Comparative Study of Wainganga river Water, During Covid and After Covid at Chhapara, in seoni district(M.P)

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Abstract: The main aim of this study is to check the suitability of the water for domestic and drinking purpose. A systematic study has been carried out to assess the water quality index of Wainganga River, at different locations. In present study, Compare the physio-chemical parameters of the Wainganga river at Chhapara , in Seoni district of Madhya pradesh state studied for the five locations which use for the different purposes like bathing ,farming, pooja, washing, etc.

In the present paper, water quality index (WQI) was estimated for the River Wainganga to compare the affects of the human activities to the bank of the river and river water. The study was directed toward the use of WQI to describe the level of pollution in the river for the locations. The study also identifies the critical pollutants affecting the river water quality during its course through the village and city. The indices have been computed for five locations compare between during COVID-19 and After COVID -19 in the river. The objective of WQI is to turn complex quality data into easily understandable and useable by the public.

These samples are analyzed physio-chemical parameters like pH, Turbidity(NTU), Total Dissolved Solids (mg/L), Total Alkalinity (mg/L),Total Hardness (mg/L), Calcium Hardness (mg/L), Magnesium Hardness (mg/L), Iron (mg/L),Chloride (mg/L), Fluoride (mg/L), Sulphate (mg/L), were taken to assess the impact of pollutants due to anthropogenic activities .The results are compared with standards prescribed by WHO. Water quality of existing untreated and intermittent chemical & distribution of Chhapara village with special reference to suitability of water for drinking and domestic purposes. The practical approach shows its unsuitability for drinking without treatment.

Keywords: Wainganga River, Water Pollution, Water quality index, Quality of water, WHO standards.

1. INTRODUCTION

Freshwater is most important for the survival of life on earth. It is not only essential for human beings, but also for plants and animals . Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human population grows and demand more water of high quality for domestic purposes and economic activities. Globally, there is an increasing awareness that water will be one of the most critical natural resources in future. Thus preventing and controlling the overall degradation of the quantity and quality of these resources, proper management of available water resources is essential for the survival of mankind. The chemical composition of water is a measure of its suitability for human and animal consumption, irrigation, and for industrial and other purposes . At the present time, to safeguard freshwater resources, it is important to develop a comprehensive river water quality monitoring program all over the world. Water chemistry describes the seasonal changes in the behavior of the major ions and catchment characteristics.

Rivers are the essential natural resources for the development of human civilization and are being polluted by industrial and domestic waste discharges, which affect the physio-chemical and microbiological properties of river water. Rivers are lifeline of human establishments. They provide us with water and fertile lands. Civilizations have always settled on the banks of rivers.

Wainganga also passes through many major cities and districts including, Seoni, Balaghat and Bhandara . Wainganga is not a transboundry river. It originates and ends within the Indian borders(Major rivers in India, Details of Wainganga river) . The River Wainganga is exist in Seoni and Balaghat district in Madhya Pradesh. The river originates from Talab of Village Mundwara , District Seoni and passes through Chhapara, Keolari towns of Seoni District and then enter in Balaghat District. Balaghat city is located approx 3 km from bank of the River. After approx. 250 Km travel from origin in state of MP, it enters in to the state of Maharashtra(Regional office, M.P. pollution control board , Jabalpur). The River stretch may be observed in Figure

Figure 1. shows satellite view of wainganga river at Chhapara.

Waingangā river is a perennial river and water is used for drinking purpose by near by towns and cities and villages and for irrigation as well as for power generation (Regional office, M.P. pollution control board , Jabalpur). In Chhapara river water is directly used to farming purpose.
The Wainganga river basin consists of 9472 streams of different order. Analysis of the stream orientation reveals that 7% streams join the main stream from north, 24% from south, 13% from East, 5% from West, 6% from NE, 14% from SE, 19% from NW, 11% from SW. Most of the rivers that originate in the upland area of Deccan Plateau are sinuous in the source region. But the Wainganga channel is straight at source and meandering at confluence. In most of the places straight channel pattern is observed in segments . However, when a large number of samples and parameters are monitored, it becomes difficult to evaluate and present the water quality as a single unit . Traditionally, river water quality has been assessed by comparing the values with the local norms.
However, this technique does not provide any information on the spatial and temporal trends of the overall quality . Thus, modern techniques such as water quality indices (WQI) and water quality modeling were developed .
A water quality index (WQI) helps in understanding the general water quality status of a water source and hence it has been applied for both surface and ground water quality assessment all around the world.
WQI is a mathematical tool which has the ability to provide a single number for the large quantities of water quality data in a comprehensive manner. Therefore, it is a simple tool for decision makers on the quality and possible uses of a given water body.

