Assesement of Environmental Impact of Wainganga River Water Near Kardha Villege

N. P. Meshram
S.K. Porwal College Kamptee, Nagpur (M.S.) {India}
mnitin_p@yahoo.co.in

Abstract:

Wainganga river is situated in Bhandara District is common source of water for large density of people inhabiting in the periphery of the river. It was necessary to study the quality of water it supplies to the people and to minimize organic and Inorganic pollutant present in water. Wainganga River carry waste water from other industries. It also carry amount of sewage water with it, which provide favorable condition for microorganism, so it becomes necessary to assess water and look for any biological and chemical pollutant present in water
Standard practice of routine water analysis and microscopic Examination for microbial diversity including phytoplankton and Zooplanktion thus can provide a necessary platform for assessment of environmental impact on the quality of water.

Keywords: *Sewage water, Pollutant, Industrial effluents,Wainganga River.*

Introduction:

Entry of pollutants causes disturbances in an ecosystem which manifest themselves into a chain of adverse reactions often very complex in nature. The meaning of verb pollute is physical contamination of terrestrial or aquatic environment of a body of water by fascinating world of myriads of living organisms including microscopic phytoplankton and zooplankton, green plant, fishes and variety of other aquatic animals. A proper understanding of the physical, biological and the chemical and environment is necessary for comprehending the nature of river water. [1].

Pollution of the water resources is caused by one or more of following factors such as atomospheric dissolved gases, weathering of soil and rock mineral decomposition of animal and vegetable material and industrial effluents i.e., sewage and municipal waste. It is well known fact that water is most important source for drinking purpose. :So it become necessary to minimize organic and inorganic pollutant present in water and make germ free which is suitable for drinking purpose. Wainganga River situated in Bhandara carry waste water from other industries. It also carry amount of sewage water with it, which provide favourable condition for microorganism so it becomes necessary to assess water and look for any biological and chemical pollutant present in water[2].

Due to many complex substances present in water there are chances of presence of many types species of organism so work on water and its analysis will itself be a part of study of microbial diversity in water.

Standard practice of routine water analysis and microscopical examination for microbial diversity including phytoplankton and zooplankton thus can provide a necessary platform for assessment of environmental impact on the quality of water [3].

The environmental impact on the pollution generation has been well documented. The role of eutrophication and human behavior in pollution generation is well known. Under such circumstances, it is imperative to apply common sense and judge the common source of water supply to the community from point of view of its environmental impact. [4].

Since Wainganga River is common source of water for large density of people inhabiting in the periphery of the river, it was necessary to study the quality of water it supplies to the people. The frequent cases of gastroenteritis and other waterborn disesases in Bhandara and adjoining area suggestive of the present work.

The present work was carried out with the intention to study.
Pathogenic load assessment.

B.O.D. as biological pollution index.
Microfloral variation in relation to its quality change.

Literature Review

Water is essential to all forms of life. Nearly 30 % of earth is land and rest 70% is covered by water. About 97% of earth's water supply is in the oceans, which regulates the composition of our atmosphere, influences rainfall, temperature and wind. A rich repository of oil and minerals, the 3-dimentional expanse of the oceans also constitutes the largest ecosystem on earth. Nothing could survive on earth without water. Since water is a natural resource therefore conservation and keeping up of the good quality of water is of prime importance.

The term "Water pollution" generally refers to contamination of natural water resources. Man has polluted much of this limited quantity of water with sewage, industrial wastes and wide area of synthetic chemicals. Moreover the rainfall on its way down to the earth brings down the air pollutants by either dissolving the soluble chemicals or by physically bringing down the particulate contaminants. The pollutants are of various types like natural pollutants, oxygen – demanding wastes, and disease causing agents, synthetic organic compounds. Plant nutrients, suspended solids, organic chemicals and mineral substances thermal pollutants and radioactive wastes. Of these, the natural pollutants and some of the oxygen consuming wastes are biodegradable and rest of these are non- degradable. Most of the non degradable pollutants originate from industrial operations. These pollutants affect man directly or indirectly by endangering his health, harming is living resources and ecosystem or by interfering with legitimate uses of the environment. As a result of investigations conducted recently, nearly 70% of our water resources are polluted, about 15000 plant species and 75000 animal species are on the verge of extinction.

