Water Quality Assessment of Mahi River in M.P. Region

P.C. Choyal ,Vijay R. Chourey*

Govt. P.G. College Dhar,(M.P.) India
Govt. Holkar Autonomous College Indore (M.P.) India-452017

ABSTRACT: The present work deals with the study of various water quality parameters of Mahi River in M.P. region. Seasonal variability of parameters was studied during the period from March 2015 to February 2016. The samples from six different places were analysed for odour, colour, cation, anions, temperatures, conductivity and for pH parameters. The relationship between parameters has been discovered. Result of analyzed parameters depicted that some parameters values are within the limit as prescribed by ISI and WHO while other are beyond the limit due to various reasons.

KEYWORDS: Mahi River, Water Quality Assessment.

I. INTRODUCTION

Life of all living organism is greatly dependent upon water and lack of such water may endanger the life. This was the reason why many civilizations originated in the vicinity of various rivers which could make water available for drinking and other purposes. It is necessary to keep this aquatic environment as clears as possible.

From the hydrological and environmental point of view it is essential to estimate the certain water quality parameters. These must be monitored and controlled in order to keep the quality of water reveres at an optimal level. Some of these directly affect the health of the system.

The river water is generally used for irrigation purpose, so the study was carried out to access the suitability of water for the same purpose. Around 40% of Indian agricultural output is contributed from areas irrigated by flowing water (Ravichandran et al 2007, Sharda Mani et al 1990). Also the study was carried out to see the impact of locality i.e. nearby villages on its water quality. For this the sampling stations selected are having different identified locations.

It has been observed that recent society have become insensitive towards water contrary to the past.

Our natural water resource are being constantly exploited, mistreated and contaminated. It is very much important to make water quality as safe as practicable. Interventions to improve the quality of water provide significant benefits.

Water quality refers to the physical, chemical and biological characteristics of water. The assessment of water quality in related to the safety of human being and to the Ecosystem.

Purely physico chemical investigation in the lentic and lotic water in India have been made by number of workers (Chattopadhyay et al 1984, Somashekhar at al 1984, Zingde eta al 1985, Palharya et al 1993, Sharma et al 2000, Lakashminarayan et al 2000, Kanase et al 2005, Pandit et al 2005). According to literature survey some of the main reveres of India like Ganga, Yamuna, Godawari, Cauvery and Damodar have been declared as severely polluted (Verma 2009, Verma et al 2009, Soni et al 2013, Kahtoon et al 2013, Baskar et al 2013, Gor et al 2014). Hence systematic assessment was carried out to monitor and evaluate the hydrochemistry of river Mahi in the proposed area of M.P.

The stretch undertaken for present work is about 39 Km downstream from Bhopawar to Labriya Mahi Dam in M.P. This belongs to the Southern Zone of the river.

The sampling station are denoted as given below from S1 to S6-
S1- Bhopawar (Jhirneshwar Dham)
S2- Sardarpur (Navgrah Temple)
S3- Narsingh Devala
S4- Molana
S5- Gundikheda Charan and
S6- Labariya (Mahi Dam)

The stations are located between longitude 70˚21' to 75˚19' E and latitude from 21˚46' to 24˚30' N in Dhar District of Madhya Pradesh.

II. EXPERIMENTAL

All parameters of water samples from various part of Mahi river were determined using standard method of water analysis from their ecological and economic (productivity) importance.

The sampling was done once in a month from March 2015 to February 2016 (Raval et al 2011). The water samples were collected from surface and also from some depth.

Samples were collected in clean polyethylene bottle (PET) which were cleaned and rinsed carefully given a final rinse with distilled water. Finally it was rinsed three to four times with the water samples. Specific reagents were used for the analysis and doubly distilled water was used for preparation of solution.

Parameters like odour, colour, pH were checked within required period. The obtained results were reproducible within ±2.8 to zero % error limit.

III. RESULT AND DISCUSSION

The monthly variation in the physico-chemical parameters of water samples observed at all sites are presented in tables 01 to 06 for study months from March 2015 to February 2016.

A   Temperature:-

The temperature of all station were monitored. As for as any standard guideline concern, there is no limit of temperature for flowing water , Indian Standard 1992. As per observation it has variation between 25˚C to 36˚C independent of reasons. It is more or less moderate in all seasons.

B   Odour:-

The odour of water sample from all collection centers is unobjectionable, Thus water samples are supposed to acceptable for all purposes.