Water Quality Index

Categorization of water quality started in the mid-twentieth century by Horton (1965) and Landwehr (1974). Horton 1965 used the arithmetic aggregation function for the WQI.
He selected 10 most commonly measured water quality variables for his index including dissolved oxygen (DO), pH, coliforms, specific conductance, alkalinity, and chloride. The arithmetic weighing of the water quality variables was multiplied with the temperature and ''obvious pollution'' to obtain the sum aggregation function from which the overall water quality index was found out.
The index weight ranged from 1 to 4. Brown et al. (1970) developed a general WQI. More than 20 water quality indices being used till late 1970s were reviewed by Ott (1978) and Steinhart et al. (1981). Steinhart et al. (1982) applied a novel environmental quality index to sum up technical information on the status and trends in Great Lakes ecosystem.
In India, the pioneer work on WQI was done by Bhargava (1983a, b, c), wherein the water quality is expressed as a number (ranging from 0 for highly/extremely polluted to 100 for absolutely unpolluted water) representing the integrated effect of the parameters amplifying the pollution load.

2. DESCRIPTION OF STUDY AREA

Seoni, state Madhya Pradesh. It rises from village Mundara in Seoni district and passes through Chhapara, Keolari towns of Seoni District and then enter in Balaghat District. This river flows in West to East direction.
After approx. 250 Km travel from origin in state of MP, it enters in to the state of Maharashtra. During its total course of 569 km, Wainganga river passess through the states of Madhya Pradesh and This study is conducted in the Wainganga River which is an important river of the District Maharastra. Water
quality monitoring of the River at Chhapara, Balaghat and near Budunda (State Boundary) is carried out every month and at Keolari

once in 3 months. In the study area waterbody receives the domestic wastes and drainage water from the residential area throughout the season. During dry seasons waste water do not reach to the river and these Nalas generally observed dried but during rains waste water mixing with storm water reaches to the river.