In assessing water pollution, it becomes relatively easy to estimate the extant of pollution due to the sources irrespective of whether it is a natural or artificial. When certain amount of chemical is produced for human consumption, the quantity of its entering the environment can presumably be calculated fairly precisely. If we assess pollution, there are plenty of ways by which water can polluted. It may or may not be possible to curb pollution but we can at least reduce to its an extent that it dose not affect our own survival and ecosystem. Many a study by various agencies has been conducted in past few decades to assess the damage caused by release of industrial effluents and trade and domestic wastes to the ecology of river Ganga and the effects thereof on the quality of the receiving waters as well as on riverine biote. These studies have, however, by and large adopted a qualitative approach towards assessment of river ecology often showing that under the impact of pollution, the water quality does get locally degraded, some times intensely. [5]

Phytoplanktons of fresh water lakes and river have been studied extensively in India. [6,7] . However, not much information is available on ecology of fresh water or of phytoplankton from Maharashtra, one of the leading industrial state of India. Gunal and Blakrishnan 1951, [8] Reported phytoplankton of river Mula and Mutha from Pune and identified bioindicators of pollution. Records of phytoplanktons as bioindicators are available from various parts of the world and their importance as bioindicators is now increasingly recognized. [9,10].

Rapid population growths, increasing living standards, wide range of human activities, industrialization and greater stress on food production have lead to an incrase in population of aquatic ecosystem. The impact of pollutants in most cases mainifest in communities due to which the most of organisms are on verge of extinction. World wide, more than 700 species of vertebrates, invertebrates and vascular plants have been recorded to vanish since 1600. [11] from fresh water bodies. In this concern, it is imperative to investigate the problem systematically from primary producer to top consumer level is essential. For this their requirement of quick and reliable biotool to monitor water quality of river Ganga as well as interrelation ship between species.The traditional physic chemical analysis does not help in determining long term quality of water.[12] quickly in field of studies and

provide an indication when its concentration remains very low. However, biological indicators provide direct clue and quick information of system.Most organisms are been extensively use das indicator for monitoring work in now called biological litmus paper. [13]. The most striking advantage of biological monitoring of water quality is it can integrate many different environmental factors and pollutants over long period of time and maintain their position in water. Many mathematical equations scales and indices [14,15] have been developed but unfortunately as general agreement to detect the level of water pollution is still wanting. Problems related to this factor evaluate the water quality is that either they take maximum time period in calculation or very in their number and composition in an area due to effect of different environmental factors. For sake of that following group of organisms i.e. algae, [16] bacteria, [17] protozoa, [18] benthic macroinvertebrates, [19] and other organisms. [20] may be employed as pollution thermometer. Qualitative estimation of biotic communities for monitoring work is necessary to assess the pollution load of aquatic ecosystem. Bacteria and plankton reflected the recent pollution of aquatic ecosystem, however certain macroinvertebrates remain in their inhabitant for longer period, which face and survive even in stress condition and given informations of post pollution of system.

Material and Methods:

The present work involved through sampling of water over an extened period of time. Hence, a period spanning between August to December was selected for sampling primarily with the idea of covering rainy and winter blooms. All water samples were collected in standard sample bottles obtained from Himedia. At times 3 liter sterile glass jars fitted with grounded glass corks were used for large volume water sampling. Since, the river is only 1 km away from the site of the laboratory, no specific transport medium was used but the samples were processed immediately for the respective work. All the sampling works done by random representative repetitive was done from the river at a depth of around one foot.

The present work involved enumeration , isolation and identification of the bacterial population of the river water . Hence standard methods were practiced as stated below.

Enumeration

Enumerations of microbial load from the collected samples were done by standard plat count method as per the protocol sitted in the laboratory Manuel. The results were reported as colony forming units per ml. [21].

