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Environmental Assessment and Photodegradation of Narmada River Water and Tawa Dam Reservoir by ZnO Nano Catalyst

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Abstract

Narmada river water is the main source of drinking, irrigation, fish culture and other important activities for central India. Hence the present investigations and plane of work is consisting to observe the chemical and physical constituents of Narmada river water flow. The quality of water with the view to being out a transparence image of the water pollution status of river and assessment of its effect and bringing forth suggestion for improvement. Through study is to be carried out. The sample collection, preservation and pretreatment will be according to standard method of collecting samples at international level *i.e.* APHA and WHO procedure. Prior to this a through survey will be conducted to know about probable pollution source and other relevant features.

Keywords: Water pollution; Quality of water; Assessment; Chemical and physical constituents; Pretreatment

Introduction

Narmada is one of the sacred rivers of India, attracting pilgrims from all parts of the country. It originates from Amarkantak in Shahdol district, at an elevation of 1057 meter above MSL, covers distance of nearly 1312 km and total basin of 98,79,680 sq. km. The Narmada basin is about 1288 km long and 80 km broad running from east to west in Madhya Pradesh, occupies a central position in the country and empties into the Gulf of Cambay below broach [1-3].

In the present study Narmada river and Tawa dam reservoir are selected. One is the example of the floating water and the other is the example of stagnant water. Narmada River is the most important river the Madhya Pradesh, while Tawa dam reservoir is on the Tawa River in central India. It is located in Itarsi of Narmadapuram district of Madhya Pradesh state, above Betul district [4-6].

Due to urbanization and industrialization, environmental pollution is increasing day by day. The disposal of city waste, sewage and industrial effluents is becoming a major problem. The present study has been carried out to evaluate the impact of man induced environmental changes on the water quality through variation in the chemical and microbiological properties at different locations [7].

Materials and Methods

The river Narmada has been surveyed throughout the year, over a distance of about four sampling sites were selected. In Narmada site first is situated at “Sethani ghat” second site is the “Paramhansh ghat” third site is the “Vivekananda ghat” and forth is the “Post office ghat”. Here many people take bath and wash their cloths daily and also where continuous discharge of domestic sewage of the city is going on. Tawa dam reservoir site is situated site A5 and site A6 [8].

The various physico chemical and biological parameters were determined as per methods suggested by APHA. Temperature, pH and dissolve oxygen were recorded immediately after collection of samples at the sites, while other parameters were analyzed in laboratory within 24 hours samples for the planktons were collected simultaneously and sedimentations were made in glass jars, after adding 10 ml of acid Lysol’s solution for preservation. After 24 hours, the supernatant was discharged then remaining 25 ml of sediments was taken on glass slide and plankton’s number counted under the microscope. Their estimation was made by drop method [9,10].

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Nanoparticles

The fundamentals of nanotechnology are that the properties of substances change significantly when their size is reduced to the nanometer range. When a bulk material is divided into small particles in one are more dimensions in the nanometer range or even smaller, the individual particles show unexpected properties that are completely different from those of the bulk material. Bulk solids have continuous physical properties.

Ultrafine particles, nanoparticles are between 1 nm to 100 nm in size. The properties that distinguish nanoparticles from bulk material generally develop at a critical length of less than 100 nm. Nanoparticles may or may not have size related properties that are significantly different from those seen in fine particles or bulk solids.

ZnO nano catalyst

Nano materials are largely due to the large surface area of the materials, which dominates the contributions of the small mass of the material E. Roduner.

The distinguishing in energy between the conduction band and the valance band is called the band gap. ZnO haves valence band is 3, conduction band is -0.2, band gap 3.2(eV) and band gap wavelength (nm) is 387.

It is a white powder that is almost insoluble in water. ZnO semiconductor has several advantageous properties: Good transparency, high electron mobility, large band gap, strong luminescence at room temperature etc. Zinc oxide is non-toxic and skin compatible, making it a suitable additive for textiles and surfaces in contact with humans. It is also used as a catalyst for the synthesis of methanol. Increasing the surface area of zinc oxide at the nanoscale compared to larger powders.

