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Evaluation of various activities affecting to the physico-chemical behavior of Machna River, Betul (M.P.), INDIA

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ABSTRACT

Deterioration of water body is a major threat to the life of living organism.Machna river is a important source of drinking water for the people of the city.Human,Indusrial,Religious and various other activities taking place in and around this river are making the water of this river unsafe for human consumption.The parameters like Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Turbidity,Alkalinity,Conductivity etc which are monitored regularly for the period of two years specially during the mass religious activities.These activities release various types of materials which may be the suitable habitate for the bacterial growth.After a study it was found that water is severly polluted at some places and this polluted water when used for the irrigational purposes affects to the vegetables and crops also.Ultimately,adverse impact of this polluted river water is seen on human beings and living organisms who are directly or indirectly depended on this river.Decrease in the Dissolved oxygen,increase in the Biochemical Oxygen Demand,C.O.D,Alkalinity,Turbidity etc indicates to pollution in this water body.

Key Words: Dissolved Oxygen, Bio-chemical Oxygen Demand, Chemical Oxygen Demand, Turbidity, Alkalinity, Conductivity.

INTRODUCTION

Degradation of rivers in the urban areas has become a serious problem around the world.

Though the causes leading to river degradation are diverse, disposal of solid and liquid waste,encroachment upon the river waterway and water extraction are some of the obvious causes of river degradation. The studies focusing on river degradation often limit the area of inquries to the assessment of changes in the river hydrology, morphology and water quality. In India, religious practices have deep relationship with water bodies.Religious activities like mass bathing during religious days or immersion of Idols or other offerings etc. into rivers and other water bodies round the year, increase the pollution load in them.Madhya Pradesh, the Central state of India is known for various festivals like Navratris,Durga Pooja,Ganesh Festival, Moharram,Teej etc. This study was carried out with the aim of evaluating the factors and processes leading to the degradation of Machna River and the solid waste,industrial, religious and livelihood consequences therefrom and the adaptation of people depending on river for their livelihood. Machna River is an important tributary of the Tawa River with a catchment area of 82 square km in the city. The river originates from sasawad village near Amla . The river is lifeline of the people of Betul city because it is an important source of fresh water supply, major drainage waterway and the river has special cultural and religious significance among the people.

River Machna has significant economic, environmental and cultural value in Betul City. Rising in the Satpura Valley and flowing into the Tawa, the river traverses a course of more than 79 km through the plains of Shahpur and specially Satpura region. Due to increasing population in the region and poor management of urbanization and industrial growth, the water quality of River Machna has significantly deteriorated, particularly in the dry season. The primary sources of pollution are untreated sewage and industrial wastewater. Non-point pollution sources from religious activities at various locations along the river, agriculture and livestock as well as poor solid waste management also contributes to pollution. In addition, substantial abstraction of water, primarily for irrigation, has led to low flows and associated poor water quality in the critical middle stretch of the river.

Study Area

The District Betul may be described generally as a central plateau surrounded by a belt of hilly and forest-covered country, wide on the north and west, but narrower on the east and south. The northern portion, down to the valleys of the Bel and Machna rivers, and the town of Badnur, is principally occupied by the main chain of the Satpuras and its outlying spurs. About half of this tract consists of forest-clad ranges, between which lies an undulating country, inter-sected by innumerable watercourses and covered principally with a thin sandy soil of little value for cultivation. In the north-east the Tawa river flows along the border of the District, and is joined east of Shahpur by the Machna, which rises close to Badnur(Sasawad village).The present study was undertaken to assess the impact of different Religious and other activities like(industrial,solid waste disposed by human being,washing,bathing etc.).The seven sampling stations were determined in the Machna river which were severly polluted with respect to other sampling stations.

MATERIALS AND METHODS

The physico-chemical variables were estimated as per the Standard Methods **[1]**.Water samples collected for the purpose of estimation of various parameters were brought to the laboratory and subjected to analysis immediately as for as possible. Standards Methods for Estimation of Water and Wastewater 20th edition, 1998 were referred for estimation of parameters viz., Turbidity, Conductivity, Dissolved Oxygen,Biochemical Oxygen Demand,Chemical Oxygen Demand, Alkalinity etc.

