Environmental Assessment of Narmada River Tributary I. E Ganjal River Water and its Photo Chemical Degradation using TiO$_2$ Nanocatalyst

Sandhya Katare[1], Ritu Awasthi[2], Dr. S. K Diwakar[3]

Research Scholar, Department of Chemistry, Govt. Narmada College Narmadapuram

Assistant Professor, Department of Chemistry, Narmada College Narmadapuram

Abstract: *Narmada river is the largest holy river of Madhya Pradesh. Narmada river has many tributaries which also includes one Ganjal river. The study aims of to asses of the water pollution of Ganjal river. This study was conducted at two sites of Ganjal river and water samples were collected from both the sites physicochemical parameters of the collected water samples like pH, temperature, conductivity, TDS (Total Dissolve Solids), DO (Dissolve Oxygen), TH (Total Hardness), BOD (Biochemical Oxygen Demand), and COD (Chemical Oxygen Demand) etc. were evaluated. Average of physico - chemical parameters of water samples in the results of the Bureau of Indian Standard (BIS) values, which indicates water pollution of the river. Nanotechnology has great potential in handling water treatment, generating less waste then traditional methods photocatalytic process is a promising technology for the treatment of organic pollutants in ambient conditions. Photocatalytic reaction in the presence of TiO$_2$ nanoparticles provided a better way to destroy hazardous organic contaminants. After the parameters are out, Photo degradation of water by TiO$_2$ Nanocatalyst reduced the level of pollution in the samples water of the River.*

Keywords: Tributary, Degradation, Nanocatalyst, TiO$_2$ (Titanium dioxide) etc.

1. Introduction

Water is one of the most valuable resource on planet Earth. The rivers plays an important role in providing drinking and irrigation water supplies. (Gholami, S.) River have always been the most important resource of fresh water, along the banks of which our ancient civilization head flourished and most developmental activities are still depended upon them. (Warhate, SR.) For the human and industrial growth water is considered to be the main requirement increase in pollution and industrialisation, the demand of the last decade. (Dr. D. S Shaluja) This demand full field by the Rivers which provide the water for human life and agriculture purpose. Due to the waste discharged from the human and industrial activities the quality of river water has deteriorated which affected human as well as aquatic life. (A. Kumar)

River water pollution is challenging issue due to continuous organisation and rapid industrialisation for sustainable development. (Abbasi) Narmada River is 5th largest west flowing river (Total length 1312km) covering of Madhya, Gujrat and Maharashtra state of India. (central water commission) it is commonly known as the lifeline of Madhya Pradesh. There are many tributaries of Narmada River which include the Ganjal River flows in Betul, Narmadapuram and Harda districts of Madhya Pradesh. Ganjal river perennial river and an important tributary of Narmada River in the centre water course, originates from Satpura hilly ranges near Borpani Village. From Betul district of Madhya Pradesh this river flows in north southerly direction to join the Narmada from left Bank and meets it near Gondagaon village. The river is the boundary of Narmadapuram and Harda district. TiO$_2$, due to its non toxic, inexpensive and highly reactive nature, has been extensively, investigated as a heterogeneous photo catalyst for the remediation of contaminated environment. (Hassan et al) Nano materials is best option to treat waste water treatment because it has some unique properties like Nano size, large surface area, highly reactive, strong solution mobility. (a review) Strong mechanical property, Some heavy metals like pb, Mo, etc. organic and inorganic pollutants and various harmful microbes are reported to successfully removed by Nanomaterials. (Bhargava) Nano Photocatalyst are commonly used for wastewater purification, as they help to enhance the reactivity of catalyst due to having a greater surface ratio and shape dependents features. (Yaqoob)

2. Materials and Methods

Study area
For the present study of assessment of Narmada River tributary of Ganjal river water quality analysis. So, I visited this river saw the water of this river in the village is getting polluted from many sources like, discharge of swage, domestic wastes, bathing, washing clothes, bathing cattle, plastic waste, flowers, and fertilizers and pesticides used in agriculture on the river banks. I collected water sample from two station Naharkola and Gondagaon. Station - 1 (Naharkola Khurd) 177° South NL - 22°29'30" and 77°16'33" EL and station - 2 (Gondagaon) southeast 157° and NL 22° 33'44" to 77°12'45" EL.