Isolation :

Large volume of samples were used for isolation of organisms by spread plate technique. Representative aliquot of water from the large volume samples were spread over a large vaeiety of media including nutrient agar,P.D.A., XL.D. and B.S.A. The plates were incubated at 37^{O}C for 24 horus except for P.D.A., which were incubated at 25^{O}C for 3 to 5 days. Different colony characteristics were examined microscopically, biochemically and by culture on specific media. The standard isolation and characterization procedures were followed as per the protocol. [22]

Identification :

The organisms were identified on the basis of staining procedures including gram stain, endospore stain, and by motility by hanging drop method . Sugar fermentation test were carried with selected sugars including Dextrose, Maltose, Lactose and Mannitol. All the organisms were subjected to IMVIC test using standard chemicals from Himedia and the cultural characteristics were done on MacConkey, X.L.D. B.S.A., and T.S.I. The production of catalase, oxidase and urease was also tested the antibiogram of the isolates were done by using antibiotic disc from Himedia against Vancomycin, Norfloxacin, Penicillin, Ceftazidime and amikacin. All the procedure was done as per the standard protocols. [21,22]

Chemical parameter :

Due to paucity of time total hardness, alkalinity and B.O.D. were selectively chosen as the chemical parameters for chemical characterization. Total hardness was estimated by E.D. T.A. titramatic method as describe in APHA. B.O.D. was estimated by Wrinkler's modified method as stated in earlier reference. Total alkalinity was determined by using phenolphthalein and methyl orange indicators as per the standard method described in APHA. [3,4].

Result and Discussion:

Enumeration of water sample from waingangariver :

The collected samples were serially diluated and plated on nutrient agar sterile plates for determining colony forming units. The sampling of the extended period between August -12 and December -12 is suggestive of a very low count bacterial microflora over this period. Although rainy samples showed upto 100 e.f. u. per ml but it gradually decreased over the period to below 60 as shown in (Figure. 1).

Enumeration of water Sample from Kanhan River

Extended Time Period

Isolation, identification of organisms :

A regrous sampling and isolation from the samples was done with 1 ml of sample spread over a series of nutrient agar, P.D.A. , X.L.D. and B.S.A. The ranges of colonies obtained on these media are showed in table 1.

For brevity of work only 5 colonies were selected for further studies. The colony characteristic studied on nutrient agar and B .S.A. are shown in table 2. The five selected isolates were marked as Ut-1 to Ut-5 as shown in table 2.

Identification of selected five isolates

A) Microscopically examinations of five isolates were performed with respect to Gram stain, endospore stain and motility. The results were as shown in table. 3

B) Sugar fermentation and IMVIC test :

- All the five isolates were subjected to sugar fermentation and IMViC test as per the standard methods. The results were as shown in table 4

C) Cultural characteristics an enzyme production

- All the five isolates were grown MacConkey, X.I.D., :B.S.A., and T.S.I. and the production of catalase, oxidase and urease were done as per standard method. The results are shown in table 5.

D) Antibiogram :

- Five antibiotics were selected for studying the antibiogram of the five isolates the result with zone of inhabitation and sensitivity is reported in table. 6

Chemical Parameter

Three chemical parameters were selected and after regular sampling over an extended period of time they were estimated and overall picture of alkalinity, B.O.D. and hardness is represented in Table. 7.

The present study shows certain striking features above the environmental impact assessment about wainganga River. Significantly low levels of organic load in terms of low B.O.D. and moderately high D.O. in the range of 5 to 6 mg/lit sugest that the level of environmental degradation of the water body with respect to organic pollution is genuinely low. However, the high levels of alkalinity and pH is indicating of inorganic pollution from industrial plant is being discharge directely into the river, the process of silting must be responsible for abnormal inorganic pollution of the river.

Significant absence of coliforms is clearly visible from the cultural characteristics experiment. Predominance of Proteus an absence of wide varieties suggest that the water has got low profile capacity to act a source of continuous infection. However, a point is to be me here that the protozoal studies should have been carried out for complete assessment. The low standard plate count along with

number of isolates suggests the simple treatment process and good management can still render the water as good source of potable water.