RESULTS AND DISCUSSION

Turbidity values ranged from 03 to 11 NTU. Maximum value reported at sampling station S4 and S5 in the month of January it may be due to release of huge amount of domestic sewage and waste material from the people living nearby this area. Minimum value was found at S6 and S7 in the month of May and April which indicates that all impurities are settled down due to gravity. The electrical conductivity ranged from 0.15 mhos/cm to 0.96 mhos/ cm during the month of May and Aug at S2 and S6 respectively. These findings tells us that Machna Nagar point is less polluted than other stations but Maximum value at S6 is due to joining of hospital and municipal waste. Many chemicals released from the hospital increase the ionic concentration which results in increase of conductivity of water at that sampling station . It depends on presence of ions in the form of dissolved solids. The ion concentration increases due to increasing pollution load. This is evident from the results and also matches with the findings of Barik and Patel **[2].** Dissolved oxygen is another important parameter which is the indicator of purity of water sample. Its value ranged from 1.0 mg/l at S7 in the month of May to 3.9mg/l at S1 in the month of September. These values show that oil, ash from cement factory, milk etc reduces the Dissolved oxygen concentration at sampling station S7 while Shankar ward point was comparatively less polluted in the month of September because its value was very high. The dissolved oxygen plays a major role in survival of aquatic Life. The Decrease in D.O is due to effect of various ritual activities and rise in temperature **[3]** also The value of COD in conjugation with BOD are helpful in knowing the toxic conditions and presence of biologically resistant organic substances**[4].**B.O.D values were found between 7.4mg/l to 398mg/l. Maximum value is observed for the S7 in the summer season which is due to heavy load of pollutants from surrounding industrial area. C.O.D represents to biologically oxidizable organic as well as inorganic matter in the water. The values ranged from 22 mg/l(S2)to 390 mg/l at S3.The maximum value was reported in the month of June which is summer season in Madhya Pradesh and in this area. Alkalinity ranged from 134mg/l (S7) to 2604 mg/l(S6)in the month of June. Alkalinity values are found higher in the summer season due to increase in the concentration. Maximum value indicates that hospital waste, washing and bathing activities and other municipal waste are making the water much alkaline in nature greater than permissible limits. The alkalinity is the buffering capacity of water. It increases due to various religious activities, domestic waste and especially due to soaps and detergents**[5]**. The alkalinity decreases due to onset of rains**[6]**

The oil reaches in the river water as the devotees offer oil to the god or goddess in the templesOut of heavy metals, chromium, manganese, lead and nickel ranged from 0.003 ppm to 0.049 ppm; 0.015 ppm to 0.132 ppm; 0.007 ppm to 0.042 ppm and 0.010 ppm to 0.181 ppm, respectively.**[7]** The heavy metals reach rich river water due to various anthropogenic activities. The main source of these heavy metals are ritual activities and especially the idol immersion, as the colour, paint and sindur are added to the water.**[8]**

Table No(1)Monthly Variation of Turbidity at different sampling stations

Sampling Stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	8	9	8	6	5	4	7	8	9	10	8	7
S2	7	8	7	5	5	6	8	9	9	8	7	6
S3	10	9	8	7	6	5	7	8	8	9	6	5
S4	11	10	8	6	6	4	6	7	6	5	4	4
S5	11	9	7	5	4	5	7	9	8	7	5	6
S6	7	8	5	3	3	4	6	8	8	8	6	5
S7	6	7	6	4	3	5	9	8	8	7	5	6

Table No(2)Monthly Variation of Conductivity at different sampling stations

Sampling Stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	0.3	0.3	0.28	0.2	0.18	0.19	0.28	0.36	0.4	0.3	0.31	0.3
S2	0.3	0.3	0.3	0.2	0.15	0.23	0.27	0.37	0.4	0.3	0.34	0.4
S3	0.8	0.8	0.82	0.7	0.56	0.85	1.36	1.59	1.6	1.6	0.98	0.8
S4	0.9	0.8	0.8	0.7	0.68	0.93	1.34	1.78	1.8	1.6	0.8	0.8
S5	0.7	0.6	0.55	0.5	0.32	0.67	0.86	1.33	1.3	1.2	0.75	0.7
S6	1.6	1.6	1.36	1.2	0.89	1.13	1.69	1.96	1.8	1.7	1.58	1.5
S7	2.5	2.3	1.7	1.3	0.78	0.94	1.42	1.66	1.7	1.7	1.32	2.5

