

Assessment of Ground Water Toxicity Due to Tannery Industry at Jajmau, Kanpur (UP)

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ABSTRACT: The present study was carried out with the objective of determining the extent of groundwater pollution caused by tanning industries in Jajmau area, Kanpur (U.P.) which is located at the bank of Ganga river. Groundwater Samples were collected from four different places, nearby area of Jajmau viz., CETP, Peudi village, Shekhpura, and Wazidpur Village and analysed for the physio-chemical parameters and heavy metals and all results were compared with Indian standard specification for drinking water IS 10500(1993). The study reveals that the concentration of major ions and chromium are exceeding the permissible limit. Groundwater is unsuitable for human consumption as it contains higher concentration of major ions and chromium. Contamination of groundwater causes water scarcity for domestic purpose of this study is to highlight the impact of tannery effluent on groundwater.

KEYWORDS: Groundwater, physiochemical, Tanneries, metals.

I. INTRODUCTION

Water has been playing a major role in development of human civilization. Industrialization, urbanization has changed the natural environment by the addition of various toxic and harmful ions, which has resulted in various health impacts to the flora & fauna living in environment. Keeping in view of the pollution effects and its risk management to the ecosystem, it is very essential to monitor the impact of industrial effluents on ground water quality.

Groundwater provides drinking water for more than 80 cities and towns in Uttar Pradesh. It is also used to irrigate crops, provide drinking water for stock and to support industry. Contamination of drinking water has become a major concern to the Environmentalist in the developing countries, in [1]. Major water pollutants include microbes, nutrients, organic chemicals, oil, heavy metals and sediments. The common sources of ground water contamination in are :

1. Waste disposal activities that use the surface as a pollutant receptor, such as hazardous waste landfills, industrial waste ponds and lagoons, waste water land treatment operations and deep well disposal system.
2. Industrial waste landfills are the most common source of serious ground water contamination because of their large number of potential for leaching a variety of hazardous substances, which are relatively mobile. The potential for contamination from landfill leach ate is greatest in areas with shallow ground water table and high rainfall.

Heavy metals are important environmental pollutants. Metal contamination of the environment results both from natural sources and industrial activities[2].

The toxic effects of heavy metals are now well recognized and the toxic concentrations were very well studied. During the last decade an extensive database has been published providing a direct link between the exposure to low concentration of heavy metals and different diseases. Heavy metals viz, Cr, Pb, Cd, Ag, Co, Ag, Hg, Ca and Sc are recognized highly toxic and dangerous pollutant [3,4]. Recent research has found that chromium, lead, mercury, cadmium, aluminum and arsenic can cause a wide variety of health problems [5,6]and long time exposure leads to immuno modulation [7].

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The toxic heavy metal like Cd, Pb and Hg affect biological function, affecting hormone system and growth. Many heavy metals accumulate in one or more of the body organs in food animals which eat by human and are transmitted through it causing serious public health hazard [8].

Studies have documented that direct disposal of effluents to land and water bodies has potential to contaminate air, surface, ground water as well as soils and crops grown on these soils which will have bearing on human health [9].

Long-term disposal of tannery wastes has resulted in extensive contamination of agricultural land and water sources in many parts of India. The tannery industry mushrooming in North India has converted the Ganga River into a dumping ground. Pollution becomes acute when tanneries are concentrated in clusters in small area like Kanpur [10]. Chromium (Cr), a toxic heavy metal, is a major contaminant in tannery wastes, and its accumulation in soil and water is an environmental issue of increasing public concern in India. The present study was carried out with the objective of determining the extent of groundwater pollution caused by tanning industries in Jajmau area, Kanpur (U.P.) which is located at the bank of Ganga river. Groundwater Samples were collected from four different places, nearby area of Jajmau viz., CETP, Peudi village, Shekhpura, and Wazidpur Village and analysed for the physio-chemical parameters and heavy metals and all results were compared with Indian standard specification for drinking water IS 10500(1993).

II. MATERIALS AND METHODS

The groundwater samples were collected from hand pumps of four different places, nearby area of Jajmau viz., - G1- Hand Pump near CETP, G2- Near Peudi village, G3- Near Shekhpura Village and G4- Near Wazidpur Village.

The samples were analysed for different physico-chemical properties and heavy metals as per the procedure outlined in APHA (2005)[11] and Compare with Drinking water standard **IS-10500** [12]. Heavy metals were determined using Atomic Absorption Spectrophotometer as described. The determined parameters were Temperature, pH, TDS, SO₄, K, Na, total hardness, Chloride, Ca, Mg, Cd, Cr, Cu, Fe, Ni, Pb, Zn, As and Hg.

