Water Potability Level of Different Water Reservoir of Bilaspur Region, Chhattisgarh, India

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Abstract- *The environmental quality is greatly focused on water because of its importance in maintaining the human health of the ecosystem. Many parts of the world are facing water scarcity problem due to limitation of water resources coincided with increasing population. One of the greatest concerns for the water consumers with respect to the quality of drinking water is contamination with pathogenic microorganisms. The present research work attempted to investigate the bacterial flora of water reservoir (Dam) in Bilaspur region. Dam water is generally used for irrigation purpose. During summer in scarce of water in most of the rural area situated near dam often use dam water for drinking and other domestic purpose. The physicochemical and microbiological analysis of water samples taken from Khutaghat dam Ghongha dam from Bilaspur. The physicochemical includes the determination of pH, conductivity, turbidity, alkalinity, total hardness, total dissolved salt and biological oxygen demand using standard methods. Most probable number (MPN) counts were by the multiple tube fermentation technique. All the water samples were found to highly coliform organisms in number greater than the WHO standards of water. The MPN counts ranges from 93 to 2400 MPN/100ml. The isolated organisms were identified to be Escherichia coli, Enterobactor aerogenes, S. aureus, Streptococcus, P. aeruginosa. The waters will therefore need to be treated, before it will be fit for drinking.*

Keywords- Physicochemical, Microbiological, Reservoir, Most probable number, Bilaspur

I. INTRODUCTION

Water a vital nutrient in chemical metabolism which plays an important role in the digestion, absorption of food, transportation of nutrients in the body and elimination of waste products via urine. Physical, chemical and microbiological qualities of drinking water have a fundamental importance in chemical industry (Jafari et al., 2006). Water is a resource that has many uses, including recreation, transportation, and hydroelectric power, domestic, industrial, and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well being. Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption (Iskandar 2010). In India almost 70% of the water has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes (Sangu and sharma1987). Potable water is defined as water that is free from disease producing microorganisms and chemical substances deleterious to health (Ihekoronye and Ngoddy, 1985).

Water covers approximately 70% of surface of earth and remaining volume is found in the environment, out of which only 2% of the world's water is drinkable(Lim,1999). No life without water is a common saying, as water is the essential requirement of all life supporting activities. Water can be obtained from a number of sources among which are streams, lake, rivers, dams, ponds, rain, springs, and taps (Okonko et al.,2008). Chemically water is a molecule containing importance of feature of life. As water is a universal solvent it dissolves salts, inorganic and inorganic compounds and gases that take part in metabolic reactions, maintain the macromolecular framework, stabilize plasma membrane, thermoregulation, transport nutrients and maintain hemostasis and body volume/weight (Armstrong et al.2007). Water is an important component of all cells and is prerequisite of life on earth. The water composition of a cell varies from 45% to 95%, according to (Anthony and Elizabeth 1980). Water is lost from the earth by the way of evaporation, transpiration, exhalation, and is returned to the earth by the way of precipitation (Verma, 2004). water is one of the most important requirements for survival of life on the earth. Now a day the demand of the water increases due to the increase of human population in cities. Many developing regions suffer for the lack of safe drinking water for their population. About 800 billion people in Asia and Africa are living without access to safe drinking water. Consequent this has caused many people to suffer from various diseases. (Tanwir et al. 2003).

Several types of organisms found in water such as Escherichia coli, Enterobactor aerogenes, S. aureus, Streptococcus, P. aeruginosa, Salmonella sp, Shigella spp which cause water borne diseases. Coliform bacteria are a commonly used indicator of sanitary quality of foods and water. They are defined as rod-shaped Gram-negative non-

spore forming and motile or non-motile bacteria which can ferment lactose with the production of acid and gas when incubated at 35–37°C(APHA, Washington, DC 1985).

II. MATERIALS AND METHODS

1. SAMPLE COLLECTION

I have taken 14 water samples from site-1 of khutaghat dam, ratanpur bilaspur (C.G.) and site- 2 of ghonga dam, kota, bilaspur (C.G.) in white plastic bottles which have 7 samples from each sites in month of february to august in 2016(single sample in each months as shown in table). The collected samples were placed in a thermocol box. The temperature in the box was maintained at 4°C by using ice packs.