Table. 1-Range of colony of different media

Sr. No.	Type of Media	Number of colonies
1.	Nutrient Agar	14
2.	X.L.D.	-
3.	B.S.A.	2
4.	P.D.A.	-

Table. 2-Colony characteristics of isolates

Sr. No.	Colour of Colony	Colony formed	Number of colonies	Isolate mark
1	Yellow	Round Slimy	5	Ut-1
2	White	Raised entire	4	Ut-2
3	Grey	Irregular shape	5	Ut-3
4	Cream	Raised serrated	5	Ut-4
5	Green	WithslightGrey	1	Ut-5

Table. 3- Microscopic examination five isolates

Sr. No.	Isolate number	Gram reaction	Morphology	Motility
1	Ut-1	Negative	Rod shape bacilli	Sluggishly motile
2	Ut-2	Negative	Rods	Highly motile
3	Ut-3	Positive	Rods	Randomly motile
4	Ut-4	Negative	Small Rods	Sluggishly motile
5	Ut-5	Negative	Large Rods	Randomly motile

Table. 4- Sugar Fermentation and IMViC report of five Isolates.

Sr.No.	Isolate No.	Sugar Fermentation								IMViC Test			
		Dextose		Maltose		Mannitol		Lactose		Indole	Methyl Red	VogesProskauer	Citrate
		A	G	A	G	A	G	A	G				
1	Ut-1	+	-	+	-	-	-	+	-	-ve	-ve	-ve	-ve
2	Ut-2	+	-	+	-	-	-	+	-	-ve	-ve	-ve	-ve
3	Ut-3	+	-	+	-	-	-	+	-	+ve	+ve	-ve	-ve
4	Ut-4	+	-	+	-	-	-	+	-	-ve	-ve	+ve	-ve
5	Ut-5	+	-	+	-	-	-	+	-	+ve	+ve	+ve	-ve

A= Acid Production **+ = Positive**
G = Gas production **- = Negative**

Table. 5- Cultural Characteristics and Enzyme Production of five isolates

Sr. No.	Isolate No.	Cultural Characteristics				Enzyme Production		
		MacConey	T.S.I.	X.L.D.	B.S.A.	Oxidase	Catalase	Urease
1	Ut-1	No growth	Pink spreding colony	No growth	No growth	Negative	Positive	Positive
2	Ut-2	No growth	Black colony	No growth	Black colony	Negative	Positive	Highly Positive
3	Ut-3	No growth	Black colony	No growth	No growth	Negative	Positive	Highly Positive
4	Ut-4	No growth	Pink colony	No	Black	Negative	Positive	Positive

				growth	colony			
5	Ut-5	No growth	Black colony	No growth	No growth	Negative	Positive	Positive

Table 6 : Antibiogram of five isolates

Sr. No.	Isolate No.	Vancomycin		Norfloxacin		Pencillin		Ceftazidime		Amikacin	
		Zone of inhibition	Resistant/ Sensitive	Zone of inhibition	Resistant/ Sensitive	Zone of inhibition	Resistant/ Sensitive	Zone of inhibition	Resistant/ Sensitive	Zone of inhibition	Resistant/ Sensitive
1	Ut-1	17 mm	Sensitive	27 mm	Sensitive	12 mm	Sensitive	19 mm	Sensitive	16 mm	Resistant
2	Ut-2	19 mm	Sensitive	24 mm	Sensitive	>70 mm	Sensitive	>70 mm	Sensitive	17 mm	Sensitive
3	Ut-3	16 mm	Sensitive	22 mm	Sensitive	10 mm	Sensitive	>70 mm	Sensitive	17 mm	Sensitive
4	Ut-4	18 mm	Sensitive	30 mm	Sensitive	10 mm	Sensitive	>70 mm	Sensitive	26 mm	Sensitive
5	Ut-5	12 mm	Sensitive	05 mm	Sensitive	>70 mm	Sensitive	>70 mm	Sensitive	10 mm	Resistant

Table. 7- Chemical characterization of wainganga River water

Sr. No.	Chemical parameter	Average values over extended period	Percent variation
1.	Alkalinity (Mg/lit)	365	+8 %
2	Total hardness (Mg/lit)	36.5	+2 %
3	D.O. (Mg/lit)	5.035	+10 %
4	B.O.D. (Mg/lit)	65.430	+25%
5	pH	7.2 to 7.4	+1%

