Current World Enviroment Vol. **2**(2), 199-204 (2007)

Water quality criteria and Arpa river water of Bilaspur city (C.G.)

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(Received: June 05, 2007; Accepted: October 17, 2007)

ABSTRACT

The present paper aims to study quality of water in the Arpa river of Bilaspur district (C.G.). Standard testing method have been adopted for the measurement of water quality of Arpa river. Adoption of pollution abatement measures plays a great role in improving water quality[1].

Key words: Water quality, Arpa river, Bilaspur.

INTRODUCTION

Water quality is terms used to define the physical, chemical, biological of radiological characterstics by which a particular type of water may be establish its acceptability for various beneficial uses[2-4].

MATERIAL AND METHODS

All the chemicals used were of AR grade. Double distilled water was used for preparation of reagents. Six strategic locations were chosen for the sampling of water. Those are Koni Petrol Pump (Station-I), Indira Setu (Station-II), Old Bridge (Station-III), Submersible bridge (Station-IV), Kanoi Paper Mill (Station-V) and Near Gatora Bridge (Station-VI). Water samples were collected in one-litre polythene bottles previously soaked with 8N.HNO_3 and cleaned with detergent. The samples were acidified with 6N.HNO_3 (8m/L) soon after sampling.

Analytical methods

PH of the sample was measured by pH meter (Orion pH meter model 940). Cd and Pb were determined (after complexiation and extraction) by AAS (Varion AA model 220). Conductivity of samples have been measured by Digital conductivity bridge (Systronics-304). The operation conditions for AAS have been described below in the Table 1.

Dissolved oxygen (DO) and Biological Oxygen Demand (BOD) were determined by prescribed lavoratory titrimetric methods.

Table 1:

S.No.	Elements		Flame type	Slit	Lamp current
1.	Pb	217nm	Air+C2H2	1.0nm	5mA
2.	Cd	288.8nm	Air+C2+H2	0.5nm	4mA

Dissolved oxygen (Wrinklers method)

300ml sample was taken in BOD bottle, then 2ml. $MnSO_4$ and 1ml. Alkaline Iodide Azide solutions was mixed with it 2ml. H_2SO_4 acid was added and titrated with 0.025N Hypo, using starch as indicator. The dissolved oxygen was then calculated using standard formual[5].

[1ml of 025 N.Hypo solution = 1mg/l of dissolved oxygen]

Biological oxygen demand

Water sample were kept in the dark for five days. Then dissolved oxygen was determined using

Table 2: Indian Standards/Specification for drinking water is (10500.1083)

S.No.	Paramaters	Limit	Unit
1.	Colour Hazen units	10Max	
2.	Odour	Unobjectionatinable	
3.	Taste	Agreeable	
4.	Turbidity NTU. Max	10	
5.	pH value	6.5 to 8.5	
6.	Total Hardness (as CaCo)	300 Max	mg/l
7.	Calcium (as Ca)	75 Max	mg/l
8.	Magnesium (as Mg)	30 Max	mg/l
9.	Copper (as Cu)	0.05 Max	mg/l
10.	Iron (as Fe)	0.3 Max	mg/l
11.	Manganesium (as Mn)	0.1 Max	mg/l
12.	Chlorides (as Cl)	250 Max	mg/l
13.	Sulphate (as So_4)	150 Max	mg/l
14.	Nitrate (as No_3)	45 Max	mg/l
15.	Fluroide (as F)	0.6-12 Max	mg/l
16.	Phenolic compounds (as C_2H)	0.001 Max	mg/l
17.	Mercury (as Hg)	0.001 Max	mg/l
18.	Cadmium (as Cd)	0.01 Max	mg/l
19.	Selenium (as Se)	0.01 Max	mg/l
20.	Arsenic (as As)	0.05 Max	mg/l
21.	Cyanide (as Cn)	0.05 Max	mg/l
22.	Lead (as Pb)	0.1 Max	mg/l
23.	Zinc (as Zn)	5.0 Max	mg/l
24.	Anionic Detergnets (as MBAS)	0.02 Max	mg/l
25.	Chromium (as Cr^{6+})	- Max	mg/l
26.	Polynuclear Aromatic Hydrocarbons (as PAH)	- Max 0.1	mg/l
27.	Mineral Oil	Max	mg/l
28.	Pesticides	Absents Max	mg/l
29.	Residual Free Chlorine	0.2 Max	mg/l
30.	Radioactive material		
	a) Alpha emitters uc/ml	10*	
	b) Beta emitters uc/ml	10*	