Results

The basic physical properties of mass and nano ZnO differ significantly; the study of the photo luminescent properties of ZnO confirmed that quantum confinement increases the energy of band the gap of ZnO (Figures 1-3). The change in band gap energy of ZnO nano particles also shows such size dependence. Improving surface conditions by making ZnO nanorods smaller is also well established (Tables 1 and 2).

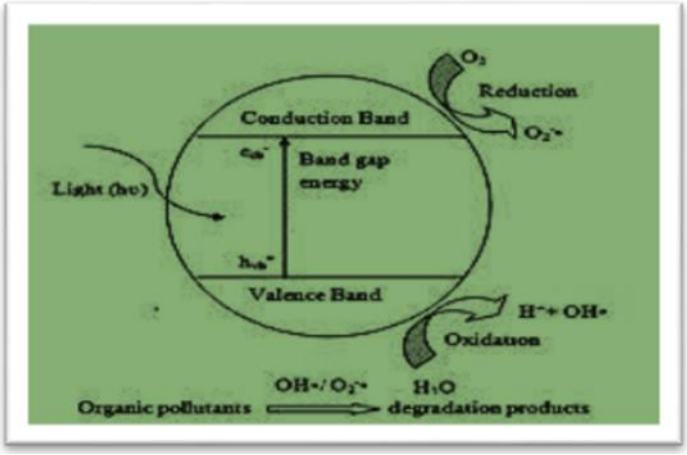

FIG. 1. **Energy between the conduction band and the valance band.**

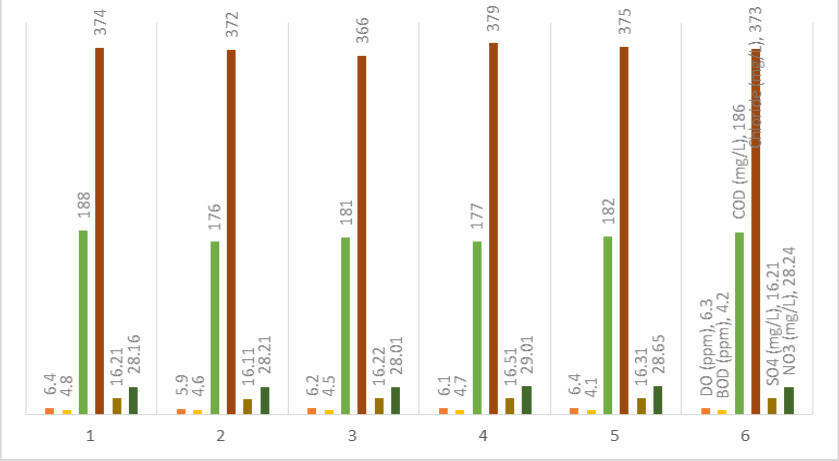

FIG. 2. **The basic physical properties of mass and nano ZnO.**

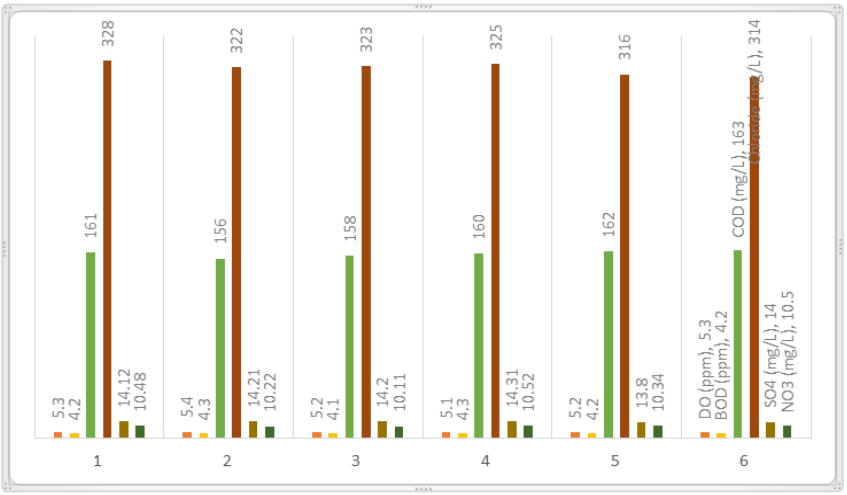

FIG. 3. **The study of the photo luminescent properties of ZnO.**

TABLE 1**. Physico chemical parameters at sampling sites in river Narmada and Tawa dam reservoir.**

