STUDY ON POLLUTION OF WATER AND SOIL DUE TO COPPER MINING IN KHETARI COPPER MINE PROJECT

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ABSTRACT

Pollutant concentrations were measured in water and soil at the vicinity of Khetri copper mining project Rajasthan to investigate the influence of copper mining on environment. Pollutant concentrations in water and soil were determined by Spectrophotometer. Metal concentration in water samples were found greater than the normal soil copper concentration due to washing away of mineral with water. In the water sample collected from region metal concentration ranges from 22.5 mg/liter to 695.56 mg/liter, whereas in soil sample at a depth of 12 inches metal concentration ranges from 9.37 mg/kg to 194.16 mg/kg and soil sample on surface ranged from 4.9mg/kg to 143.72mg/kg. High concentration of copper was found in the water near mining site with maximum 695.56 mg/liter copper, at a site of 500mts from mining with maximum 400mg/liter and at a distance of one kilometer from mining sits 150mg/kg copper. The present study reflects the elevated concentration of copper in water and soils at the vicinity of Khetri mining sites.

Key Words: *Water Pollution, Copper, Soil Pollution, Mining.*

INTRODUCTION

The environmental impact of mining includes erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater and surface water by chemicals from mining processes. In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil. Besides creating environmental damage, the contamination resulting from leakage of chemicals also affects the health of the local population. Mining companies in some countries are required to follow environmental and rehabilitation codes, ensuring the area mined is returned to close to its original state. Some mining methods may have significant environmental and public health effects. Mining is an important part of economy of a country. Minerals extracted as raw from earth, are processed to yield basic substances such as metals, fuels, fertilizers etc. Industrial society could not exist without these essential commodities.

REVIEW OF LITERATURE

A combined total of about 1680 million tons of heavy metals (copper, lead, cobalt, zinc, cadmium and chromium) have been mined by man since the Stone Age. It is further estimated that an annual output of 14 million tons of heavy metals is being mined with annual growth of 3.4% (Matagi et al., 1999). The continued advancements in industrialization and the ever increasing demand for energy resources and minerals, have led to a spurt in mining activities, bringing in its wake imbalances in ecological equilibrium and many environmental hazards Vamerali et al., 2011). Mining activities such as crushing, grinding, washing, smelting and all other processes used to extract, concentrates generate waste products such as mine overburden and mine tailings (waste soil). As a result, very significant volumes of wastes have been deposited on soil and wild plants and animals are exposed to elements contained in the residue. People living near these sites are also exposed through water and soil erosion. The direct effect is loss of cultivated land, forest or grazing land, and the overall loss of production. The indirect effects include air and water pollution and siltation of water body. This will eventually lead to loss of biodiversity, and economic wealth. The management of these waste materials is an important issue for mining industry worldwide. It is estimated that the median values of worldwide emissions of Cd, Cu, Pb, and Zn into soils were 21, 934, 793 and 1370 107 kg/yr, respectively; more than half of those metals were associated with base metal mining and smelting activities (Lone et al., 2008). Some heavy metals e.g., Mn, Fe, Cu, Zn, Mo and Ni are essential as micronutrient for microorganisms, plants and animals while others have no known biological function (Welch, 1995). All heavy metals at high concentrations have strong toxic effects and regarded as environmental pollutants (Doran, 2000; Chehregani et al., 2005). Elevated concentrations of heavy metals pose significant risk to flora, fauna and human population. Contaminated soil negatively affects crop growth because of interference of phytotoxic contaminants with metabolic processes and sometimes also leading to plant death (Pal and Rai, 2010). Human are at risk from polluted soils and water through dermal contact, ingestion, consumption of food grown on polluted soil, water and inhalation of dust or vapors and causes acute and chronic diseases such as gastrointestinal, respiratory, heart, brain and kidney damage and effects on skin and mucous membranes and various systemic effects on intestines, also cause DNA damage and carcinogenic effects by their mutagenic ability (Nathanail and Earl, 2001; Jadia and Fulekar, 2008). Contaminated soil disrupts biological cycling of nutrients, also affect the hydrosphere comprising the quality drinking water resources and threatening the aquatic ecosystem (Bilek, 2004; Sheoran et al.).

OBJECTIVE OF STUDY

The present research aimed to investigate the influence of mining activity on the concentration of heavy metals in water and soil surrounding copper mining sites at village Gothra-Banwas, Khetri located in Jhunjhunu, Rajasthan, India.