III. EXPERIMENTAL RESULTS

The experimental results of the physio chemical analysis of ground water samples of hand pumps are presented in table 1.

pH ranges of water resources were depicted from 6.5-8.0 it is in the normal range of standard values, Total Dissolved Solids ranged from 1110-2350 mg/L, higher than the normal range of standard values. Turbidity was within limit in all sampling location. Sulphate was in range 223-584 mg/l which was higher than standard values. Fluoride was found 1.4 – 3.5 mg/l, which was higher than the normal range of standard values in many sampling location. Total Hardness (TH) ranged from 924 - 1037 mg/L which was much higher as compared with the standard values 200 mg/L. The value of calcium and magnesium were also found high as compared to limit of the standard values. Alkalinity was found 420-505 mg/l which was also much higher as compared with the standard values 200 mg/l in all sampling station. Chloride was found 228- 794 mg/l in all sampling locations which was above the limit of the standard values of IS: 10500 :1991. The total hardness is relatively high in all samples due to the presence of calcium, magnesium, chloride and sulphate ions. Based on TH, groundwater exceeding the limit of 300 mg/l is considered very hard [8]

Heavy metals:

Chromium (Cr) - The minimum and maximum concentrations of Chromium were found to be 0.06 to 0.085 mg/L respectively. Whereas the maximum allowable limit for chromium as per IS 10500:1991 guidelines, is 0.05 mg/L. Chromium concentration levels in all studied samples were exceeding then compared, WHO Standards is 0.05 mg/L. Chromium toxicity is frequently the result of long term low level exposure to pollutants common in our environment: air, water, food and numerous consumer products. [14]. Exposure to chromium is associated with many chronic diseases such as dermatitis, ulcers and perforation of the nasal septum and respiratory illness as well as increased lung and nasal cancer. [13,15].

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Table 1

Physico-Chemical Characteristics of Groundwater of Hand Pumps from four different locations (G1-G4) at Jajmau, Kanpur(U.P.) India.

Parameters	G-1	G-2	G-3	G-4	IS-10500 Limit
pH	6.8	7.0	6.8	6.7	6.5-8.5
TDS	1670	1110	2100	2350	500 mg/l
Conductivity	3338	2225	4090	4424	–
Turbidity	1	1	1	2	Max 1
Na	350	150	180	430	–
K	18	14	16	55	–
Sulphate	304	223	418	584	200 mg/l
fluoride	1.5	1.4	2.7	3.5	1 .0mg/l
Total Hardness	980	1037	924	980	200 mg/l
Calcium	495	285	276	290	75 mg/l
Magnesium	485	752	648	690	30 mg/l
Alkalinity	420	492	505	482	200 mg/l
Chloride	591	228	785	794	250 mg/l
Cr	0.08	0.06	0.085	0.077	0.05 mg/l
Cd	0.001	0.002	0.006	0.054	0.003 mg/l
Cu	0.032	0.012	0.027	0.045	0.05 mg/l
Zn	0.095	0.120	0.380	0.265	5 .0 mg/l
Fe	0.120	0.07	0.250	0.154	3.0 mg/l
Ni	0.012	0.01	0.005	0.044	0.02 mg/l
Pb	0.002	0.001	0.002	0.002	0.01 mg/l
As	BDL	BDL	BDL	BDL	0.01 mg/l
Hg	BDL	BDL	BDL	BDL	0.001 mg/l

Cadmium (Cd) - The minimum and maximum concentrations of Cadmium were 0.001 to 0.054 mg/L respectively. Whereas the maximum allowable limit for cadmium as per IS 10500:1991 guidelines is 0.01 mg/L.

Copper (Cu) - The minimum and maximum concentrations of Copper were 0.012 to 0.045 mg/L respectively which is very much in the maximum allowable limit for copper as per IS 10500:1991 is 0.05 mg/l.

Zinc (Zn) - The minimum and maximum concentrations of Zn was 0.095 to 0.380mg/L respectively. Whereas the maximum allowable limit for zinc as per IS 10500:1991 is 5.0 mg/l.

Iron (Fe) - The minimum and maximum concentrations of Fe was 0.07 to 0.250 mg/L respectively. Whereas the maximum allowable limit for iron as per IS 10500:1991 is 0.03 mg/l.

Nickel (Ni) - The minimum, and maximum concentrations of Nickel were 0.01 to 0.044 Mg/L respectively. Arsenic (As), Lead (Pb), and Mercury (Hg) were analysed in all G₁ to G₄ sample and all the three parameters were found below detectable limit.

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IV. CONCLUSION

From the study it is clear that the ground water of Jajmau is seriously contaminated due to tanning activity in area heavy metals and other parameters are found beyond the permissible limit IS 10500:1991. So the ground water in the studied area is not fit for drinking purpose before proper treatment. The toxic heavy metal like Cd, Pb and Hg affect biological function, hormone system and growth. Many heavy metals accumulate in one or more of the body organs in food animals consumed by human and are transmitted through it, causing serious public health hazard.

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