

PHYSICO CHEMICAL STUDY OF SOIL NEAR BHILAI STEEL PLANT EFFLUENT CHANNEL

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ABSTRACT

Land and water are precious natural resources on which rely the sustainability of agriculture and the civilization of mankind. Unfortunately, they have been subjected to maximum exploitation and severely degraded or polluted due to anthropogenic activities. Variation in the parameter of effluents like temperature, pH, total dissolved solid, free carbon dioxide, chloride, dissolved oxygen, biological oxygen demand, chemical oxygen demand, phosphate, sulphate, nitrite, nitrate, ammonia, magnesium, calcium, iron and phenol effects the plants, animals and humans.

KEYWORDS :Effluent, Biological Oxygen Demand, Chemical Oxygen Demand

The pollution includes point sources such as emission, effluents and solid discharge from industries, vehicle exhaust and metals from smelting and mining, and nonpoint sources such as soluble salts (natural and artificial), use of insecticides/pesticides, disposal of industrial and municipal wastes in agriculture, and excessive use of fertilizers. Alloway *et al.*, 1995; Lindqvist, 1991; Nriagu, 1994). Each source of contamination has its own damaging effects to plants, animals and ultimately to human health, but those that add heavy metals to soils and waters are of serious concern due to their persistence in the environment and carcinogenicity to human beings. They cannot be destroyed biologically but are only transformed from one oxidation state or organic complex to another (Walsh *et al.*, 1979; Kabata-Pendias, 2003). Therefore, heavy metal pollution poses a great potential threat to the environment and human health.

Most studies of water pollution are usually expressed with physical and chemical standards, placing the biological concepts in a subsidiary (Cairns *et al.*, 1971). Also, despite much progress in analytical chemistry, chemical monitoring systems have limitations. It depends much on the time and place of sampling and the thinking lying behind the sampling design (Cairns & Vander Shellie, 1980).

A polluting substance can be a solid, semisolid, liquid, gas or sub molecular particle. Pollution is the result of the action or presence of the pollutant in a part of environment where it is considered to have deleterious

effect. In the selected effluent channel of Bhilai Steel Plant, domestic waste is mixed at each spot. The domestic wastes are rich in phosphate due to extensive use of hard and soft detergents and nitrogen have been emphasized to be two nutrients much in demand, but with lesser concentration. Defining eutrophication as the enrichment of water body owing to any and all nutritive substances (Haslam, 1978). Even small addition of small organic matter from polluted lakes has been found to stimulate bloom of algae (Srinivasan, 1969).

The physico-chemical analysis indicates the status of water quality, whereas, biological study shows the impact of water quality on the organism. Hence both the studies are essential for have complete knowledge of water body.

STUDY AREA AND SITES

Bhilai steel Plant (BSP), Bhilai is situated in District Durg, Chhattisgarh (Fig 1). The steel plant was started in the year 1959. It is the largest integrated steel plant in our country with an annual production capacity of about 4 million tonnes. Bhilai is situated 32 Kilometers away from Raipur city on its west on G.E.

The channel one (Samodha Nala) was taken for present research work. The colour of the effluent of the channel was dark brown throughout the year. It is very common, also, to observe bathing of people and cattle washing, in this effluent water, without any complaints or ill effects.

The soil on the two sides of effluent channel is either Bhata Soil or a vertisol, which is locally called Kanhar soil. Kanhar is a black soil. The distance of this

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effluent journey is approximately 16 km from Bhilai Steel Plant to Sheonath River. For effluent sample collection, 9 spots along the effluent channel were selected.

MATERIALS AND METHODS

Collection of Effluent Samples

Wastewater (effluent) samples from Bhilai Steel plant was collected in plastic cans, from the sites mentioned earlier under study area and sites. Samples for dissolved oxygen determination was collected in BOD bottles. Analysis for physico-chemical characteristics of the samples was started immediately after reaching to the laboratory.

Analysis for Physico-Chemical Parameters

The analysis for physico-chemical characteristics of effluent was carried out at the sampling site as well as in the laboratory. Parameters like temperature, pH, total dissolved solids, dissolved oxygen, alkalinity, was determined at the time of sampling while analysis for remaining parameters was continued in the laboratory within about 30 minutes of samplings in appropriately preserved samples (Sudhakar, 1994). Preservation of samples was made as prescribed in Standard Methods. (APHA-AWWA-WPCF 1975).

RESULTS AND DISCUSSION

Table 1: Physico- chemical characters for the soil near effluent

Parameters	Range	Mean
Temperature (°C)	24.3-35.2	27.7
pH	6.49-8.65	7.98
Total Dissolved Solids (mg/l)	205-493	358
Dissolved Oxygen (mg/l)	2.5-3.77	1.23
Total alkalinity(mg/l)	20-29	22
Free Carbon-Di-Oxide (mg/l)	0.8-46.6	12.67
Chloride	33.33-70	52.15
Biological Oxygen Demand (mg/l)	Nil-3.77	0.88
Chemical Oxygen Demand (mg/l)	110-122.5	56.5
Phosphate (ppm)	0.55-5.8	1.14
Sulphate (ppm)	1312-6273	4506
Nitrate- Nitrogen (ppm)	1010-6871	2905
Nitrite- Nitrogen (ppm)	282-28.13	9.42
Ammonia- Nitrogen (ppm)	2014-11225	6525
Magnesium (ppm)	43-207	99
Calcium (ppm)	33.27-527	163
Iron (ppm)	440-27173	5360

These effluents had adverse effect on the soil near the effluent channel and different plants. Chulter (1971) Schorder (1991) also had investigated the effect of effluent on plants.

In spot no. 1 & 2, the effluent colour is dark brown. Here cobalt, copper, lead, nickel, zinc, cadmium and magnesium are present in the form of sulphate, phosphate, chloride, carbonate, nitrate and nitrites etc in high concentration. So the plants present near the effluent channel showed a drastic

change in its height. And concentration of chlorophyll a, b, total chlorophyll and magnesium increased.

When we moved downstream the effluent channel dilution of effluent took place by the addition of domestic wastes. So the concentration of heavy metals decreased. The size of the plants was larger at the places where the concentration of heavy metals was high. Presently effluent from Bhilai Steel Plant and mixture of domestic waste water has noticeable effect on different plants. Thus, if a little more care is taken to treat the waste water, it can be used for irrigation of vegetation surrounding the channel very safely.

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