MATERIALS AND METHODS

Sampling Sites

The study area Gothra-Banwas Khetri is located in the Jhunjhunu District of Rajasthan, some 190 km Southwest of Delhi, and 180 km North of Jaipur. And about 30 km from Govt. College, Narnaul (Haryana) it is situated 550m above mean sea level. Gothra-Banwas Khetri copper mines are located in northern extremity of the Khetri Copper belt between Lat. 28º 03'35" to 28º 04'45" and longitudinal is 75º47'40" to 75º46'45" in Jhunjhunu District. Khetri Copper Complex is a major constituent part of Hindustan Copper Ltd. (HCL), a Government of India enterprise established in November 1967.The copper deposits were mined in ancient times with some workings have dating from to the Mauryan Period, over 2050 years ago. The mines were active again in the times of the Moghul Emperiors. A report in this respect is written by Abu Fazal, a courtier of Emperor Akbar, in 1590. More recently, the mines were worked by local people who paid a royalty on production basis to the Princely State of Khetri. Two mines were functioning in the towns of Singhana and Khetri until closed by the British in 1869. Regular mining was ceased in 1872, although sporadic activity continued until 1910. From 1944 to 1955 the lease was held by the Jaipur Mining Corporation Ltd. The Geological Survey of India began prospecting the area in 1954, and exploratory mining by Indian Bureau of Mines began in 1957. The Project was handed over to the National Mineral Development Corporation in 1961 for further investigation. Initial feasibility studies were completed in 1963. By then, there was a pressing need to increase indigenous production to narrow the gap between India's own output and steadily rising demand. The decision to proceed with development of Khetri Copper Complex was taken in 1962. Shaft sinking and mine development began in 1964 and the first production of ore took place in 1970. The project was transferred to the newly-created Hindustan Copper Limited in November 1967. A fertilizer plant, based on the sulphuric acid by-product from the smelter, plus rock phosphate from southern Rajasthan, began production in 1975. There are two major operating mines in the Khetri Complex, namely- Khetri, Kolihan underground mines. The study area consists mostly of garnetiferous chlorite quartz schist. In the northern part of the Khetri copper mine about one kilometer long strip was selected as the sampling location along Gothra-Banwas. Most of this part is covered with alluvium soil.

RESULTS AND DISCUSSION

Water samples were collected from water bodies from different sites of mining area. Pollutant concentrations were measured in water and soil at the vicinity of Khetri copper mining project Rajasthan to investigate the influence of copper mining on environment. Pollutant concentrations in water and soil were determined by Spectrophotometer. Metal concentration in water samples were found greater than the normal soil copper concentration due to washing away of mineral with water. In the water sample collected from region metal concentration ranges from 22.5

mg/liter to 695.56 mg/liter, whereas in soil sample at a depth of 12 inches metal concentration ranges from 9.37 mg/kg to 194.16 mg/kg and soil sample on surface ranged from 4.9mg/kg to 143.72mg/kg. High concentration of copper was found in the water near mining site with maximum 695.56 mg/liter copper, at a site of 500mts from mining with maximum 400mg/liter and at a distance of one kilometer from mining sits 150mg/kg copper. The present study reflects the elevated concentration of copper in water and soils at the vicinity of Khetri mining sites.

CONCLUSION

Erosion of exposed hillsides, mine dumps, tailings dams and resultant siltation of drainages, creeks and rivers can significantly impact the surrounding areas. In areas of wilderness mining may cause destruction and disturbance of ecosystems and habitats, and in areas of farming it may disturb or destroy productive grazing and crop plants. In urbanised environments mining may produce noise pollution, dust pollution and visual pollution. Water pollution

Mining can have adverse effects on surrounding surface and ground water if protective measures are not taken. The result can be unnaturally high concentrations of some chemicals, such as arsenic, sulfuric acid, and mercury over a significant area of surface or subsurface. Runoff of mere soil or rock debris -although non-toxic- also devastates the surrounding vegetation. The dumping of the runoff in surface waters or in forests is the worst option here.

With open cast mining the overburden, which may be covered in forest, must be removed before the mining can commence. Although the deforestation due to mining may be small compared to the total amount it may lead to species extinction if there is a high level of local endemism.

To ensure completion of reclamation, or restoring mine land for future use, many governments and regulatory authorities around the world require that mining companies post a bond to be held in escrow until productivity of reclaimed land has been convincingly demonstrated, although if cleanup procedures are more expensive than the size of the bond, the bond may simply be abandoned. Since 1978 the mining industry has reclaimed more than 2 million acres (8,000 km²) of land in the United States alone. This reclaimed land has renewed vegetation and wildlife in previous mining lands and can even be used for farming and ranching.

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