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Studies Based On River Water with Physio-chemical Parameters: Before Covid and During Covid on Wainganga River, Chhapara, Seoni, M.P

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ABSTRACT

Rivers are a major source of fresh water,which can be used for drinking and irrigation purpose. They are often rich source of fish and other edible aquatic life. Rivers are subjected to physical, chemical, and biological variation due to human activities which is result from increased concentration of dissolved substances to such an extent that the water becomes polluted. River Wainganga is one of the most important rivers of Seoni and Balaghat Districts of Madhya Pradesh. River water is used for bathing, drinking, pooja and irrigation purposes. This river is the lifeline of the nearest village population and the river is mostly polluted by the direct flow of polluted water to the river.The study was conducted to assess the water quality of the Wainganga river basin by water quality index (WQI). Five stations were selected along the river basin. WQI measured along the river basin for the time of winter season during covid 19. Weighted arithmetic water quality index method was used to find WQI along the stretch of the river basin. The water quality index results showed that the water quality of the river is not suitable for direct use without any treatment process.

KEYWORDS : *Wainganga River, Water Pollution, Physiochemical Parameters, Water Quality Rating, Weighted Arithmetic Index*

INTRODUCTION

Water is a priceless content in this world and a very most important things for livelihood. For this it is important to safe water and save water. But in the recent time mostly water sources are polluted just because of the unnecessary and unusable and mankind little activities. Water pollution is a major problem for recent time. Thus,the use of water without any treatment process is can't even think.Water, one of the most vital resources, is essential to sustain life. Based on the fundamental quality, water is used in

different sectors like domestic, agriculture,and etc.Therefore, one should have some basic information on quantity and quality of water resources for its proper usage and management. The increase of water demands due to increasing population and developmental activities has resulted in more use of groundwater than the surface water resource which has led to groundwater depletion(Krishan et al,2016).The quality ofwater is defined in terms of its physical, chemical and biological parameters. Its development andmanagement play a vital role in agriculture production, poverty reduction, environmental sustenanceand sustainable economic development. In India, most of the population is dependent ongroundwater as the only source of drinking water supply(Singh et al.,2016).

River Wainganga is an important river forSeoni district. The river drains into the eastern Nagpur plain and the areas around Seoni and Chhindwara. During the rainy season the river is navigable for only a short distance upstream from the confluence with the Bagh River.This river covers all the nearest villages for the drinking, fishing, agriculture and other purposes. It's originated from the Mundara village to Chhapara village in Seoni district. Chhapara is located very close to the river. This river receives waste water directly from the town. Waingangā river is a perennial river and water is used for drinking purpose by nearby towns and cities and villages and for irrigation as well as for power generation. Bheemgarh dam is on the river which fulfill the water supply for drinking and irrigation. (Regional office, MP Pollution control board, Jabalpur,2019).

Water quality index (WQI) is defined as water quality by differentwater quality parameters. Horton (1965) has firstly used the concept of WQI, which was further developedby Brown, Mc Clelland, Deininger, and Tozer (1970) and improved by Deininger (ScottishDevelopment Department, 1975). WQI is one of the most effective tools to communicate informationon the quality of any water body. WQI is a mathematical equation used to transform largenumber of water quality data into a single number. The water quality of the study was determined for five samples using the weighted arithmetic indexmethod. In this method, the eleven important parameters such aspH, turbidity,total alkalinity (CaCO3),total dissolved solid (TDS), total hardness, calcium (Ca2+), magnesium (Mg2+), sulphates (SO−4),chlorides (Cl−), nitrates (NO−3), fluorides (F−), Iron, and manganese were taken for the water quality (Singh et al.,2016). Weight arithmetic water index method classified the water quality according to the degree of purity.

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 physico-chemical parameters and the results are compared with the standards given by Indian Standards(IS) to determine the extent of pollution. Water samples were collected in the properly washed water bottle of 1 litre capacity in the

month December 2019 before covid-19 to month of December 2020 during covid-19, from the five selected sites at 9.00am to 11.00am of River Wainganga for analyzing the water quality parameters.