2. TEST FOR COLIFORMS BACTERIA OR MOST

The original test for the presence of coliform in water is done by standard multiple tube fermentation technique. This method involves the three routine standard tests:

a) The Presumptive Test:

A series of fermentation tubes each containing lactose broth of known concentration, are inoculated with known amount of water. These tubes are incubated for 24 to 48 hours at 350 C. Generally, 3 fermentation tubes containing single or double strength broth are inoculated with 10 ml water, 3 tubes with 1 ml water and 3 with 0.1 ml water.

b) The Confirmed Test:

The confirmed test is done by eosine methylene blue (EMB) agar or endo agar method. In eosine methylene blue agar method, a definite amount of two stains (eosine and methylene blue) is added to a melted lactose agar.

c) The Completed Test:

In the last, the completed test id performed to ascertain about the presence of coliforms in water. The purpose of the completed test is to determine whether

I. The colonies growing on EMB agar are again capable of fermenting lactose and forming acid and gas,
II. The organism transferred to agar slants show the morphological appearance of coliform group.

3. BIOCHEMICAL TEST

The Biochemical test perform include Gram's staining, CatalaseTest, Coagulase test. , Indole production test, Methyl red test, Voges proskauer test, Citrate utilizing test, Triple sugar iron agar (TSI) test, Urease agar test, Oxidase production test. These biochemical tests were performed as per standard microbiological methods.

4. CHEMICAL ANALYSIS

The chemical analysis test perform include Temperature, pH, Turbidity, Alkalinity, Total hardness, Total dissolve salt, Biochemical oxygen demand (BOD), Electrical Conductivity.

III. OBSERVATION AND RESULT

On doing microorganism identification testing, we found following microorganism after incubation:

Culture media showing growth for *E.coli* identification

Fig1: After overnight incubation in MacConkey Agar Plate

Fig2: After overnight incubation in Blood Agar Plate

Culture media showing growth for *Enterobacter aerogenes* identification

Fig3: After overnight incubation in MacConkey Agar Plate

Fig4: After overnight incubation in Blood Agar Plate

Culture media showing growth *Pseudomonas aeruginosa* identification

Fig5: After overnight incubation in MacConkey Agar Plate

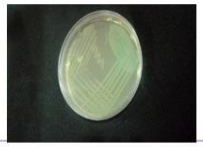


Fig6: After overnight incubation in Nutrient Agar Plate

Culture media showing growth*Staphylococcus aureus*identification

Fig7: After overnight incubation in Blood Agar Plate

Fig8: After overnight incubation in Mannitol salt Agar Plate

Culture media showing growth*Streptococcus species* identification

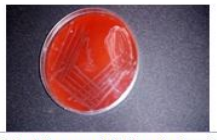


Fig9: After overnight incubation in Blood Agar Plate

Fig10: After overnight incubation in Nutrient Agar Plate

Table No.1: Site-1 of khutaghat dam, ratanpur bilaspur

S.No.	Months	Number of tubes giving positive reaction of			
		3 of 10 ml each	3 of 1 ml each	3 of 0.1 ml each	MPN index per 100 ml
1	February	3	1	2	120
2	March	3	2	0	93
3	April	3	2	1	150
4	May	3	2	2	210
5	June	3	3	1	460
6	July	3	3	2	1100
7	August	3	3	3	2400

Table No.2: Site- 2 of ghonga dam, kota, bilaspur (C.G.)