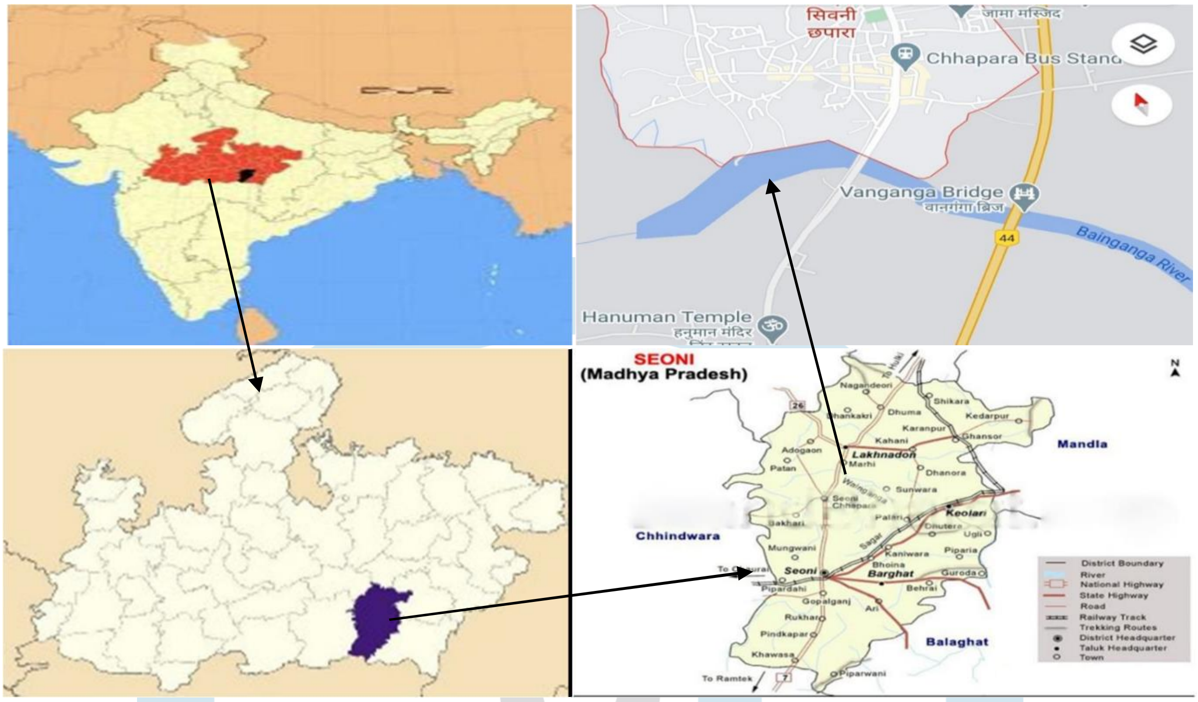


Figure. 2.1 Layout Of The Study Area

Sampling and Collection of Water Samples

With the objective in view the present work is planned to assess the quality of water from five different sites of Wainganga river in Seoni district, village Chhapara, for physio-chemical parameters and the results are compared with the standards given by WHO to determine the extent of pollution. Water samples were collected in the properly washed water bottle in the December month 2022 , from the five selected sites at 10.00 am to 12.00 am of River Wainganga for analyzing the water quality parameters within a period of 6 months from July 2022 to December 2022. The main objective of study is To Compare the physico- chemical properties of water.

Table: 2.1 Sampling sites of Wainganga river at Chhapara, District-Seoni,(M.P.)

Sampling Sites	Places	Longitude Latitude
W1	Near sidhbaba Mandir	N22,23,24E79,32,19
W2	Near shiv Temple	N22,23,22E79,32,31
W3	Near kumhari ward Temple	N22,23,36E79,32,38
W4	Near main road Bridge	N22,23,21E79,32,32
W5	Near NH-7 bridge	N22,23,1E79,32,51

3.MATERIALS AND METHODS

The water samples from the water body were collected at after COVID and compare for 11 physicochemical parameters by following the established procedures. The parameters like pH, Turbidity, Total Dissolved Solids, Total Alkalinity, Total Hardness, Calcium Hardness, Magnesium Hardness, Iron, Chloride, Fluoride, Sulphate, were analysed in the laboratory , REGIONAL OFFICE , POLLUTION CONTROL BOARD – JABALPUR (M.P.) , under the guidance of Junior Scientist – Amiya Ekka , as per the standard procedures of APHA (1995). In this study, for the calculation of water quality index, 11 important parameters were chosen. The WQI has been calculated by using the standards of drinking water quality recommended by the World Health Organisation (WHO), Bureau of Indian Standards (BIS) and The weighted arithmetic index method (Brown et. al.,) has been used for the calculation of WQI of the waterbody. Further, quality rating or sub index (Qn) was calculated using the following expression. Calculation of WQI was carried out by following the 'weighted arithmetic index method' (Brown et al. 1970), using the equation:

$$WQI= \Sigma QnWn/\Sigma Wn$$

Where

Qn is the quality rating of nth water quality parameter.

Wn is the unit weight of nth water quality parameter.

The quality rating Qn is calculated using the equation
Qn = 100 [(Vn –Vi)/(Vs-Vi)]
where
Vn is the actual amount of nth parameter present,
Vi, is the ideal value of the parameter
[Vi = 0, except for pH(Vi = 7) and DO (Vi = 14.6 mg/l)],
Vs is the standard permissible value for the nth water quality parameter.

Unit weight (Wn) is calculated using the formula
Wn = k/Vs
where k is the constant of proportionality and it iscalculated using the equation
k = [1/Σ1/Vs = 1,2,…….,n].
The water quality status (WQS) according to WQI isshown in Table 1.