S. no.	Parameters	Site I	Site II	Site III	Site IV	Site V	Site VI
1	pH	8.2	8.3	8.0	8.5	7.9	8.1
2	Conductivity	0.18	0.16	0.15	0.18	0.18	0.17
3	TA (mg/L)	161	164	162	180	172	168
4	TH (mg/L)	232	222	231	198	228	226
5	DO (ppm)	6.4	5.9	6.2	6.1	6.4	6.3
6	BOD (ppm)	4.8	4.6	4.5	4.7	4.1	4.2
7	COD (mg/L)	188	176	181	177	182	186
8	TDS (mg/L)	327	329	341	325	333	336
9	TSS (mg/L)	839	826	822	835	813	802
10	Chloride (mg/L)	374	372	366	379	375	373
11	Fluoride (mg/L)	0.6	0.6	0.5	0.6	0.5	0.5
12	Ca (mg/L)	276	268	271	273	274	272
13	Mg (mg/L)	19.23	18.60	18.21	19.11	19.33	19.22
14	SO_4 (mg/L)	16.21	16.11	16.22	16.51	16.31	16.21

15	NO_3 (mg/L)	28.16	28.21	28.01	29.01	28.65	28.24
16	Na (mg/L)	57.02	56.00	56.78	57.00	56.08	57.1
17	K (mg/L)	4.81	4.80	4.30	4.33	4.77	4.80
18	*E. coli* (CFU/100)	58000	57500	57800	58100	57600	57500

TABLE 2. **After photodegradation by ZnO nanocatalyst physico chemical parameters at sampling sites in river Narmada and Tawa dam reservoir.**

S. no.	Parameters	Site I	Site II	Site III	Site IV	Site V	Site VI
1	pH	7.1	7.2	7.0	7.5	7.1	7.4
2	Conductivity	0.12	0.13	0.12	0.11	0.12	0.12
3	TA (mg/L)	132	128	126	131	132	133
4	TH (mg/L)	203	196	201	203	204	202
5	DO (ppm)	5.3	5.4	5.2	5.1	5.2	5.3
6	BOD (ppm)	4.2	4.3	4.1	4.3	4.2	4.2
7	COD (mg/L)	161	156	158	160	162	163
8	TDS (mg/L)	368	358	362	361	357	363
9	TSS (mg/L)	745	712	743	702	729	724
10	Chloride (mg/L)	328	322	323	325	316	314
11	Fluoride (mg/L)	0.52	0.48	0.47	0.51	0.52	0.53
12	Ca (mg/L)	241	231	236	235	239	242
13	Mg (mg/L)	17.22	17.02	17.17	17.3	17.33	17.23
14	SO_4 (mg/L)	14.12	14.21	14.20	14.31	13.80	14.00
15	NO_3 (mg/L)	10.48	10.22	10.11	10.52	10.34	10.50
16	Na (mg/L)	52.32	52.01	51.55	52.02	52.55	52.44
17	K (mg/L)	4.10	4.20	4.30	4.02	4.00	4.33
18	*E. coli* (CFU/100)	21400	20200	21200	21100	23100	23200

Observations

The survey of the river water resources includes the identification and characterization of sites, which cause the pollution problems.

Discussion

Several physico chemical and biological parameters and their variability have been studies in relation to the pollution of Narmada river water and Tawa dam reservoir. The chemical analysis showed that polluted sites contained high values of chloride, total hardness, alkalinity, *E. coli* and *Coli* from count, but very low dissolve oxygen, which indicated a high pollution load.

Conclusion

Photocatalytic water treatment by nano catalyst is a hot topic for pollutant degradation. ZnO has a unique property for above work because it has band gap 3.2(eV) and band gap wavelength (nm) is 387, low operating cost, simple morphology design, nontoxic and have a band gap energy.

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