Materials and Methods

Water quality index calculation started in the mid-twentiethcentury by Horton (1965) and Landwehr (1974). Brownet al. (1970) developed a general WQI. More than 20 waterquality indices being used till late 1970s were reviewed byOtt (1978) and Steinhart et al. (1981).

Water quality rating (qn) was calculated using the following expression.

qn = 100 [Vn –Vio]/ [Sn –Vio]

where**qn** = Quality rating for the nth parameter at given sampling station.

Vn = Estimated value of nth parameter at given sampling station.

Sn = Standard permissible value of the nth parameters.

Vio = Ideal value of the nth parameters in pure water.

The unit weight was calculated by a value inversely proportional to the recommended standard value (Sn) of the corresponding parameter.

Wn= k/Sn

Where, **Wn**= Unit weight of the parameters.

Sn= Standard permissible value of the nth parameters.

k= Constant for proportionality.

The overall WQI was calculated by aggregating the quality rating (qn) with the unit weight linearly.

WQI = Σ qnwn / Σ wn

Where, **wn**= Unit weight of the parameters &

qn= Quality rating for the nth parameter at given sampling station.

In order to calculate WQI eleven important parameters pH, turbidity, total alkalinity, chloride, total hardness, calcium, magnesium, total dissolved solids, iron, sulphate, and fluoride has been chosen. These parameters utmost donate for the quality of river. For water quality index calculation, we first have to know the weightage of each factor as shown in Table2. Parameters which have higher tolerable limits are less hazardous because they can harm quality of river water when they are present in very high amount. So, weightage of parameter has an inverse affiliation with its suitable limits. Water quality index is

calculated to determine the suitability of water for different purposes (Kankal et al, 2012, Pandey et al.,2014)

Table1. sampling point of the river

Sampling Sites	**Places**	Longitude Latitude
S1	Near sidhbaba Mandir	N22°23'24" E79°32'19"
S2	Near shiv Temple	N22°23'22" E79°32,31
S3	Near kumhari ward Temple	N22°23'3" E79°32'38"
S4	Near main road Bridge	N22°23'21" E79°32'32"
S5	Near NH-7 bridge	N22°23'1" E79°32'51"

Table 2 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

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CHHAPARA SEONI

Figure. 1 Layout of the Study Area

Table 3: Showing Drinking Water Standards Recommending Agency and Unit Weight (Wn) Expressed in (mg/l)

S. NO.	PARAMETERS	AS PER IS:10500-2012	UNIT WEIGHT Wn
1	pH	6.5 to 8.5	0.249
2	Turbidity	1	0.424
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
10	Sulphate	200	0.0011
11	Fluoride	1	0.212

Table 4 Calculation of WQI at Site 1

Before COVID				During COVID		
Parameters	**Vn**	**Qn**	**QnWn**	**Vn**	**Qn**	**QnWn**
pH	7.91	93.0588	2.321	7.93	93.2941	2.327
Turbidity	5.9	118	5.003	19.2	384	16.28
Total Alkalinity	189	94.5	0.1	182	91	0.096
Chloride	27.9	11.16	0.009	20.1	8.04	0.007
Total Hardness	219	73	0.052	202	67.3333	0.048
Calcium	56.5	75.3333	0.213	46.7	62.2667	0.176
Magnesium	20.3	67.6667	0.478	20.1	67	0.473
Total Dissolved Solids	245	49	0.021	221	44.2	0.019
Iron	0.07	23.3333	16.49	0.1	33.3333	23.56
Sulphate	11	5.5	0.006	8.9	4.45	0.005
Fluoride	0.15	15	3.18	0.16	16	3.392
ΣWnQn= 27.87				**ΣWnQn= 46.38**		
WQI =27.87				**WQI =46.38**		

Table 5 Calculation of WQI at Site 2

	Before COVID			During COVID		
Parameters	**Vn**	**Qn**	**QnWn**	**Vn**	**Qn**	**QnWn**
pH	7.79	91.647059	2.286	7.87	92.5882	2.309
Turbidity	11.4	228	9.667	18.5	370	15.69
Total Alkalinity	185	92.5	0.098	181	90.5	0.096
Chloride	26.6	10.64	0.009	12.8	5.12	0.004
Total	223	74.333333	0.053	214	71.3333	0.05