Table No(3)Monthly Variation of D.O. at different sampling stations

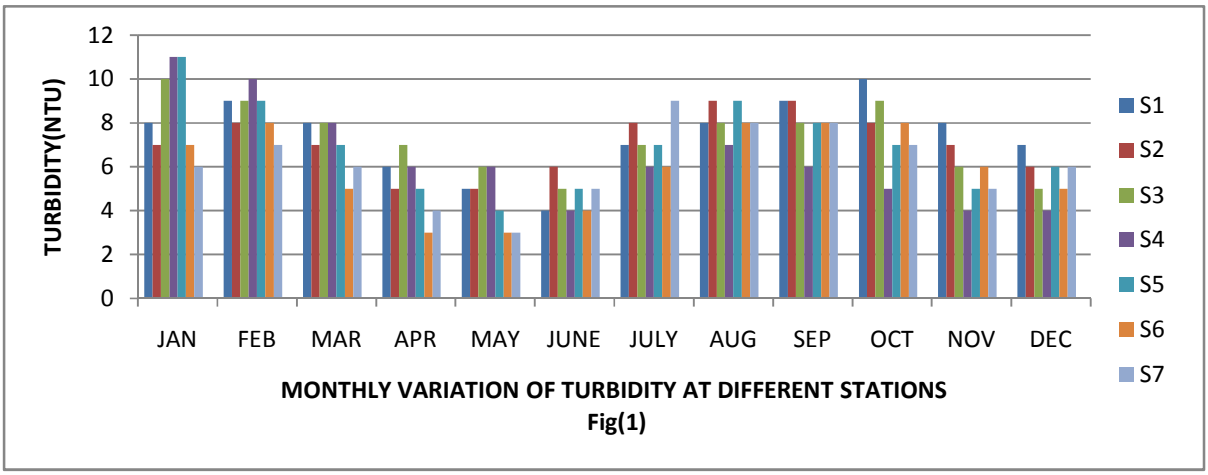
Sampling Stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	3.4	3.3	3.2	3	2.8	2.6	3.2	3.8	3.9	3.6	3.5	3.4
S2	3	3	2.8	2.5	2.3	2.2	2.9	3.5	3.6	3.4	3.2	3
S3	3.5	3.4	3.1	2.8	2.4	2.2	2.7	3	3.1	3.2	3	2.8
S4	3.2	3.1	2.7	2.5	2.3	2.4	3	3.6	3.4	3.5	3.3	3
S5	3.6	3.5	2.9	2.5	2	2.3	2.8	3.8	3.2	3.3	3	2.9
S6	2.6	2.7	2.4	2.3	2.1	2	2.6	3.2	3	3.1	2.9	2.7
S7	1.4	1.2	1.3	1.2	1	1.2	1.8	2.3	2.3	2	1.8	1.5

Table No(4)Monthly Variation of B.O.D at different sampling stations

Sampling stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	9.3	9.2	9.5	9.7	9.7	9.6	9.5	9	8.6	9.3	9.5	9.5
S2	8.2	8.3	8.5	8.4	8.7	8.6	8.4	7.8	7.4	7.8	8	8.1
S3	29	30	3.2	3.3	3.4	33	32	27	25	29	31	32
S4	27	29	33	34	35	31	29	25	22	27	28	29
S5	23	25	27	26	27	24	23	20	19	23	24	25
S6	26	27	29	28	28	26	24	18	16	20	22	23
S7	131	134	136	146	136	134	132	128	125	131	132	131