Table 3.1 WQI range, status and possible usage of the water sample (Brown et al. 1972)

WQI	Water quality status (WQS)	Possible usage
0–25	Excellent	Drinking, irrigation and industrial
26–50	Good	Drinking, irrigation and industrial
51–75	Poor	Irrigation and industrial
76–100	Very poor	Irrigation
Above 100	Unsuitable for drinking and fish culture	Proper treatment required before use

Table 3.2 Drinking Water standards As per Bureau of Indian Standards and Unit Weight

S. NO.	PARAMETERS	AS PER IS:10500-2012	UNIT WEIGHT,Wn
1	pH	6.5 to 8.5	0.0249
2	Turbidity	1	0.0424
3	Total Alkalinity	200	0.0011
4	Chloride	250	0.0008
5	Total Hardness	200	0.0007
6	Calcium	75	0.0028
7	Magnesium	30	0.0071
8	Total Dissolved Solids	500	0.0004
9	Iron	1	0.7067

Table 3.3 Calculation of WQI at Site 1

Parameters	During COVID			After COVID		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	7.93	93.2941	2.326865	8.06	94.82	2.237
Turbidity	8.5	170	7.208001	6.0	120	4.812
Total Alkalinity	142	71	0.07526	28	14	0.014
Chloride	14	5.6	0.004749	20	8	0.006
Total Hardness	138	46	0.032507	130	43.33	0.0303
Calcium	36.8	49.0667	0.138695	28.86	38.48	0.104
Magnesium	11.5	38.3333	0.270889	14.15	47.17	0.316
TDS	159	31.8	0.013483	222	44.44	0.017
Iron	0.2	66.6667	47.11112	0.21	70	46.82
Sulphate	7.5	3.75	0.003975	6.0	3	0.003
Fluoride	0.17	17	3.604001	0.18	18	3.61
	ΣWnQn= 60.79 WQI=60.79			ΣWnQn= 61.58 WQI =61.58		

Table 3.4 Calculation of WQI at Site 2

Parameters	During COVID			After COVID		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	7.75	91.17647	2.274	8.14	95.76	2.259
Turbidity	10.9	218	9.243	6.3	126	5.05
Total Alkalinity	187	93.5	0.099	26	13	0.013
Chloride	26.4	10.56	0.009	11.88	4.752	0.004
Total Hardness	221	73.66667	0.052	136	45.33	0.032
Calcium	57	76	0.215	40.08	53.44	0.144
Magnesium	19.2	64	0.452	8.78	29.28	0.196
TDS	248	49.6	0.021	222	44.44	0.0177
Iron	0.06	20	14.13	0.16	53.33	35.67
Sulphate	16	8	0.008	2.7	1.35	0.00135
Fluoride	0.14	14	2.968	0.175	17.5	3.512
	ΣWnQn= 45.55 WQI =45.55			ΣWnQn= 50.42 WQI =50.42		

Table 3.5 Calculation of WQI at Site 3

Parameters	During COVID			After COVID		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	8.21	96.5882	2.409025	7.4	87.05	2.05
Turbidity	12.5	250	10.6	18	360	14.436
Total Alkalinity	136	68	0.07208	60	30	0.03
Chloride	11.7	4.68	0.003969	19.98	7.99	.0063
Total Hardness	144	48	0.03392	90	30	0.021
Calcium	39.2	52.2667	0.14774	28.05	37.4	0.10
Magnesium	11.5	38.3333	0.270889	4.88	16.26	0.109
TDS	158	31.6	0.013398	180	36	0.014
Iron	0.2	66.6667	47.11112	0.22	73.33	49.05
Sulphate	7.6	3.8	0.004028	5	2.5	0.0025
Fluoride	0.17	17	3.604001	0.17	17	3.41
	ΣWnQn= 64.27 WQI =64.27			ΣWnQn= 69.276 WQI =69.276		