Hardness						
Calcium	59	78.666667	0.222	47.5	63.3333	0.179
Magnesium	20.1	67	0.473	20.5	68.3333	0.483
Total Dissolved Solids	250	50	0.021	225	45	0.019
Iron	0.05	16.666667	11.78	0.11	36.6667	25.91
Sulphate	17	8.5	0.009	7.4	3.7	0.004
Fluoride	0.16	16	3.392	0.15	15	3.18
ΣWnQn= 28.01				**ΣWnQn= 47.92**		
WQI =28.01				**WQI =47.92**		

Table 6 Calculation of WQI at Site 3

	Before COVID			**During COVID**		
Parameters	**Vn**	**Qn**	**QnWn**	**Vn**	**Qn**	**QnWn**
pH	7.85	92.352941	2.303	8.25	97.0588	2.421
Turbidity	9.8	196	8.31	18.6	372	15.77
Total Alkalinity	182	91	0.096	185	92.5	0.098
Chloride	25.5	10.2	0.009	15.6	6.24	0.005
Total Hardness	229	76.333333	0.054	214	71.3333	0.05
Calcium	61.6	82.133333	0.232	49.1	65.4667	0.185
Magnesium	10.9	36.333333	0.257	17.1	57	0.403
Total Dissolved Solids	252	50.4	0.021	240	48	0.02
Iron	0.1	33.333333	23.56	0.1	33.3333	23.56
Sulphate	13	6.5	0.007	7.2	3.6	0.004

Fluoride	0.17	17	3.604	0.16	16	3.392
ΣWnQn= 38.45				**ΣWnQn= 45.91**		
WQI =38.45				**WQI =45.91**		

Table 7 Calculation of WQI at Site 4

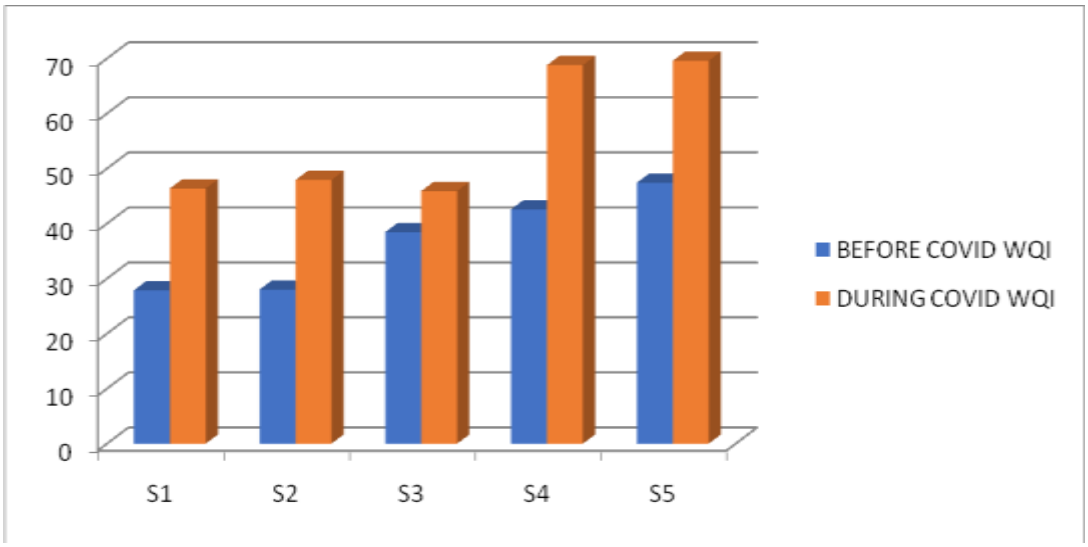
	Before COVID			**During COVID**		
Parameters	**Vn**	**Qn**	**QnWn**	**Vn**	**Qn**	**QnWn**
pH	7.9	92.941176	2.318	8.3	97.6471	2.435
Turbidity	15.4	308	13.06	17.7	354	15.01
Total Alkalinity	179	89.5	0.095	166	83	0.088
Chloride	32	12.8	0.011	19.6	7.84	0.007
Total Hardness	215	71.666667	0.051	219	73	0.052
Calcium	69.7	92.933333	0.263	48.1	64.1333	0.181
Magnesium	19.4	64.666667	0.457	12.1	40.3333	0.285
Total Dissolved Solids	263	52.6	0.022	265	53	0.022
Iron	0.1	33.333333	23.56	0.2	66.6667	47.11
Sulphate	11	5.5	0.006	7.1	3.55	0.004
Fluoride	0.13	13	2.756	0.17	17	3.604
ΣWnQn= 42.59				**ΣWnQn= 68.8**		
WQI =42.59				**WQI =68.8**		