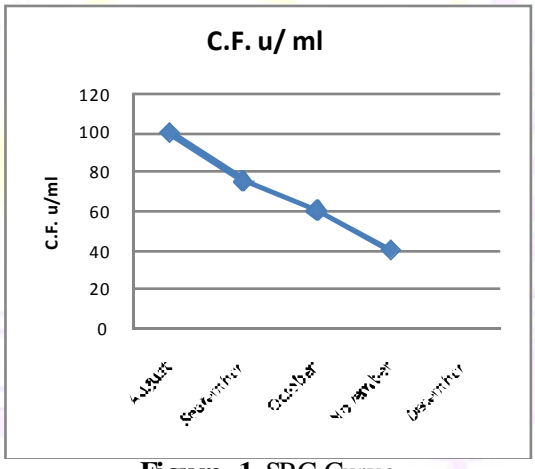

Figure. 1-SPC Curve

Figure. 2-Representative sample plates of Ut 1and Ut 4

Conclusion:

The present study was carried out for a period of only four months and hence final conclusion about the status of river may be enormous. However, it can be calculated from the present study that.

- The river water is still usable for drinking purposes because of absence of coliforms and low B.O.D. levels
- Organic pollution of the river is low there by suggesting that with proper management, the quality of the wate can be further improved.
- The wainganga river water has a low microbial diversity
- Inorganic eutrophication of the river is suggestive of the fact that the flow characteristics of the river will slow down with the concomitant decrease in the level of water of wainganga River.

References:

1) **Mishra S.P**"Assessment of water pollution" AP.H. Publishing corporation © 1996.

2) **APHA (1985),** 16th Ed. American public health association, Washington ,D.c.

3) **APHA (1989),** 17th Ed. American public health association, Wahington, D.C.

4) **Michal J. Pelzar, J.R. E.S.C.S. Chan Norel. R. Krie** Tata McGraw Hill Publishing Limited fifth edition sixth reprint 1996.

5) **Lancing M. Prescot, John P. Harley, Donald A. Klein** "Mircobiology" Copyright 1990 by Wm C. Brown Publisher.

6) **Phawa D.V. (1979)**Indian J. Anim , Sci., 49 212- 219 "Assessment of Water Pollution S.R. Mishra APH Publishng Corporation © 1996.

7) **Trivedy , R.K. 1980,** Ph.D. thesis, University of Rajasthan, Jaipur "Assessment of water Pollution" S.R.Mishra APH Publishing Corporation © 1996

8) **Pramshivan S. And Sreenvisan, A. 1982,** Pollution J. Environ Biol 3 (1):1-9 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

9) **Kolkwits, R and Marsson, M. 1908**Ber. dt. Bot Ges. 26 A 505-519 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

10) **Hentschel , 1925**Arbeitsmethoden 92 1: 233-280, Berlin. V

11) **Naumann, S. 1932** IN F Theinemann. Dis Dinnononeaser 11: 1-176 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

12) **Hynes, H.B.N. (1963),** Biology of Polluted Wwaters, Liverpool University Press, Liverpool, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

13) **Vass, K.K. (1991)** Proc. Work Teg. Viomnon. R. Ganga Barrackpor, 52-61 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

14) **Shannon C.E. and W.Waver (1963)** University of Illions Press Urbana "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

15) **Hynes, H.B.N. (1969),** the Ecology of Runnign Waters Liverpool University Press, Liverpool, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

16) **Wilhm, J.L. and T.C. Dorry (1968)** Bioscience, 18 477-481 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

17) **Fijerdingstad, E. (1964)** Int. Rev. GesHydrobial, 49, 63-131, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

18) **Stamek – Husek, R. (1958),** Ver. Int. Ver. Limnol, 13, 636-645 "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

19) **Gaufin, A.R. and C.M. Tarzwell (1956)**ind.wAtes, 28 906-924, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996

20) **Kolkwitz R. and M. Marsson (1909)** Int. Revue, Ges. Hrdrobiol Hydrogr,2 ; 126-152, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996.

21) **Bilgrami, K.S. (1988)** Proc. Indian Nath. SciAcad, B 54(2 and 3) 171-174, "Assessment of water Pollution", S.R.Mishra APH Publishing Corporation © 1996.

22) **Harold J. Benson** Microbiological Applications fifth edition Wm, C. Brown Publishers © 1990 (50).