C   Colour:-

Colour is not adversely affecting the water quality but colour is aesthetically not acceptable. In all sampling stations colour was checked in Hazen unit. From the analysis it seems that water samples having acceptable colour amongst all samples studied. While S_2 station sample show high colour in the months of May and June 2015 having values 200 and 300. Same also observed in April 2016 having value 200 in Hazen unit. It might be due to the presence of high Iron or may be due to the presence of some other elements.

D   pH:-

All water samples were also tested for pH measurement. It was observed from the pH values that water samples are slightly alkaline mostly varying between 7.13 - 8.81 and these values are within the prescribed limit as given by WHO and ICMR (APHA 1998, WHO 1993, Patil et al 2001) .Very low pH values of station -1 sample for December 15 is towards acidic side which may change the taste and colour. High values of pH-9.1 in the month of March 2015 have been observed which may be attributed to the presence of acidic material.

As pH has no direct adverse effect on health, however, higher values of pH hasten the scale formation in water heating apparatus and also reduce germicidal potential of chloride. pH below 6.5 starts corrosion in irrigation pipes thereby releasing toxic metals such as Zn, Pb, Cd and Cu etc. from pipes used for irrigation purpose . In the present study, pH of water samples of all stations are within prescribed limit.

E   Conductivity:-

The EC values of water samples are found within the permissible limit. It shows water quality is medium throughout the year. High EC values in particular month of few station indicating the leaching of the salts from the bank side enclosing sediments. Salt water in some way useful for the irrigation purpose. It is in the range of 170-1120 m mhos/ cm. (micro mhos/gm)

No drastic change has been observed in the salt load i.e. EC. Use of such water for agricultural fields creates no problems (Sharma et al 1981, Dashrath et al 2005).

Analysis of Ions:-

The samples collected were also analyzed for measurement of anions and cations. Samples were analyzed for cations As^{+++}, Ca^{++}, Mg^{++} and for Fe^{++}, Chloride (Cl^-), Nitrate (NO_3^-), Sulphate (SO_4^{--}) and Fluoride (F^-) were analyzed as anions.

Study of Anions:-

A   Chloride (Cl^-)

Presence of chloride ranging from 9 to 271 mg/L is also very low from specified range as 250/1000 mg/L.

B   Fluoride (F^-)

Presence of fluoride ranging from 0.15 to 0.61mg/Lis also very low from specified range as 1.0 to 1.5 mg/L.

C   Nitrate (NO_3^-)

Nitrate (NO_3^-) is a important nutrients in the water for eutrophication process. This supports the fast growth of aquatic plant. In the present study the result if nitrate are between 2.2 to 8.8 mg/L Sudden increase in the quantity of NO_3^- in the station 2,3 and 4 in months of November 2015 , above 200 mg/L may be due to divestok facilities agro-chemicals etc. High values of nitrate in water is a big threat to the public health but fit for agricultural use. Presence of chloride ranged from 9 to 271 mg/L. It is well below their prescribed limit as 250-100 mg/L. Chloride usually occurs as $NaCl$, $CaCl_2$ and $MgCl_2$ in widely varying concentration in all natural waters. They enter in water by solvents actions of water on salts present in the soil due to fertilizers waste i.e. agricultural disposal . As nitrate problem represents seepage of agricultural field water into the river (Raj et al 2007).

D   Sulphate(SO_4^{--})

Presence of sulphate ranged from 8 to 164 mg/L. The values are well below the prescribed limit as 200-400 mg/L. Sudden increase in station 1 in the month of December 2015 as 1800 mg/L may be due to dissolutions of agricultural salts. As turbidity, total hardness and TDS also have high values as 57.2 NTU, 396 mg/L and 3055 mg/L in the same month. Conductivity is also observed high as 1072 mili mahos /cm.

Analysis of Cations:-

All samples were analyzed for quantitative and qualitative determinations of cations as Arsenic, Calcium, Magnesium an Iron by standard methods.

Arsenic (As^{+++}) was analyzed as heavy metal in the sample. Its presence has been found as almost nil. Its desirable limit is 0.01 to 0.05 mg/L.

Amount of total calcium (Ca^{++}) is 13-91 mg/L is well below from the WHO specified limit as 100 mg/L.

Amount of Magnesium (Mg^{++}) is also in prescribed limit ranging from 5-60 mg/L.

