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Analysis of Chromium Content in Ghaghra River in Ballia

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Abstract. The paper expresses the asseement of chromium concentration in Ghaghra river at four sites in Ballia district, U.P., India. The river Ghaghra appears due to joining of a large number of tributaries and hence the quality of waters achieved from the tributaries proportionates the characteristics of Ghaghra river. On the bank of tributeries of Ghaghra, several taneries are established, which use the chromate salts for purification of the products and these chromate salts join the tributeries and flow into Ghaghra corridors. The concentration of chromium is decreased after a long run of the river and due to the heavier metal ion a larger concentration has been observed in the bottom layer which becomes very low in the surface layer. The dilution of the river water in rainy months decreases the concentration of chromium.

1. Introduction

Any disturbance in the natural cycle creates ecological imbalance, which is the root cause of environmental pollution. Pollution of our environment is increasing at a dreadful rate particularly during post-industrial period and has created a serious environment crisis, threatening the very survival of mankind.

In recent years some attempts[1-8] have been made to evolve a simple and reasonably objective method indicating the general state of rivers. Trace metal levels in river systems were studied[5,9-13] at different component levels. Shukla etal. studied the water quality of Sangam before the "Kumbh-Melas" far the months October, November and December, 1988 and reported that water was not fit for human use.

The river Ghaghra is a majar left bank tributery of Ganges river, rising as Karnali river in the Tibetian Himalayas and flowing southest into Nepal, cutting southward across Sivalic Hills, it splits into two branches to rejoin the Indian border and form the Ghaghra proper. The stretch of Ghaghra in Ballia is about 97 kilometers. Sier, Nawanagar, Maniar, Bansdih, Reoti and Baria are the main towns situated on or near the bank of Ghaghra. The river is mainly polluted in Nawanagar, Shikandarpur, Maniar and Sier regions. Several Nallahs and drains were found adding the load of pollution in the river water among which for four Nallahs were observed carrying the maximum amount of industrial effluents, domestic wastes and other

pollution causing materials. These were Usari, Bahera, Chakra and Barauli Nallahs.

The most common contamination form of chromium in drinking water is in hexavalent form. Chromate salts are used in wool dyeing, tanneries, electroplating, ceramics, explosives etc. Cotton dyeing, specially in the dyeing of Khaki dress, chromium is discharged in water. Hexavalent Cr is toxic to plants.

Experimental

The reduction-precipitation method finds wide applications in the treatment of chromium. It is economical and the removal efficieny is 98-99%. The steps invalved in this method are -pH adjustment, reduction and precipitation. pH adjustment is achieved with the use of H_2SO_4, where the pH is reduced to 2-3. At this level, the reduction of Cr^{6+} to Cr^{3+} is achieved very efficiently. For precipitation, the most favourable pH is between 8 to 9. Neutralization was carried out by using NaOH or $Ca(OH)_2$.

Water for analysis have been collected from four different sites viz. Belthara Road (S1), Haldirampur (S2), Maniar ghat (S4). Sampling from each site was performed in three steps. The first step includes the collection of samples from surface, at a depth of 10 cm., secondaly it was performed from midddle layer and the sampling was also made from the bottom layer. Such sampling was performed periodically at an interval of 10 days and average of readings was obtained , separately for surface, middle and bottom layers, and the average denotes the result for the concerned month. The procedure was repeated in every month in the duration Jan. 2001 to Oct.2002.

Result and Discussion

The data recorded through the physico-chemical analysis of samples of water applying standard methods[2,7] have been presented in table-1.

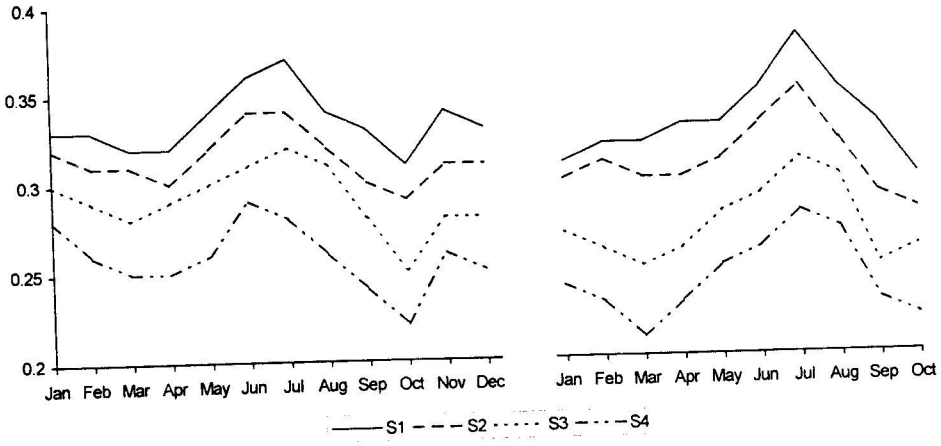
The analysis of river water for heavy metal indicated the presence of chromium in trace amounts at all the sites. A narrow range of 8.20 ppm to 0.35 ppm was obtained with a significant monthly variation. However at S4 in March 2002, the concentration of Cr was least (Fig.1) with a value of 0.21 ppm. It reached to its peak point of 0.38 ppm (fig.1) in Jul.2002 at S1. The Cr content was found largest in the bottom layers and lowest concentration of chromium was observed in the surface layers. The root cause of such observation is the heaviness of the metal. A zig-zag variation in the concentration of this metal can be seen from the curves (Fig1), at the station Belthara Road and the lowest concentration in 2001 can be observed at S1 in Jan and the highest one occured in July and Nov. In 2002 we observe an up steep slope of the curve at S1 from Jan to July and then a down steep curve from July to October. The curves of the same nature are also observed at S2, S3 and S4. Which indicates that variation in contents of chromium at all the four stations depend on weathers and seasons of the year.