Table 8 Calculation of WQI at Site 5

	Before COVID			During COVID		
Parameters	**Vn**	**Qn**	**QnWn**	**Vn**	**Qn**	**QnWn**
pH	7.95	93.529412	2.333	7.9	92.9412	2.318
Turbidity	18.8	376	15.94	18.5	370	15.69
Total Alkalinity	186	93	0.099	165	82.5	0.087
Chloride	25.6	10.24	0.009	19.5	7.8	0.007
Total Hardness	214	71.333333	0.05	211	70.3333	0.05
Calcium	56.6	75.466667	0.213	46.7	62.2667	0.176
Magnesium	21.2	70.666667	0.499	21.9	73	0.516
Total Dissolved Solids	249	49.8	0.021	248	49.6	0.021
Iron	0.11	36.666667	25.91	0.2	66.6667	47.11
Sulphate	13	6.5	0.007	7.6	3.8	0.004
Fluoride	0.11	11	2.332	0.17	17	3.604
ΣWnQn= 47.42				**ΣWnQn= 69.58**		
WQI =47.42				**WQI =69.58**		

Table 8 Water Quality Index values and WQI status for all five locations for Wainganga river Basin

SAMPLE NO.	BEFORE COVID WQI SCALE	WQI STATUS	DURING COVID WQI SCALE	WQI STATUS
S1	27.87	Good	46.38	Good
S2	28.01	Good	47.92	Good
S3	38.45	Good	45.91	Good
S4	42.59	Good	68.80	Poor
S5	47.42	Good	69.58	Poor



RESULTS SHOWS WQI VALUE VARIATION

RESULTS AND DISSCUSSION

The test results give information about water quality. Table 4 to 8 shows the test result of 11 parameters and Water Quality Index (WQI) value of all five locations (S1,S2,S3,S4,S5) water sample of river basin before COVID and during COVID.

For the first location variation of WQI value is before COVID 27.87 to during COVID 46.38, the water quality status goes good to good quality for the time of before COVID to during COVID respectively. Second location WQI value is 28.01 before COVID to 47.92 during COVID and status was good to good quality. The water quality status variation is not found for the first second and third location. Third location WQI value is 38.45 is before COVID and 45.91during COVID, gives water quality status is good quality to good quality. Fourth location WQI value is in increase order is 42.59 before COVID and 68.80 during COVID. And the fourth location water quality status is good quality to poor quality. Fifth location water sample test gives high value of WQI from the fourth location. WQI value is 47.42 before COVID and 69.58 during COVID, by the values water quality status record is good to poor quality.

As per WQI, the value of WQI is higher in fifth location(S5) near NH7 bridge, before COVID time and also during COVID time. This area is highly used for the pooja, bath and 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 third location S3 (38.45-45.91=7.46), is lesser than other sites, then in increasing order in first location S1 (27.87-

46.38=18.51), second location S2 (28.01-47.92=19.91), fifth location S5 (47.42-69.58=22.16), fifth location S5 (47.42-69.58=22.16), fourth location S4 (42.59-68.80=26.21), fifth location S5 (47.42-69.58=22.16), , and high difference in WQI value is in fourth location.

CONCLUSION

From the results, water quality of the water of Wainganga river during the study period was showing the less variations from good quality to good in three sites and good quality to poor quality for two locations. The pollution increases as we go to end point of chhapara village near NH-7 bridge. Water quality of Wainganga river was comparatively good before COVID.

Based on WQI values, it could be inferred that the water quality was good, good, good, good and good before COVID and good, good, good, poor, and poor during COVID. This study will help to the water quality monitoring and improve water quality and management of water quality.WQI value helps for making water quality suitable for drinking, irrigation and other purposes.

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