



THE EVALUATION OF WATER QUALITY INDEX AROUND WCL KOLERA-PIMPARI COAL MINES

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ABSTRACT

The objective of this work is to provide information on the ground and surface water Pimpri area in order to appreciate the impacts of mining activities on the quality of water and to discuss its suitability for human consumption from the water quality index values. The water quality of Pimpri village which is very near to the open cast coal mines (WCL Kolera Pimpri) were calculated by considering eight parameters viz. pH, total hardness, TDS, chloride, nitrite, nitrate, sulphate and sodium. For the study the water samples were collected from a Nalha, a river (surface water) and three tube wells (ground water) during Dec. 2003 to April 2006. The nalha receives discharged water from the mine. The river water analysis was carried out considering two stations one before discharged and other after discharged. The study revealed that the water quality is poor at Nalha and unfit for human consumption without treatment whereas, the river and ground water is acceptable.

Key words: Water quality index, Coal mines, River, Nalha, Tube wells.

INTRODUCTION

The use of water quality index (WQI) simplifies the results of an investigation related to a water body, as it summarizes in one value of parameters analysed. In this way, the index is very useful to transmit information concerning water quality to the public giving a good idea of the water quality to besides allowing the comparison between different watercourses or different locations. The index studied to analyse pollution at the location and also accomplishing analysis for the necessary parameters.

Bascarón developed a highly flexible index denominated WQI_B. This index allows the introduction or exclusion of parameters in agreement with the needs or limitations for data acquisition (Bascarón, 1979).

The objective of this article is to present a water quality evaluation surface water that receives discharged water from a coal mine. The river and a nalha were chosen for this study because it represents an environmental degradation. Employment opportunities and economic growth of a region being the main objectives, mining activities are carried out without the proper consideration of the environmental impacts. In this way, rivers and nalha receive great volumes of contaminants daily.

The sampling stations around coalfield area are located in Maharashtra state, India. It lies between latitude: 20°03' to 20°06' N and longitudes: 79°01' to 79°03' E. the area is covered by Survey of India Topo Sheet No. 56P/4. Topographically the area is situated in plains, flat having an altitude between 170 to 220 meters above mean sea level.

Methodology

The objective of an index is to turn complex water quality data into information that is understandable and useable by the public. Sampling of all sites was carried out from Dec. 2003 to April 2006. Water samples were taken at three months interval and after determining field parameter (temperature), they were kept in the dark at a cool temperature in a cool box before being transported to a laboratory for quantification of other parameters.

Water quality index is calculated by the Bascaron Method (1979). In this method water quality index is calculated using following equation.

$$WQI_B = K \frac{\sum C_i P_i}{\sum P_i}$$

where:

C_i = Percent value corresponding to the parameter, defined in Table 1.

P_i = Parameter weight, defined in Table 1.

K = Constant of adjustment in function of the visual aspect of the water, as follows: 1.00 for clear water with no apparent contamination.

Table 1: Percentage values of parameters to calculate WQI

Parameter	pH	Total hardness	TDS	Cl ⁻	NO ₂ ⁻	NO ₃ ⁻	SO ₄ ²⁻	Na	Apparent aspect	Percent value C _i
Weight P _i	1	1	2	1	2	2	2	1		%
Analytical value of the parameter	1	>1.500	>20.000	>1.500	>1	>100	>1.500	>500	Worst	0
	2	1	10	1	0.5	50	1	300	Very bad	10
	3	800	5	700	0.25	20	600	250	Bad	20
	4	600	3	500	0.2	15	400	200	Unpleasant	30
	5	500	2	300	0.15	10	250	150	Inappropriate	40
	6	400	1.5	200	0.1	8	150	100	Normal	50
	6.5	300	1	150	0.05	6	100	75	Acceptable	60
	9	200	750	100	0.025	4	75	50	Pleasant	70
	8.5	100	500	50	0.01	2	50	25	Good	80
	8	50	250	25	0.005	1	25	15	Very good	90
7	<25	<100	0	0	0	0	<10	Excellent	100	

Site	WQI	Quality
PW1	62.5	Acceptable
PW2	60	Acceptable
PW3	65.8	Pleasant
PW4	65.8	Pleasant
PW5	58.33	Acceptable
PW6	54.17	Nomal

The results of index application are presented quantitatively, corresponding to a value or grade of between 0 and 100, and qualitatively, in Table 2.