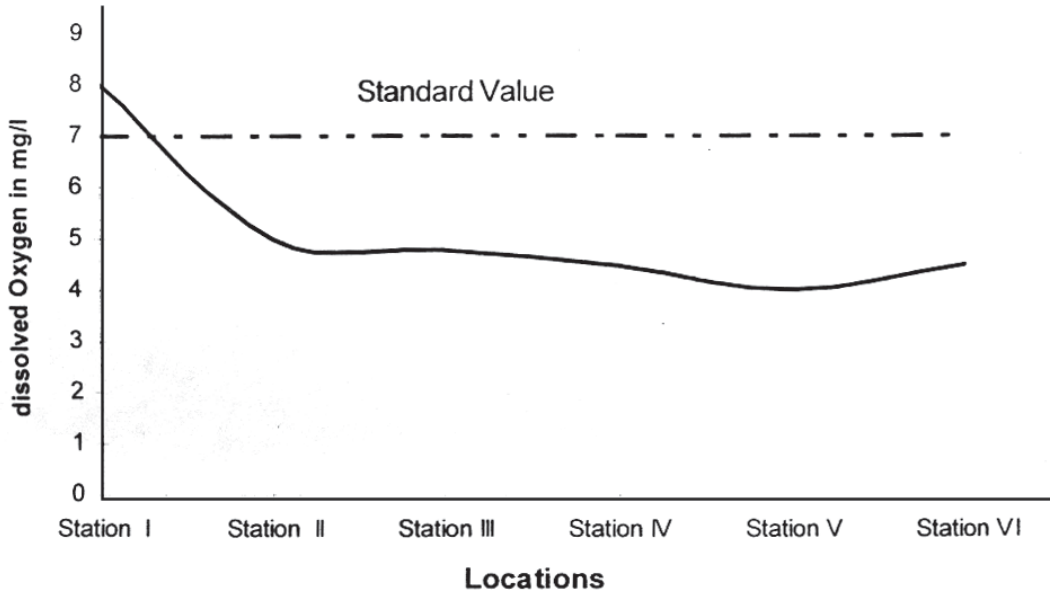

Fig. 1: Dissolved oxygen at different stations

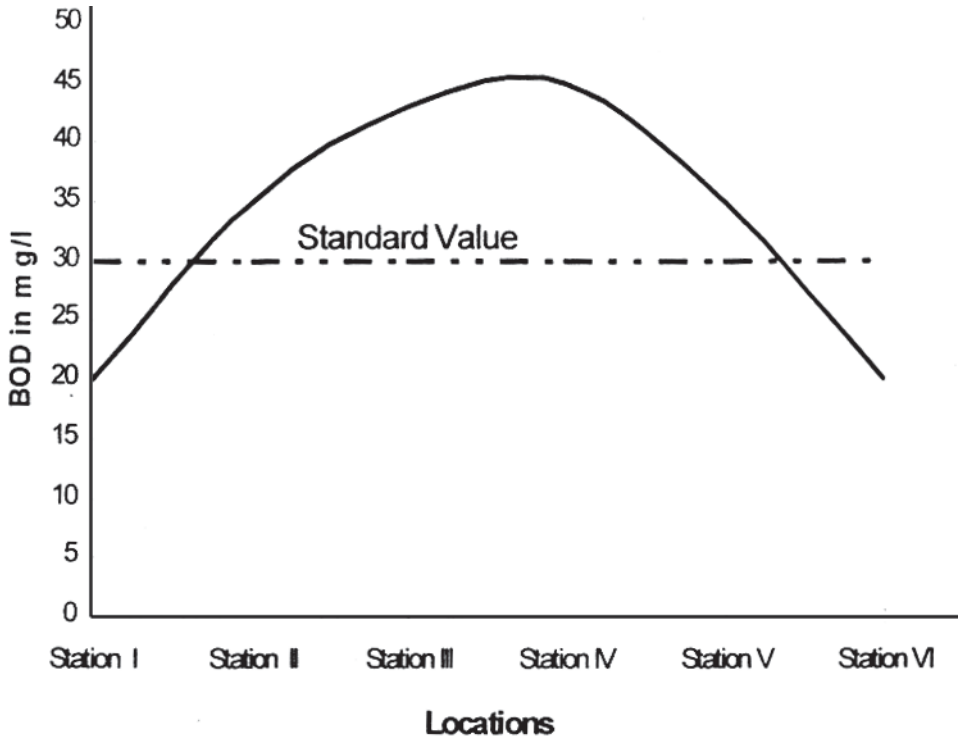

Fig. 2: Biological oxygen demand

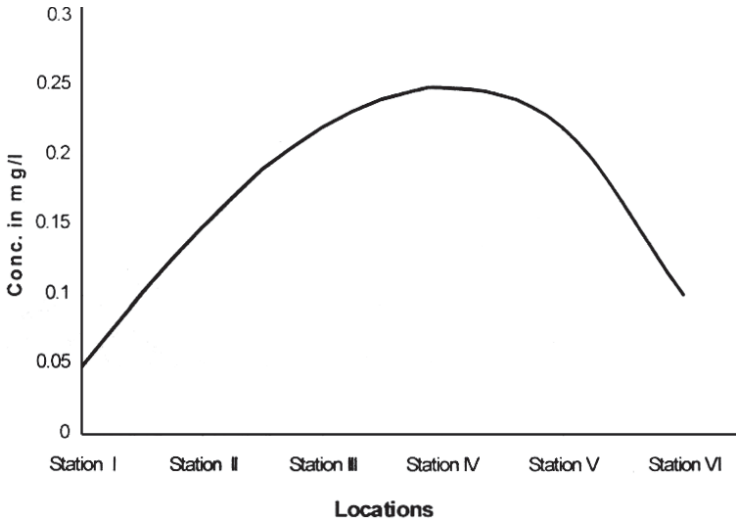

Fig. 3: Concentration on Pb^{+2} in mg/l