Samples collection
For testing of water samples were collected with White plastic bottle of 2l volume were thoroughly washed with nitric acid and rinsed with distilled water several times. River water samples where collected into this bottle and analysed in the laboratory for physicochemical parameters using the standard method (APHA). Following standard procedure. Analysis was done in research laboratory of the department of chemistry NMV Govt. College Narmadapuram. We can analysis by different parameters which has shown as below: -

Table 1

S. N.	Parameters	Methods	Instrument
1	pH	Electrometric	pH meter
2	Temperature	Thermometric	Thermometer
3	Conductivity	Electrometric	Conductivity cell
4	TDS (Total dissolve solids)	Electrometric	Digital conductivity cell
5	DO (Dissolve Oxygen)	Titrimetric wrinkle's method	Burette, pipette and glassware
6	TH (Total Hardness)	Titration with EDTA	Burette, pipette and glassware
7	BOD Biochemical Oxygen Demand)	Titrimetric Direct Method	Burette, pipet, BOD machine, glassware
8	COD (Chemical Oxygen Demand)	Titrimetric digest method	Burette, pipette and Digest COD machine glassware

Experiment

For photo degradation we use photocatalytic reactor. This reactor is made up with a high-quality glass double wall breaker. It joined with breaker and magnetic stirrer on hot plate instrument. The beaker is irradiate by UV lamp. Lamp is situated perpendicular above beaker. The radiation source is UV lamp.

Procedure

For the degradation experiments, in a photocatalytic reactor we take sample water and Nanocatalyst TiO_2. The suspension was subjected to irradiation under UV light for a fixed time. When the suspension has been stirred well than we take water parameters like pH, temperature, conductivity, TDS, and COD etc. By the digital machine and volumetric titration method. Before degradation the values decrease these parameters.

Photocatalytic Set Up

In this take 50 ml water sample quantity 0.5gm TiO_2 nanoparticle this is degraded on photo rector on 30 °C temp. For 3 hours of degradation cooling down water sample, determine these parameters.
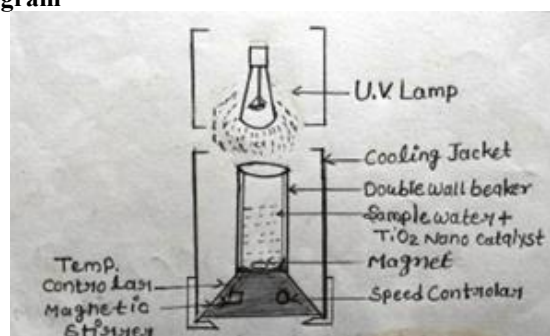
Diagram

Digram: Photodegradation process

**Table 2:** Physicochemical parameters analysis of Ganjal River water quality Before photodegradation

S. No.	Parameters/ Unit	Reference Value River Water		Observed Value the samples Befor photodegradation	
		Min	Max	S1	S2
1	Temp. ^0C	25^0C	30^0C	32^0C	34^0C
2	PH (PH Unit)	6.5	8.5	8.2	8.5
3	Conductivity (µs/cm)	0	200	53.3	55.3
4	TDS (mg/l)	200	500	280	292
5	DO (mg/l)	6.0	8.0	5.5	5.2
6	BOD (mg/l)	2.0	3.0	3.1	3.2
7	TH (mg/l)	120	200	105	112
8	COD (mg/l)	20.0	50.0	91.4	93.2

**Table 3:** Physicochemical parameters analysis of Ganjal River water quality After photodegradation

S. No.	Parameters/ Unit	Reference Value River Water		Observed Value the samples after photodegradation	
		Min	Max	S1	S2
1	Temp. ^0C	25^0C	30^0C	26^0C	27^0C
2	PH (PH Unit)	6.5	8.5	7.3	7.5
3	Conductivity (µs/cm)	0	200	50.2	51.5
4	TDS (mg/l)	200	500	250	260
5	DO (mg/l)	6.0	8.0	6.6	6.4
6	BOD (mg/l)	2.0	3.0	2.4	2.5
7	TH (mg/l)	120	200	100	108
8	COD (mg/l)	20.0	50.0	50.2	52.4