Amount of Iron (Fe^{++}) in all the sample are within the prescribed limit except for the station –5, where the values varies from 0.54 to 6.8 mg/L from March 2015 to August 2015. In the same way the amount of Iron surprisingly high for the station 1 and 2 in the month of June 2015 and in March 2016 .That is up to 5.800 mg/L.

Taste and odour are problems that may be caused by filamentous organisms that prey on Iron compounds (Frenothrix, Galionella). So such problem may arise in case of these two samples. Such sample have bitter astringent taste.

Peak values of different parameters may be attributed due to the mixing of related material in the midway during the flow of water. These are not frequent. Dissolution of various water suitable substances from the soil rock and the anthropogenic activities could excess the various elements in the resources.

Table (1)

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
			Sample Stations -1 Bhopawar (Jhirenshwar Dham)							
1	Mar-15	8.2	720	91	5	0.2	39	0.19	2.2	17
2	Apr-15	8.2	710	90	5	0.2	40	0.19	3	20
3	May-15	7.9	540	60	19	0.2	46	0.21	4.4	20
4	Jun-15	7.7	660	60	19	0.2	45	0.21	36	20
5	Jul-15	7.7	660	90	10	3.8	45	0.25	36	25
6	Aug-15	8.2	450	51	12	0.2	33	0.26	17	30
7	Sep-15	8.6	530	55	21	0.1	38	0.24	17	48
8	Oct-15	8.4	566	62	18	0.1	45	0.34	30	48
9	Nov-15	8.2	470	53	12	0.1	32	0.38	66	38
10	Dec-15	4.1	1072	58	60	0.1	34	0.36	26	1800
11	Jan-16	8.6	360	13	15	0.2	49	0.34	13	60
12	Feb-16	8.3	616	72	20	3.4	39	0.41	17	146

Table (2)

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
			Sample Stations -2 Sardarpur (Navgrah Temple)							
1	Mar-15	9.1	470	26	22	0.2	54	0.18	4.4	16
2	Apr-15	8.9	520	32	21	0.2	71	0.21	5	18
3	May-15	8.2	680	37	33	0.2	107	0.23	8.8	30
4	Jun-15	7.5	1120	40	32	4.2	271	0.4	8.8	15
5	Jul-15	7.8	480	39	20	0.1	26	0.24	30	20
6	Aug-15	8.4	370	37	14	0.1	23	0.23	17	20
7	Sep-15	8.7	450	46	18	0.05	29	0.21	17	32
8	Oct-15	8.7	420	43	18	0.05	24	0.27	6	24
9	Nov-15	8.2	510	54	19	0.05	38	0.29	220	46
10	Dec-15	8.2	350	45	10	0.1	25	0.31	17	64
11	Jan-16	8.3	810	66	40	0.1	63	0.25	8.8	84
12	Feb-16	8.1	591	54	17	2.6	58	0.34	13	152

Table (3)

Sample Stations -3 Narsingh Devala

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
1	Mar-15	8.7	700	43	34	0.2	71	0.17	30	38
2	Apr-15	8.9	650	36	34	0.2	98	0.18	33	35
3	May-15	8.4	750	30	30	0.2	129	0.2	36	40
4	Jun-15	7.6	700	35	20	0.2	114	0.16	4.4	16
5	Jul-15	8.4	600	33	18	1.2	80	0.17	15	50
6	Aug-15	8.5	390	30	20	1.7	26	0.47	17	26
7	Sep-15	8.6	480	47	21	0.1	34	0.25	17	36
8	Oct-15	8.6	530	37	28	0.1	39	0.26	22	46
9	Nov-15	8	720	76	18	0.05	61	0.61	420	72
10	Dec-15	6.9	690	73	13	0.1	59	0.28	88	96
11	Jan-16	8.2	750	54	38	0.05	52	0.2	44.4	84
12	Feb-16	8.2	894	41	52	0.2	97	0.25	8.8	164

Table (4)

Sample Stations -4 Molana

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
1	Mar-15	8.4	350	29	12	0.2	18	0.16	4.4	8
2	Apr-15	8.6	390	33	14	0.2	19	0.16	5	10
3	May-15	8.2	370	30	19	0.2	22	0.18	10	12
4	Jun-15	7.7	650	43	35	3	19	0.17	6	70
5	Jul-15	8.2	370	40	20	0.3	24	0.2	20	40
6	Aug-15	8.5	350	30	17	0.6	20	0.23	17	20
7	Sep-15	8.7	350	37	14	0.1	24	0.18	17	22
8	Oct-15	8.7	310	32	11	0.05	15	0.21	13	14
9	Nov-15	8.6	280	30	8	0.05	16	0.28	330	16
10	Dec-15	8.1	230	33	9	0.05	15	0.19	17	48
11	Jan-16	8.4	280	24	12	0.1	12	0.18	8.8	24
12	Feb-16	8.5	292	24	12	0.1	15	0.22	8.8	22

