QUALITATIVE ASSESSMENT OF GROUNDWATER AND ENVIRONMENTAL STUDIES OF SOIL & INDUSTRIAL EFFLUENTS IN AND AROUND RAIGARH (CHATTISGARH)

ABSTRACT

Drinking water quality is governed by standards prescribed by Bureau of Indian Standards (BIS) while disposal of industrial effluent on various types of land is governed by specifications issued by Pollution Control Board.BIS has specified two types of standards for drinking water-namely Maximum Desirable limits and Maximum Permissible limits while there are different values suggested by Pollution control Board for industrial effluent to be discharged on different types of land. Water quality exceeding these specifications is harmful.It can cause biochemical effects, such as inhibition of enzymes, metabolic disorders, genetic damage,hypertension and cancer.

Results of Physico-chemical and Heavy-metal parameters in groundwater samples in and around Raigarh city reveal that fluoride, nitrate and iron contents are above specified limit at many locations .Other physico-chemical parameters meet the BIS specified limit for either maximum desirable limit or for maximum permissible limit at most of the locations or show exceeding values only as isolated pockets in some locations. Fluoride was found above BIS specified maximum permissible limit of 1.5 mg/L at 5 locations in pre monsoon season and 6 locations in post monsoon season. It was found as 1.8 mg/L in Beladula, 2.2 mg/L in Vinoba Nagar, 2.4 mg/L in SECL colony, 3.2 mg/L in Atarmuda ,1.8 mg/L in Mithumura & 2.5 mg/L in Rambhata in pre monsoon season**.**

In post monsoon season, fluoride concentration was found 1.6mg/L in Beladula, 1.8 mg/L in Vinoba nagar, 1.8 mg/L SECL colony,3.6 mg/L in Atarmuda, 1.6 mg/L in Baikunthpur,2.8 mg/L in Rambhata. Nitrate concentration was found exceeding maximum permissible limit at few locations .The maximum value of Nitrate was recorded at Rajiv Gandhi Nagar (48.0 mg/L) in post monsoon and minimum nitrate value was recorded at Urdana (8.2 mg/L) in pre monsoon. Among heavy metals, iron was found exceeding maximum permissible limits at 2 locations ; Darogapara and Railway Bangla Para . Maximum iron content was found in Darogapara (1.6 mg/L) followed by Railway Bangla para (1.5 mg/L), VikasNagar (1.2mg/L) & Dhangardeepa (1.0 mg/L).

Coliform organism were detected in 18 sites out of 23 sampling sites in groundwater in and around Raigarh city but, the number of coliforms were below BIS permissible limit. Out of 23 sampling stations, only 5 stations have coliform count more than permissible limit.(>10 coliform colony /100 ml)in both seasons.

Effluents analysis of the Physico-chemical and Heavy-metal parameters of five sponge iron plants reveal that iron & chromium from all industrial effluents were excessively high. Iron content of effluents were in the range of 8.8 mg/L to 24.2 mg/L.Chromium content of the effluents were found 2.8 mg/L to 12.2mg/L.The data reveals that all these industries are discharging heavy metals above specified limit. Iron,Manganese,Copper & Cadmium are higher near Patrapali than specified limit.Maximum concentration of these ions are 2.8 mg/l, 0.12mg/l , 0.16mg/l & 0.008 mg/l respectively . Significant variations in the content of all metals have been recorded in the effluents of sponge iron plants. The result indicates that effluents contain toxic metals thereby polluting nearby soil and groundwater.

Total Organic carbon (TOC) in soil near sponge iron industries was found from 0.28 to 0.58 mg/L..The grain size analysis revealed that the amount of clay ranges between 10 to

48%. The extent of sand and silt also varied between 10 % to 50 % and 40 to 52 %.The texture of the soil tested was found loam , silty loam or clay.

Studies of the limnology of Kelo river at city stretch in Raigarh for physico-chemical and toxicological parameters at five sampling stations reveal that industrial effluents and domestic wastes are pollution river water. water quality in pre monsoon near old palace ghat is above maximum permissible limit of BIS specifications for some heavy metal parameters. However, water quality at same sampling points were found above maximum desirable limit but below maximum permissible limit in post monsoon season. It was found that drains are also adversely affecting water quality of Kelo river along the stretch of study.Municipal water is discharged into Kelo river without pretreatment. Irrigation water /surface run-off water from the surrounding farm lands also seems to be affecting river water quality at some locations.

Physico-chemical and heavy metal parameters of Kelo river at five sampling sites reveals that values of some parameters at sampling station I (near old palace ghat)are within maximum desirable limit of drinking water specifications (IS 10500: 1991). The observed values in sampling station I were 6.9 to 7.1 for pH, 485 mg/L to 327 mg/L for TDS, 78 mg/L to 66 mg/L for chloride, 78 to 58 mg/L for alkalinity, 25 mg/L to 23 mg/L for calcium, 26 mg/L to 16 mg/L for magnesium, 2.4 mg/L to 0.4 mg/l for nitrate,5.6 mg/L to 18.8 mg/L for sulphate in pre monsoon and post monsoon season.However,pH was found 8.9 in pre monsoon and 8.4 in post monsoon season which is higher than specified limit (6.5 -8.5). TDS was found 2180 mg/L which is above max. permissible limit of 2000 mg/L in pre monsoon season and 1890 mg/L(which is below max. permissible limit of 2000 mg/L but above max. desirable limit of 1500 mg/L in post monsoon season .High values of chloride,nitrate and alkalinity indicate domestic and municipal pollution while presence of heavy metals above specifications indicate that industrial effluents are also being discharged.

Studies of Physico-chemical, Toxicological and Microbiological (coliform) parameters of groundwater and treated water (i.e.packaged drinking water) reveal effective treatment for chemical and microbiological contamination of groundwater. The raw water was analysed to know the Physico-chemical and Microbiological(coliform) status of the water to be treated..The treated water was also analysed for the same parameters to know the effectiveness of the treatment system as well as meeting BIS specifications IS 14543:2004.

Comparison of analysed values for Physico-chemical, Toxicological and Microbiological (coliform) parameters of raw water with its specification IS 10500:1991 shows that the raw water is unfit for drinking without treatment with respect to some parameters.Total Hardness,Nitrate, Chloride & Coliform count was above specifications at most of the time. The maximum TDS before treatment was 1820 mg/L which after treatment came down to 156 mg/L. The maximum hardness of treated water i. e. Rail Neer was only 20 mg/L against maximum hardness of 840 mg/L in groundwater.Maximum nitrate content in treated water was 1.0 mg/L while before treatment it was found as much as 52 mg/L.The coliform bacteria's in treated water were found absent all the times while it was found maximum 250 /100 mL in groundwater.