Table 3.6 Calculation of WQI at Site 4

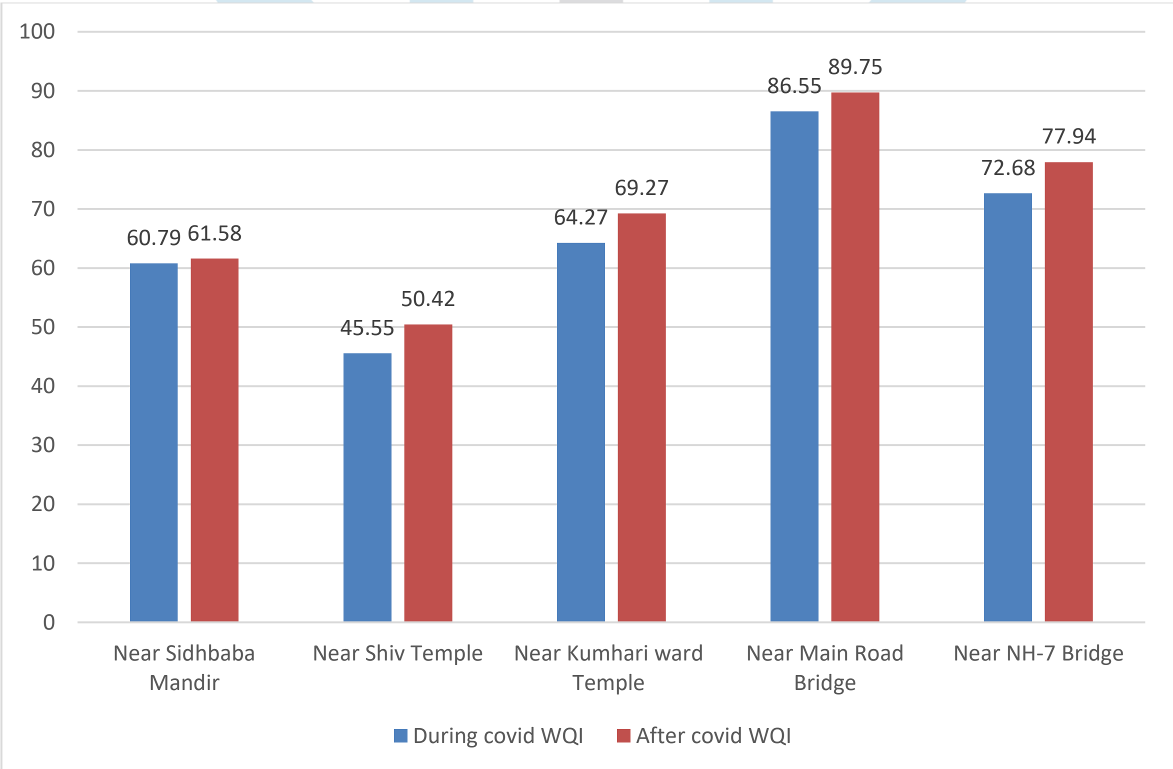
Parameters	During COVID			After COVID		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	8.32	97.88	2.4413	7.3	85.88	2.02
Turbidity	38.7	774	32.818	30	600	24.06
Total Alkalinity	128	64	0.0678	50	25	0.025
Chloride	10.8	4.32	0.0037	19.98	7.99	0.0064
Total Hardness	144	48	0.0339	80	26.67	0.018
Calcium	36	48	0.1357	24.05	32.06	0.086
Magnesium	13.5	45	0.318	4.88	16.26	0.108
TDS	152	30.4	0.0129	170	34	0.013
Iron	0.2	66.67	47.111	0.27	90	60.201
Sulphate	7.4	3.7	0.0039	6.0	3.0	0.003
Fluoride	0.17	17	3.604	0.16	16	3.212
	ΣWnQn= 86.55 WQI =86.55			ΣWnQn=89.75 WQI =89.75		

Table 3.7 Calculation of WQI at Site 5

Parameters	During COVID			After COVID		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	8.32	97.8824	2.441301	8.18	96.25	2.27
Turbidity	22.4	448	18.9952	17.3	346	13.87
Total Alkalinity	128	64	0.06784	24	12	0.012
Chloride	11.7	4.68	0.003969	13.8	5.52	0.004
Total Hardness	134	44.6667	0.031564	160	53.33	0.037
Calcium	36.8	49.0667	0.138695	52.90	70.53	0.19
Magnesium	10.5	35	0.247333	6.83	22.76	0.152
TDS	152	30.4	0.01289	265	53	0.021
Iron	0.2	66.6667	47.11112	0.26	86.67	57.97
Sulphate	7.9	3.95	0.004187	3.7	1.85	0.0018
Fluoride	0.17	17	3.604001	0.17	17	3.411
ΣWnQn= 72.65 WQI =72.65				ΣWnQn= 77.94 WQI =77.94		