3. Result and Discussion

The result Ganjal River water Quality Before photodegradation using TiO_2 Nanocatalyst
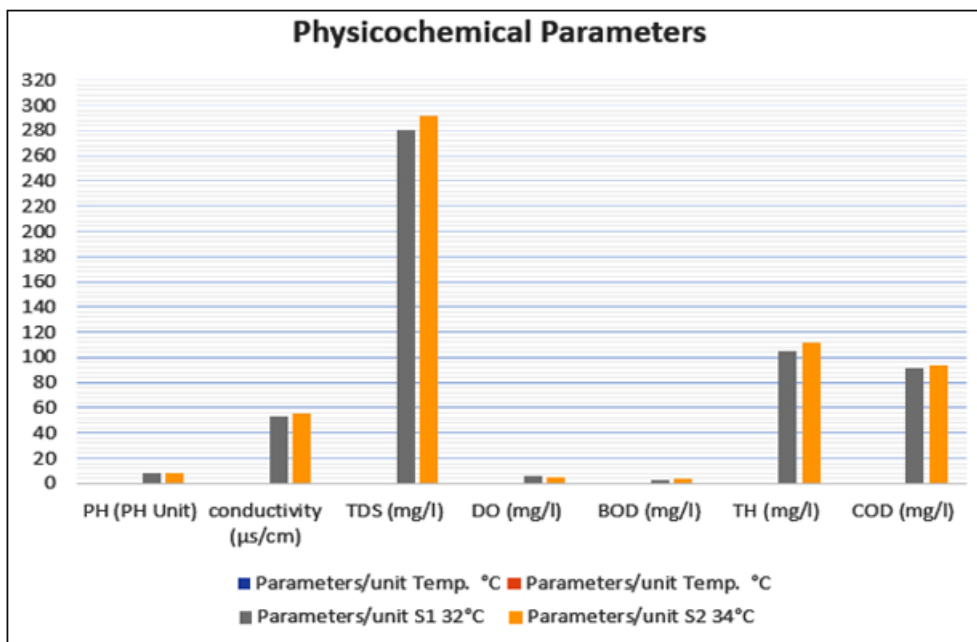
The result Ganjal River water quality After photodegradation using TiO$_2$ Nanocatalyst
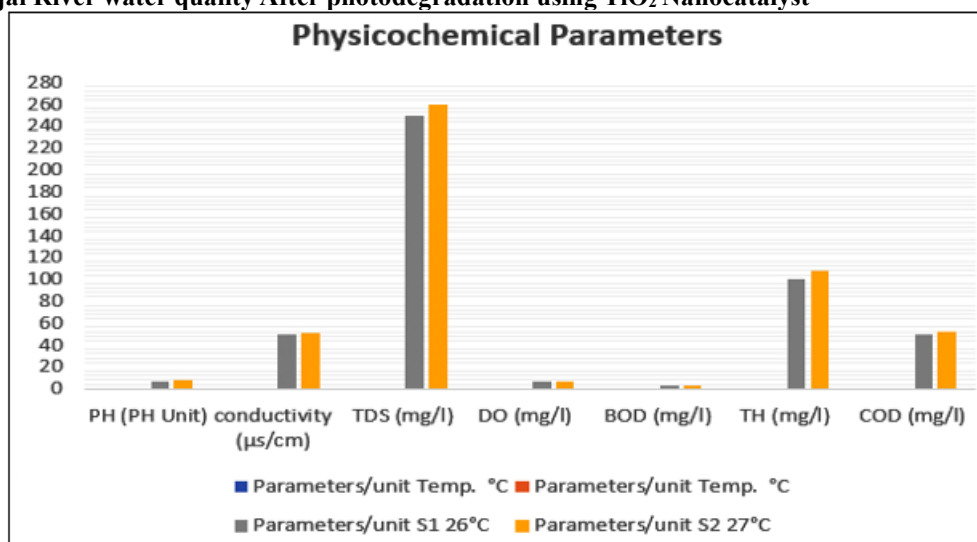
The analytical results of the parameters before photodegradation of river water samples are shown in table – 2. pH (S$_1$ - 8.2 and S$_2$ 8.5), BOD (S$_1$ - 3.1 and S$_2$ - 3.2) and COD (S$_1$ - 91.4 and S$_2$ - 93.2) etc. Parameters values increase the samples water. The result of the parameters after photodegradation of water samples are given in table – 3. After photodegradation using TiO$_2$ Nanocatalyst like, pH (S$_1$ - 7.3 and S$_2$ - 7.5), BOD (S$_1$ - 2.4 and S$_2$ - 2.5), COD (S$_1$ - 50.2 and S$_2$ - 52.4) parameters values minimised.