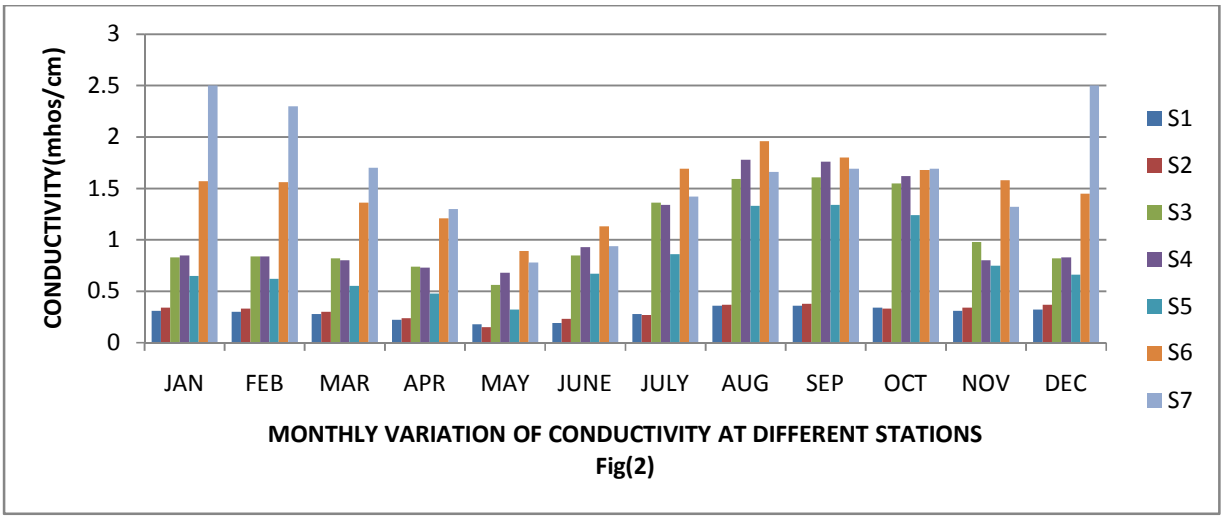
Table No(5)Monthly Variation of C.O.D at different sampling stations

Sampling stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	24	25	28	30	32	33	32	30	28	24	25	26
S2	22	24	29	32	34	35	31	28	26	22	23	24
S3	380	383	386	388	389	390	387	380	377	380	386	388
S4	65	68	70	72	74	75	72	65	64	65	66	67
S5	64	66	72	73	75	74	71	66	65	64	67	69
S6	46	47	49	52	55	54	52	46	44	46	49	51
S7	381	383	386	390	398	393	391	374	370	381	385	388



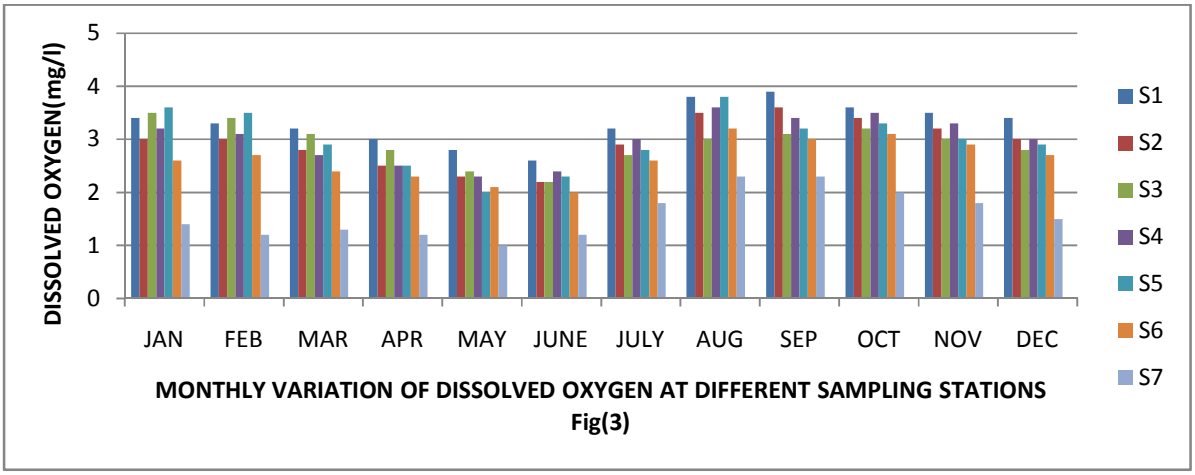
MONTHLY VARIATION OF TURBIDITY AT DIFFERENT STATIONS

Fig(1)