S.No.	Months	Number of tubes giving positive reaction of			
		3 of 10 ml each	3 of 1 ml each	3 of 0.1 ml each	MPN index per 100 ml
1	February	3	2	1	150
2	March	3	1	2	120
3	April	3	3	0	240
4	May	3	2	2	210
5	June	3	3	0	240
6	July	3	3	3	2400
7	August	3	3	2	1100

Chemical Analysis

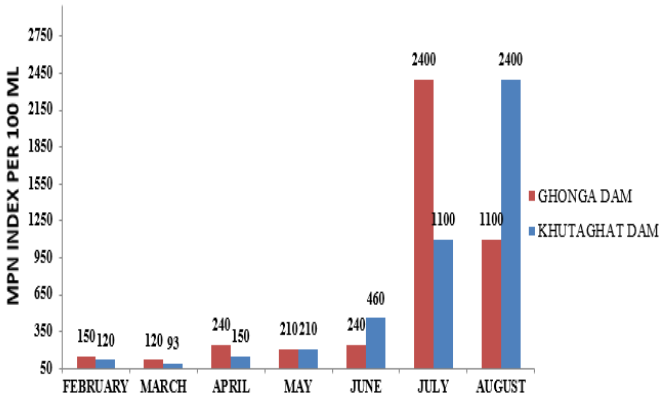
Chemical analysis of site-1 of khutaghat dam, ratanpur bilaspur (C.G.) and site- 2 of ghonga dam, kota, bilaspur (C.G.) in month of february to august(single sample in each months) is as follows:

Table No.3: Chemical analysis of site-1 of khutaghat dam, ratanpur bilaspur (C.G.)

S.No.	Parameter	Result of Month of						
		Februar y	March	April	May	June	July	August
1	Temperature	22.4°C	28.3°C	30.2°C	34.6°C	37.1^{0}C	33.6° C	28.4°C
2	PH	8.1	8.4	8.3	8.5	8.7	8.2	8.4
3	Turbidity	5.82 NTU	7.14 NTU	6.59 NTU	5.11 NTU	5.81 NTU	6.27 NTU	5.42 NTU
4	Alkalinity	80mg/l	90 mg/l	75mg/l	88mg/l	76mg/l	82mg/l	87mg/l
5	Total hardness	60 mg/l	54mg/l	58 mg/l	58 mg/l	56 mg/l	59 mg/l	54 mg/l
6	Total dissolve salt	76 mg/l	62.3mg/l	76.5mg /l	75.6 mg/l	75.6 mg/l	76.1 mg/l	76.5 mg/l
7	Biochemical oxygen demand	4.9 mg/l	4.9 mg/l	5.0 mg/l	5.0 mg/l	4.8 mg/l	4.9 mg/l	5.1 mg/l
8	Electrical conductivity	152 mmhos/c m	152.3 mmhos/c m	151.3 mmhos /cm	151.3 mmhos /cm	153.1 mmhos/ cm	151.1 mmhos /cm	152.2 mmhos /cm

Table No.4: Chemical analysis of site- 2 of ghonga dam, Kota, bilaspur (C.G.)

S.No.	Parameter	Result of Month of						
		Februar y	March	April	May	June	July	August
1	Temperature	23.7^{0}C	26.5^{0}C	29.1^{0}C	32.4^{0}C	36.2^{0}C	30.7^{0}C	26.3^{0}C
2	PH	8.3	8.5	8.4	8.2	8.6	8.2	8.3
3	Turbidity	7.26 NTU	6.27 NTU	6.87NTU	5.98 NTU	6.15 NTU	6.33 NTU	5.91 NTU
4	Alkalinity	70 mg/l	60 mg/l	70 mg/l	62 mg/l	64 mg/l	63mg/l	68mg/l
5	Total hardness	66 mg/l	60 mg/l	60 mg/l	64 mg/l	61 mg/l	63 mg/l	67 mg/l
6	Total dissolve salt	62.2 mg/l	64.1 mg/l	61.6mg /l	62.6mg/l	63.1mg/l	62.7mg/l	61.4 mg/l
7	Biochemical oxygen demand	5.6 mg/l	5.5 mg/l	5.5 mg/l	5.6 mg/l	5.4 mg/l	5.7mg/l	5.4 mg/l
8	Electrical conductivity	124.4 mmhos/c m	124.7 mmhos /cm	123.2 mmhos/ cm	125.2 mmhos/c m	125.6 mmhos/c m	123.5 mmhos/c m	124.5 mmhos/c m



Graph No. 1 Represent MPN index per 100 ml of site-1 of khutaghat dam, ratanpur bilaspur (C.G.) And site- 2 of ghonga dam, Kota, bilaspur (C.G.) in month of February to august.