The concentration of chromium in Ghaghra river at its stretches in Ballia is very small

Table-1: Variation of Chromium in the Duation 2001-2002

Month	S1				S2				S3				S4			
	S	M	B	Mean	S	M	B	Mean	S	M	B	Mean	S	M	B	Mean
Jan.	0.32	0.33	0.34	0.33	0.31	0.32	0.33	0.32	0.29	0.30	0.31	0.30	0.26	0.28	0.29	0.28
Feb.	0.34	0.33	0.33	0.33	0.30	0.31	0.32	0.31	0.28	0.29	0.30	0.29	0.25	0.26	0.27	0.26
Mar.	0.31	0.33	0.34	0.32	0.29	0.31	0.31	0.31	0.27	0.29	0.30	0.28	0.24	0.25	0.26	0.25
Apr.	0.32	0.32	0.32	0.32	0.29	0.31	0.32	0.30	0.27	0.29	0.30	0.29	0.23	0.25	0.26	0.25
May	0.33	0.34	0.34	0.34	0.30	0.33	0.33	0.32	0.28	0.30	0.31	0.30	0.25	0.26	0.27	0.26
Jun.	0.35	0.36	0.36	0.36	0.32	0.35	0.35	0.34	0.30	0.31	0.32	0.31	0.27	0.29	0.30	0.29
Jul.	0.36	0.37	0.38	0.37	0.33	0.35	0.36	0.34	0.31	0.32	0.33	0.32	0.27	0.28	0.29	0.28
Aug.	0.33	0.34	0.35	0.34	0.31	0.32	0.34	0.32	0.29	0.31	0.32	0.31	0.25	0.26	0.27	0.26
Sept.	0.31	0.33	0.33	0.33	0.29	0.31	0.32	0.30	0.27	0.28	0.29	0.28	0.23	0.24	0.26	0.24
Oct.	0.29	0.31	0.32	0.31	0.27	0.29	0.30	0.29	0.23	0.25	0.26	0.25	0.20	0.22	0.24	0.22
Nov.	0.33	0.35	0.35	0.34	0.31	0.33	0.34	0.31	0.27	0.29	0.30	0.28	0.25	0.26	0.27	0.26
Dec.	0.32	0.33	0.34	0.33	0.30	0.31	0.32	0.31	0.27	0.28	0.29	0.28	0.23	0.24	0.25	0.25
2002																
Jan.	0.30	0.32	0.33	0.31	0.30	0.30	0.31	0.30	0.26	0.28	0.29	0.27	0.24	0.24	0.26	0.24
Feb.	0.31	0.32	0.33	0.31	0.30	0.30	0.31	0.30	0.26	0.28	0.29	0.26	0.21	0.24	0.25	0.23
Mar.	0.36	0.32	0.32	0.32	0.27	0.30	0.30	0.30	0.23	0.25	0.26	0.25	0.20	0.21	0.23	0.21
Apr.	0.34	0.32	0.33	0.33	0.28	0.30	0.31	0.30	0.25	0.26	0.27	0.26	0.22	0.23	0.25	0.23
May	0.32	0.33	0.34	0.33	0.30	0.31	0.33	0.31	0.27	0.29	0.30	0.28	0.24	0.26	0.27	0.25
Jun.	0.34	0.35	0.37	0.35	0.31	0.33	0.34	0.33	0.28	0.29	0.30	0.29	0.25	0.26	0.27	0.26
Jul.	0.37	0.38	0.39	0.38	0.33	0.35	0.36	0.35	0.30	0.31	0.32	0.31	0.27	0.28	0.29	0.28
Aug.	0.34	0.35	0.35	0.35	0.31	0.32	0.33	0.32	0.29	0.31	0.32	0.30	0.25	0.27	0.28	0.27
Sept.	0.36	0.31	0.32	0.33	0.27	0.29	0.30	0.29	0.24	0.25	0.27	0.25	0.21	0.23	0.24	0.23
Oct.	0.29	0.30	0.31	0.30	0.26	0.28	0.29	0.28	0.23	0.27	0.28	0.26	0.20	0.22	0.23	0.22

Fig-1 : Chromium content variation in the duration of Jan 2001- Oct-2002



and it is not dangerous to animals and human beings. The tannaries established on the bank of Ghaghra are responsible for pollution of river water. This type of pollution can be dominent in the hills, which are in the vicinity of the tanneries.

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