Table 2: Average values of parameters at various sites during Dec. 04 - April 06

Stations parameter	PW1	PW2	PW3	PW4	PW5	PW6
pH	7.62	7.66	7.67	7.65	7.44	7.36
Total hardness	244.68	317.9	227.91	183.31	226.75	273.21
TDS	929.31	907.59	809.11	731.07	970.49	998.15
Chloride	132.66	115.3	106.07	57.49	93.75	115.4
Nitrite	0.015	0.0162	0.015	0.015	0.0162	0.0188
Nitrate	18.14	21.22	22.5	28.34	31.74	36.45
Sulphate	60.41	59.5	28.66	38.6	173.54	185.2
Sodium	116.66	91.38	105.61	88.85	137.25	142.67

RESULTS AND DISCUSSION

It was observed from the WQI that the values ranged from 54.17 to 65.8 and have fallen under “Normal”, “Acceptable”, “pleasant”, water quality respectively. In order to reach a better view of water quality in the Pimpri region, selected results from the determination of water quality parameters are discussed below.

The results of pH varied from 7.36 to 7.67, indicating that the water samples are almost neutral to sub-alkaline in nature. The Total Hardness (TH) is an important parameter of water quality whether to be used for domestic, industrial or agricultural purposes. The results obtained by water surveys shows average value 244.68 for station PW₁, 317.9 for station PW₂, 227.91 for station PW₃, 183.31 for station PW₄, 226.75 for station PW₅ and 273.21 mg/L for station PW₆. Total dissolved solids show great variation values at different sites. The average values ranges from 731.07 to 998.15 mg/L. The average values of chlorides are 132.66 at PW₁, 115.3 at PW₂, 106.07 at PW₃, 57.49 at PW₄, 93.75 at PW₅ and 115.4 mg/L at PW₆. The average nitrite values ranges from 0.015 to 0.019 mg/L. The average nitrate values ranges from 18.14 to 36.45 mg/L which were below the prescribed desirable limits set by WHO (50 mg/L for nitrate) and BIS standards IS: 10500 (45 mg/L for nitrate). The observed values of sodium were ranges from 91.38 to 142.67. The average sulphate values are 60.41 at PW₁, 59.5 at PW₂, 28.66 at PW₃, 38.6 at PW₄, 173.54 mg/L at PW₅ and 185.2 mg/L at PW₆. The sulphate content is high at site PW₅ and PW₆ whereas it is low at other stations which indicate comparatively less pollution.

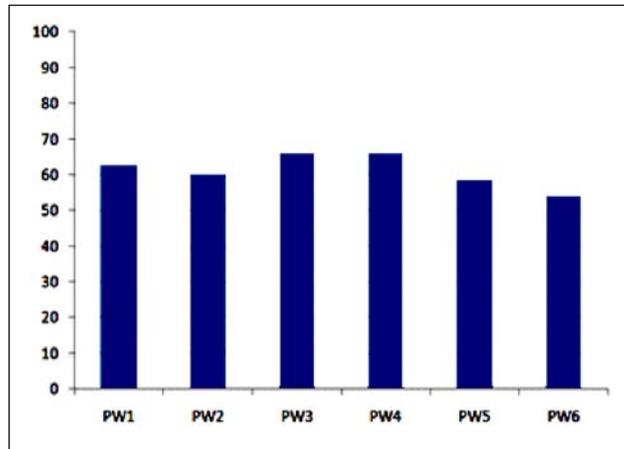


Fig. 1: Showing water quality index (0-100) of various stations

Finally, it can be implied that the preventative measures taken by the local authorities are still not sufficient; it is clear that the domestic, agricultural activities and coalmines discharge are the major threats to Pimpri region's surface and ground water quality.

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