Table No.5: Percent density of microorganisms in site-1 of khutaghat dam, ratanpur bilaspur (C.G.)

S.No.	Name of Organisms	Density of organism in % of						
		February 2016	March 2016	April 2016	May 2016	Jun 2016	July 2016	August 2016
1.	*E.coli*	35%	37%	42%	43%	38%	40%	43%
2.	*Enterobacter aerogenes*	8%	13%	16%	21%	17%	24%	26%
3.	*Pseudomonas aeruginosa*	11%	15%	21%	23%	20%	22%	24%
4.	*Staphylococcus aureus*	4%	7%	9%	8%	5%	7%	3%
5.	*Streptococcus species*	2%	4%	2%	5%	4%	7%	5%

Table No.6: Percent density of microorganism's in site- 2 of ghonga dam, kota, bilaspur

S.No.	Name of Organisms	Density of organism in % of						
		February 2016	March 2016	April 2016	May 2016	Jun 2016	July 2016	August 2016
1.	*E.coli*	37%	36%	40%	45%	40%	42%	44%
2.	*Enterobacter aerogenes*	6%	11%	13%	17%	18%	22%	25%
3.	*Pseudomonas aeruginosa*	9%	13%	19%	21%	18%	20%	22%
4.	*Staphylococcus aureus*	2%	5%	11%	10%	8%	11%	13%
5.	*Streptococcus species*	3%	5%	2%	5%	3%	7%	5%

Table No.7: Several types of biochemical characteristics of microorganisms

Property	*E.coli*	*Pseudomonas aeruginosa*	*Enterobacter aerogenes*	*Staphylococcus aureus*	*Streptococcus species*
Gas in glucose	A+G	A+(-)	A+G	_	_
Acid in Lactose	+(-)	_	+	_	_
Catalase	+	+	+	+	_
M.R.	+	_	_	_	_
V.P.	_	_	+	_	_
Citrate	_	+	+	_	_
Urease	_	_	_	_	_
TSI	A/A +G	AK/AK	AK/AG	_	_
Indole	+	_	_	_	_
Oxidase	_	+	_	_	_
Motility	+(-)	+	+	_	_
Tube coagulase	_	_	_	+	_
Bacitracin	_	_	_	_	+(-)

A=Acid production only; AG =Acid and gas production; AK = Alkaline production only; +/- = Variable reaction; + =Positive; – = Negative; (+) = Late Positive

IV. DISCUSSION

Water quality in reservoir is an important aspect of water resources management. It is for development and conservation because it determines the dynamic of aquatic organisms and drives various water used in an aquatic ecosystem including reservoirs. The water quality can be visualized in terms of the physical, chemical and biological properties within which several elements of water quality can be identified. Now in recent days water pollution is due to the alternation in physical, chemical and biological characteristics which may lead to harmful effect on human and aquatic biota. On the basis of Microbiological analysis it has been found that E.coli, Enterobacter aerogenes, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus species are present both site-1 of khutaghat dam, ratanpur, bilaspur (C.G.) and site-2 of ghonga dam, kota, bilaspur (C.G.) due to which the MPN index of both sites has increased. On the basis of chemical analysis (pH, temperature, alkalinity, turbidity, total hardness, total dissolve salt, biochemical oxygen demand and electrical conductivity) we the change occurred in every respective month with an increase in their values are observed because of these observed value contamination has been found on both sites.

V. CONCLUSION

This is all due to poor water management system which leads this to the contamination of dam water. We have found many kind of bacteria in both site-1 of khutaghat dam, ratanpur, bilaspur (C.G.) and site-2 of ghonga dam, Kota, bilaspur (C.G.) On the basis of chemical and microbiological analysis of dam water, the water of both sites has contaminated and cannot use for drinking. On the basis of potability of water it has been suggested that the water of both sites are harmful for human consumption. Already water level of region of bilaspur district has been down. This water is very useful for our work like irrigation, purifier drinking water etc. It is very necessary to stop these practices.

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