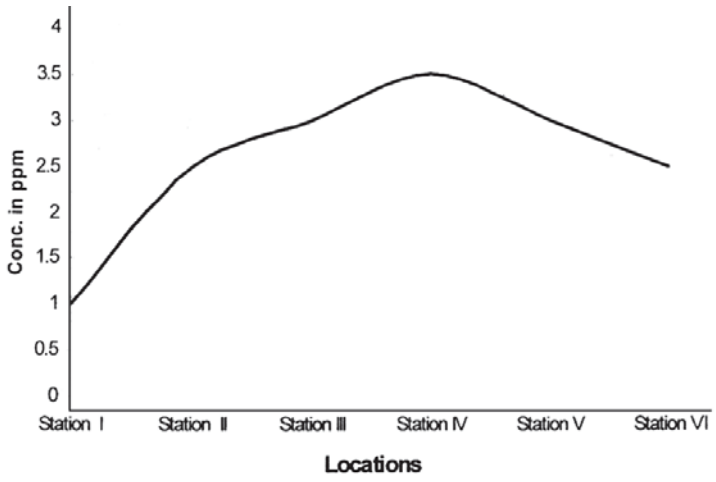

Fig. 4: Concentration of Cd^{+2} in ppm

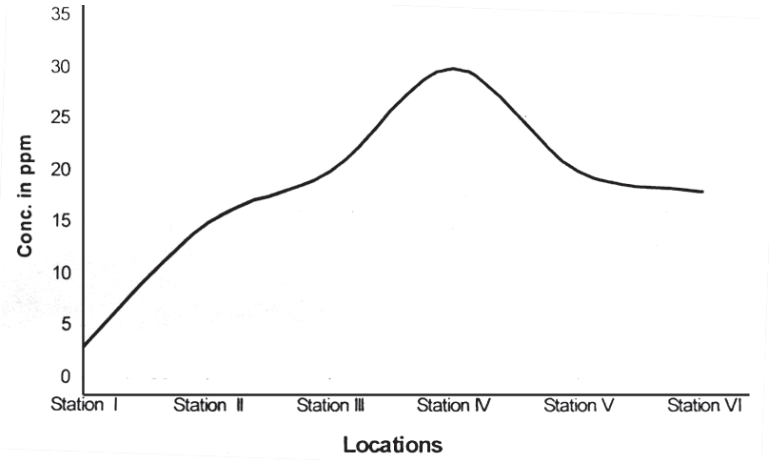

Fig. 5:Pb^{+} levels in mg/l

the Winklers titration method and calculated BOD using standard formula[5].