4. Conclusion

From above experiment clear that river gets polluted water and decrease dissolved oxygen and increase COD in water bodies. The value of COD is minimizing by photo degradation TiO$_2$ Nanocatalyst. Parameters such as the pH, temperature, conductivity, TH, TDS, BOD, and COD etc. Decrease value and DO level increase for Nano Photocatalyst. TiO$_2$ is very active nanoparticle.

References

[1] A. Kumar Mishra, (2010) "A River about to Die: Yamuna". J. Water Resource and Protection Vol.2, pp.489 - 500.

[2] Abbasi, S. A., 2002. Water Quality Indices, State of the Art Report. Scientific Contribution No. INCOH/SAR - 25/2002. INCOH, National Institute of Hydrology, Roorkee.

[3] APHA (1995). Standard method for the examination of water and waste water (19th edn). New York: APHA, AWWA, WPEC. Ball, R. C., Step.

[4] APHA (American Public Health Association), 2012. Standard Methods for the Examination of Water and Wastewater, 22nd ed. American Public Health Association, Washington, DC.

[5] APHA. Standard Methods for the Examination of water and waste waters, 22nd Edition, American Public Health Association, Washington, DC. C 2012.

[6] APHA–AWWA - WPCF, (1998) Standard methods for the examination of water and waste water twentieth edition, Washington, DC.

[7] Bhargava, D. S., 1983a. A light penetration model for the Rivers Ganga and Yamuna. Int. J. Dev. Technol. (England) 1 (3), 199–205.

[8] Bhargava, D. S., 1983b. Most rapid BOD assimilation in Ganga and Yamuna Rivers. J. Environ. Eng. Am. Soc. Civ. Eng.109 (1), 174–188.

[9] Bhargava, D. S., 1983c. Use of water quality index for river classification and zoning of Ganga River. Environ. Pollut. Ser. B (England) 6 (1), 51–67.

[10] Bhargava, D. S., Saxena, B. S., Dewakar, 1998. A study of geo - pollutants in the Godavari River basin in India. In: Asian Environment. IOS Press, pp.36–59.

[11] Cox BA. A review of dissolved oxygen modeling Techniques for low land rivers. Sci. Of the total env.2003, 314 - 316, 303 - 334.

[12] Daer, S.; Kharraz, J.; Giwa, A.; Hasan, S. W. Recent applications of nanomaterials in water desalination: A critical review and futur opportunities. Desalination 2015, 367, 37–48.

[13] Dr. D. S. Saluja Volume 9 Issue 1, January (2020) Water Quality Analysis of Narmada River with Reference to Physicochemical Parameters. International Journal of Science and Research (IJSR) ISSN: 2319 - 7064.

[14] Gholami, S., & Srikant aswamy, S. (2009). Statistical multivariate Analysis in the assessment of river water quality in the vicinity of KRS Dam, Karnataka, India. Natural Resources Research, 3 (18), 235–247.

[15] Henderson, Tarzwell CM. Bioassay control of industrial Effluents. Sewage and ind. Wastes.1957; 29 (9): 1017 - 1052.

[16] M. N. Chong et al. Recent developments in photo catalytic water treatment technology: a review (2010)

[17] Narmada Control Authority, NCA, Retrieved 21 March 2013, (2013)

[18] Narmada Valley Development Authority, NVDA, Government of Madhya Pradesh, Narmada Basin, Narmada Water Dispute, Nvda. nic. in, 1985 - 07 - 16.

[19] Soni V., Khwaja S. And Visavadia M., Preimpoundmental studies on Water Quality of Narmada River of India, Int. Res. J. Environment Sci., 2 (6), 31 - 38 (2013).

[20] Tang, W. W.; Zeng, G. M.; Gong, J. L. Impact of humic / fulvic acid on the removal of heavy metals from aqueous solutions using nanomaterials: A review. Sci. Total Environ.2014, 468, 1014–1027.

[21] Warhate SR, Yenkie MKN, Chaudhari MD, Pokale WK (2006). Impacts of Mining Activities on Water and Soil. J. Environ. Sci. Eng.48 (2): 81 – 88.

[22] Wu, Y.; Pang, H.; Liu, Y.; Wang, X.; Yu, S.; Fu, D.; Chen, J.; Wang, X. Environmental remediation of heavy metal ions by novel - Nanomaterials: A review. Environ. Pollut.2019, 246, 608–620.

[23] Yaqoob, A. A.; Ibrahim, M. N. M. A Review Article of Nanoparticles; Synthetic Approaches and Wastewater Treatment Methods. Int. Res. J. Eng. Technol. (2019)