Table (5)

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
1	Mar-15	8.4	380	33	15	0.5	17	0.16	88	10
2	Apr-15	8.6	330	24	14	0.4	16	0.15	10	10
3	May-15	8.5	340	25	17	0.4	23	0.17	13	12
4	Jun-15	8.1	350	31	14	0.4	19	0.23	4.4	8
5	Jul-15	8	200	30	10	0.6	7	0.2	12	20
6	Aug-15	7.6	170	16	6	6.8	9	0.15	13	30
7	Sep-15	8.7	240	23	10	0.1	10	0.15	13	20
8	Oct-15	8.8	240	20	9	0.05	11	0.2	8.8	10
9	Nov-15	8.6	240	26	8	0.1	13	0.25	26	12
10	Dec-15	8.7	220	24	6	0.05	14	0.21	13	22
11	Jan-16	8.4	280	24	12	0.1	12	0.18	8.8	24
12	Feb-16	8.5	271	23	12	0.05	14	0.21	8.8	16

Sample Stations -5 Gundikheda Charan

Table (6)

S.no.	Months	pH (6.5 to 8.5)	Conductivity m.mhos/cm	Cations			Anions			
				Calcium 75/200 mg /L	Magnesium (30/100 mg/L)	Iron (0.3/0.3 mg/L)	Chloride 250/1000 mg/L	Fluoride 1.0/1.5 mg/L	Nitrate 40/45 mg/L	Sulphate 200/400 mg/L
1	Mar-15	8.4	330	26	14	0	19	0.16	8.8	8
2	Apr-15	8.6	340	25	15	0	18	0.16	10	10
3	May-15	8.2	350	27	15	0.1	22	0.18	13	12
4	Jun-15	8	276	25	12	0.2	15	0.25	8.8	5
5	Jul-15	8.2	300	20	13	0.1	20	0.15	12	12
6	Aug-15	8.3	320	24	17	0.1	12	0.21	17	15
7	Sep-15	8.7	260	22	11	0.1	11	0.19	17	15
8	Oct-15	8.8	240	26	8	0.05	11	0.12	8.8	10
9	Nov-15	8.6	290	27	8	0.1	17	0.24	66	17
10	Dec-15	8.6	260	28	14	0.05	17	0.25	17	28
11	Jan-16	8.5	290	21	12	0.1	13	0.25	13	24

Sample Stations -6 Labariya (Mahi Dam)

12	Feb-16	8.6	305	24	13	0.1	16	0.28	17	18

IV.CONCLUSION

It is well known that rivers are extremely important as they are the critical elements of the earth's fresh water hydrological system and must be managed as part of larger ecosystem. The results show that water of Mahi river in the studied area is less polluted. Parameters values like temperature, pH, conductivity , colour, odour, temperature , availability of anions and cations are well below of permissible limit of WHO in all mentioned stations .Result show that quality of water for irrigation purpose is quite good so can be directly used for irrigation in respective areas. Impact of surroundings on water quality is very less .Values of some parameters above permissible limit in the sample having impact of agricultural disposal or due to fertilizers waste (Namdev et al 2011, Agrawal et al 1999, Meen et al 2012). With the study of parameters a general conclusion can be drawn as the water of Mahi river in the studied area is fit for irrigation purpose and also good for household and other purpose.