Chemical oxygen demand

Organic substances in the samples were oxidized by $K_2Cr_2O_7$ in 50% H_2SO_4 at a reflux temperature. Ag_2 SO_4 was used as a catalyst. The excess of $K_2Cr_2O_7$ was titrated with standard Fe11 $(NH_4)_2(SO_4)_2$(hypo) using ferrion as an indicator. Principle reaction is

$$C_aH_bO_c + Cr_2O_7^{-2} + H^+ \xrightarrow[Heat]{Catalyst} CO_2 + H_2O$$

RESULTS AND DISCUSSION

These figures inform about dramatic change in water quality parameters. Hence the Arpa river water is rendered unsuitable for drinking in the city area. The Arpa river is shallow but life line of Bilaspur city. Increasing population and rapid industrialization in the last few decades have icreased pollution in the potable river water. Dissolved oxygen decreases from point no 1 to 4. Paper mill at point, throws chemicals containing alkali and plant degradation products.

In the present study temperature ranged form 25°C to 29.5°C. The pH value ranged from 6.9 (Location) 8.69 (location 5) of the Arpa river. Location 5 and 6 show higher values than the prescribed limit[6].

Total dissolved solids (TDS) ranged form 230mg/l station to 1500 mg/l (station 4,5,6,).

Table 3: Classification of water quality[10].

S.No	Paramter	Clasification		
		Good	Fair	Poor
1.	Temperature	25	27	30
2.	pH	6.5-8.5	6.5-9.5	6.0-9.0
3.	Electrical conductivity	3.25×10^{-3} mhos/cm	3.5×10^{-3} mhos/cm	4×10^{-3} mhos/cm
4.	Dissolved O_2	7 mg/l	6 mg/l	5.5 mg/l
5.	Pb in mg/l	0.01 mg/l	0.01 mg/l	0.05 mg/l
6.	Cd in mg/l	0.003 mg/l	0.004 mg/l	0.005 mg/l

According to and Indian standards as shown in the Table 3, TDS should be less than 500mg/l for drinking water Table 3. The dissolved oxygen between 4 to 8 mg/l. The standard limits is 7mg// for drinking water[8]. The BOD ranged from 20mg/l to 45mg/l. The standard limit is 30mg/l[9]. Chemical oxygen demand (COD) was determined by titrimetric method. COD value informs about organic matter present in the drinking water.

Depletion of dissolved oxygen in water supplies can encourage microbial reduction of NO_3^{-1} to NO_2^{-1} and SO_4^{-2} to S^{-2} giving rise to odour problem. The Electrial conductivity value ranged between 0.50 to 6.15×10^{-3} mhos/cm to 6.15×10^{-3} mhos/cm in the present work. Higher values area 3.30,4 5.2×10^{-3} mhos/cm at locations 2,3,4,5 and 6 and water is unfit for drinking.

Standard values Pb and Cd concentration s for potable water are 0.1 mg/l and 0.003 mg/l. In the present work higher values have been found in the stations 2,3,4,5 and 6. Classification of water quality has been described in the Table 3. below.

Conclusion

Rapid urbanization and increased anthropogenic activities have deteriorated the water quality parameter of Arpa river water. Therefore the pretreatment is essential before supplying for drinking purpose. (This also applies to ground water). Following methods have been suggested as remedial measures.

Remedial measures

1. Flyash, a waste product from coal combustion can be employed as a low cost

adsorbent for the 11 treatment of Arpa river water. Kapadia et al have reported that fly ash removes metals lowers oxygen demand. Some authors have also suggested that it removes colouring material from waste water[12].

2. We propose treatment of Arpa water by photocatalytic degradation of BOD, COD, iron and E-coli bacteria. The solar detoxification is the process in which catalyst, for example TiO_2 is exposed to the sun. The catalyst absorbs high energy photons from UV. Portin of the solar spectrum and reactive free radicals (OH) are formed. These free radicals are powerful oxidizer and disinfectant. In general a concentration of 0.1% to TiO_2 is quite, effective in killing bacteria. This is quite in agreement with works is Kaushik. N.D. *et al.*[14].
3. Vermiculite, a type of mica adsorbs fluoride ion[15]. Hence this can be used for treatment of water to remove fluoride ion.

These abatement measures play a great role in improving water quality of Arpa river water.

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