already started showing significant adverse environmental impacts and there is an urgent need for rehabilitation of the degraded soils and to stop further degradation of the environment of the area.

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REFERENCES

Ataikuru, H., Omasheye, J. G. and Ukulu, H. 2005. Bioaccumulation of Heavy metals in UGU (*Telfera occidentale*), okro (*Hibicus esculentus*) and Bitterleaf (*Verononia amygdalina*) from Warri, Delta state, Nigeria. *Jr. of Industrial Pollution Control.* 21(1) : 71-76.

Dhar, B., Rolterdem, B. 1993. Environment Management and Pollution Control in Mining Industry, APH, New Delhi.

Dulka, J.J and Risby, T.H. 1976. Ultra trace metals in some environmental and biological systems. *Analytical Chemistry.* 48 (8): 640-653.

Lucus, J. 1974. *Our polluted Food.* 2 nd Edition. Helsted Press. New York.

Numberg, H.W. 1984. The Volmetric approach in trace metal chemistry of natural water and atmospheric precipitation Analyst, *Chim. Acta.* 164 : 1-21.

Pinta, M.D. 1975. *Detection and determination of Trace* elements, ANA, Arbor Science Publication INC.

Rimmer, D.L. 1982. Soil physical conditions on reclaimed colliery spoil heaps. *Journal of Soil Science*, 33: 567-579.

Wali, M.K. 1975. The problem of land reclamation viewed in a system content. Pp 1- 17. In. M.K. Wali (ed.) Practices and Problems of land reclamation in Western North America, Univ. North Dakota Press, Grand Forks.

WHO, 1985. *Guide lines for drinking water quality.* (Vol 5) World Health Organization, Geneva, Switzerland. P. 121