V. ACKNOWLEDGEMENT

REFERENCES

1. Agrawal G.D., Lunkad S.K, and Malkhed T.,Water Sci. Tech.,39(3),67-75(1999).
2. APHA, Standard method for the examination of water and waste water, American Public Health Association and Water Control Federation, Washington, DC , New Yark, Edn. 20.(1998)
3. Baskar S., Narsimhan N, Dainel ,G. Swamidass et. al., Seasonal variation in physico-chemical parameters of river Cauvery, Thanjavur, Tamilnadu, India, Int. J. Res. Bio. Sci 3(1), 8-11(2013).
4. Chattopadhyay S.N., Arora V.P., Gupta S.C. , A short term study on the pollution status of river Ganga in Kanpur region, Indian J. Environ, Hlth., 36,244-247,(1984).
5. Dasharath D. and Reddy E. Narsimha ,Orient J. Chem.,21(2), 283-286 (2005).
6. Gor Ami and Shah Arvind, Water quality index of Mahi river at Vadodara Gujarat, Int.J.Eng.Devp.Res. 2(3),3214-3219,(2014).
7. Indian Standard ,IS-3025 (Part-43),(1992)
8. Kanase D.G., Jadhav S.D., Jawale R.W. and Kadam M.S., Physico-chemical characterization of water of major Rivers, Mula, Mutha and Pavana in Pune city , Proceedings of Inte. Cong. Chem. Environ., 582-583,(2005).
9. Khatoon naseema, Rehman Masihur and Khan Altaf Husain, Study of seasonal variation in the water quality among different ghats of river Ganga,Kanpur, India, J. Environ . Res.Devp. , 8(1),1-10, July-Sept.(2013).
10. Lakashminarayan R. and Somashekhar R.K., Water quality indices of the upstream stretch of river Cauvery, J. Envirion. Pollu., 7(3),213-223,(2000).
11. Meen B.S. and Bhargav N., Ultra Chem. 8(3), 386-390 (2012).
12. Namdev. G. R., Bajpai A. and Malik S., Ultra Chem., 7(2), 167-172 (2011).
13. Palharya J.P., Malviya S. and Siriah V.K. , Environmental impact of sewage and effluent disposal on the river system, Ashish Publushing House, 25-27,Ed (1993).
14. Pandit Pramod, Ansari A.A. and Kanhere R.R., Hydrochemisty of water in Narmada river basin , Proceeding of Inte. Cong. Chem. Environ.,611-613,(2005).
15. Patil P.R., Badgujar S.R. and Waske A.M., Orient . J. Chem., 17(2),279-282 (2001).
16. Raj A. P., Ramchandra Moorthy T. and Sivasankar V., Asian J. Chem., 19(06), 4390-4394(2007).
17. Raval V.H. and Malik G. M., Ultra Chem., 7(2); 173-188(2011).
18. Ravichandran Y.D. and Ramakrishanan K. , Asian J. Chem., 19(4),2679-2682(2007).
19. Sharda Mani and Jagannath M.V., Indian J. Chem., 29A 700-702 (1990).
20. Sharma H.R., Shhetriy D., Kaushik A. and Trivedi R.C., Pariability in organic pollution of river Yamuna in Delhi, J. Environ. Pollu. 7(3),185-188,(2000).
21. Sharma O.P. et.al, Effect of saline water irrigation on crop yield and soil properties. Curr Agric . 5, 48-53 (1981).
22. Somashekhar R.K., Studies of water pollution of river Cauvery, physico-chemical characteristics, Intern. J. Environ. Studies,23(3-4),209-216,(1984).
23. Soni Virendrakumar, Visavadia Manish et al., Evaluation of physico- chemical and microbial parameters on water quality of Narmada river, India, African J. Environ. Sci. and Tech., 7(6),496-503,(June 2013).
24. Verma Dinesh and Kanhare R.R., Water quality of river Narmada in western zone, Life Sci.Bull. 6(1),27-34,(2009).
25. Verma Sarita, Seasonal variation of water quality in Betwa river at Bundelkhand region, Indian Global J. Environ. Res., 3(3),164-168(2009).

26. WHO guide line-Standard Setting and drinking water supply (1993).
27. Zingde M.D., Narvekar P.V., Sharma R.V. and Desai D.N. , Water quality of river Damanganga, Gujarat, India J. Mar. Sci.9, 34-39 ,(1985).

AUTHOR'S BIOGRAPHY

Prof. P.C. Choyal is post graduate from Vikram University Ujjain and has almost three decades of teaching experience. He has served as N.S.S. officer in colleges. Presently he is Head, Department of Chemistry, in Govt. Post Graduate College Dhar (M.P.).

Dr. Vijay R. Chourey, Doctorate in Chemistry from Vikram University, Ujjain has gained almost three decades of teaching experience in colleges affiliated to various universities. He has carried out research in the field of chemical kinetics, homogeneous catalysis, reaction mechanism and environmental studies. He has guided number of research scholars and published over forty research papers in National and International Journals of repute and article to his credit. He has coauthored a book at graduate level published by Shiva Prakashan, Indore. He has been a member of the board of studies and convener / member of academic bodies of university and autonomous colleges. Presently he is Head of Department of Forensic Science at Govt. Holkar Autonomous Science College, Indore.