Table 3.8 Water Quality Index values and WQI status for all five locations for Wainganga river Basin

SAMPLE NO.	During COVID WQI SCALE	WQI STATUS	After COVID WQI SCALE	WQI STATUS
W1	60.79	POOR	61.58	POOR
W2	45.55	GOOD	50.41	POOR
W3	64.27	POOR	69.276	POOR
W4	86.55	VERY POOR	89.75	VERY POOR
W5	72.65	POOR	77.94	VERY POOR



Graph 3.1 showing WQI values variation of all location

RESULTS

The test results gives information about water quality. Table 3 to 7 shows the test result of 11 parameters and Water Quality Index value of all five locations water sample of river basin During COVID and After COVID.

❖ For the first location variation of WQI value is 60.79 , During COVID to 61.58 , After COVID , the water quality status goes Poor quality to Poor quality for the time of During COVID to After COVID respectively, There is not much variation in water quality.

❖ For the Second location WQI value is 45.55, During COVID to 50.41 , After COVID and The water quality status was Good to Poor quality.

❖ Third location WQI value, which is 64.27 During COVID and 69.276 After COVID, slightly change in water quality.

❖ Fourth location WQI value is in incr order is 86.55 during COVID and 89.75 after COVID. And the fourth location water quality status is slightly deteriorated.

❖ Fifth location WQI value is 72.65 During COVID and 77.94 After COVID, by the values water quality status record is poor to very poor quality.it's significant change.

❖ As per WQI , the value of WQI is higher in Fourth location(W4), near main road bridge, During COVID time and After COVID time, This area is nearest by cemetery ,

❖ it is use for the different purposes, the water pollution is high in this location and WQI value is higher comparatively other four location.

❖ According to this study period time we found the difference between the WQI value in First location W1 (61.588-60.79 = 0.798), And second location W2 (50.41-45.59 = 4.86) , And third location W3 (69.27-64.27 = 5.0) , And fourth location W4 (89.75-86.55 = 3.2), And fifth location W5 (77.9- 72.65= 5.29) , then in increasing order up to fourth location.

❖ We observed that , high difference in WQI value in Fifth location W5 (77.9- 72.65= 5.29).

CONCLUSION

➢ From the results, it has been concluded that, the water of Wainganga river during the study period was showing the variations from good quality to poor quality at site W2, shows very poor to very poor quality at site W4 and shows poor to very poor at site W5, Remaining all other sites (W1 , W3) no variation in water quality status.

➢ The pollution increases site 2 to site 4 continuously, after COVID time. Water quality of Wainganga river was comparatively POOR after COVID.

➢ Based on WQI values, it could be inferred that the water quality was poor, good, poor , very poor and poor During COVID and poor in three locations (W1,W2,W3) and very poor at site fourth and fifth (W4,W5) After COVID .

➢ This study will help to the water quality monitoring and improve water quality and management of water quality and for making water quality suitable for drinking, irrigation and other purposes.

REFERENCES

[1] Asati S R, research paper, Water quality analysis of Source Wainganga River for Tirora Town,Internal Journal of life science Biotechnology and Pharma Research,Vol. 1, No. 2, April(2012),pp244-252

[2] CCME WATER QUALITY INDEX 1.0 User's Manual, In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg. © Canadian Council of Ministers of the Environment 2001 Excerpt from PublicationNo. 1299; ISBN 1-896997-34-1.

[3] Pandey Devendra, Ali MIR Mubashir, Water Quality Index of the Wainganga River, Bhandara, Maharastra, India,Inter national Journal of civil, structural,environmental and infrastructure engineering research and development Vol.3,Issue 2, Jun 2013,pp115-124

[4] Sangani Kinjal & Manoj Kapila, Appraisal of Water Quality of Tapi river in reference to Bacteriological and Physico-chemical properties, International Journal of applied and Natural science Vol. 7, issue 3, Apr – May 2018, PP 57-64

[5] Sharma Deepshikha, Kansal Arun, Water Quality Analysis of River Yamuna using Water Quality Index in the national capital territory, India,(2000-2009)