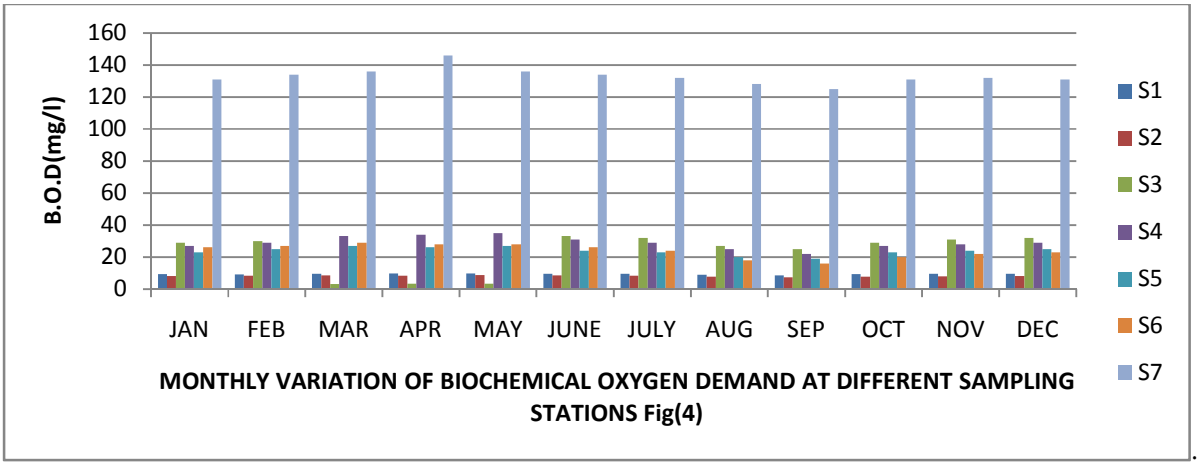


MONTHLY VARIATION OF CONDUCTIVITY AT DIFFERENT STATIONS

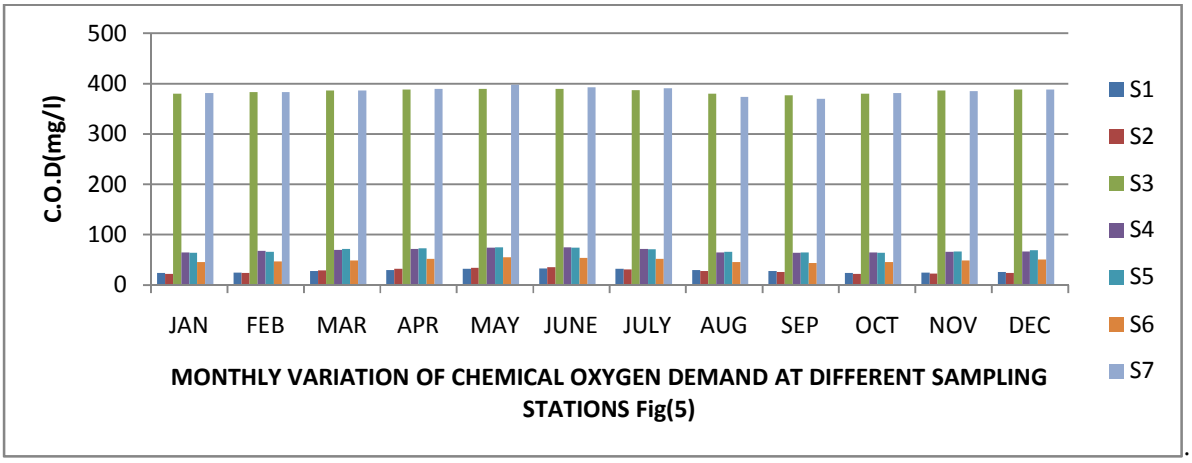
Fig(2)



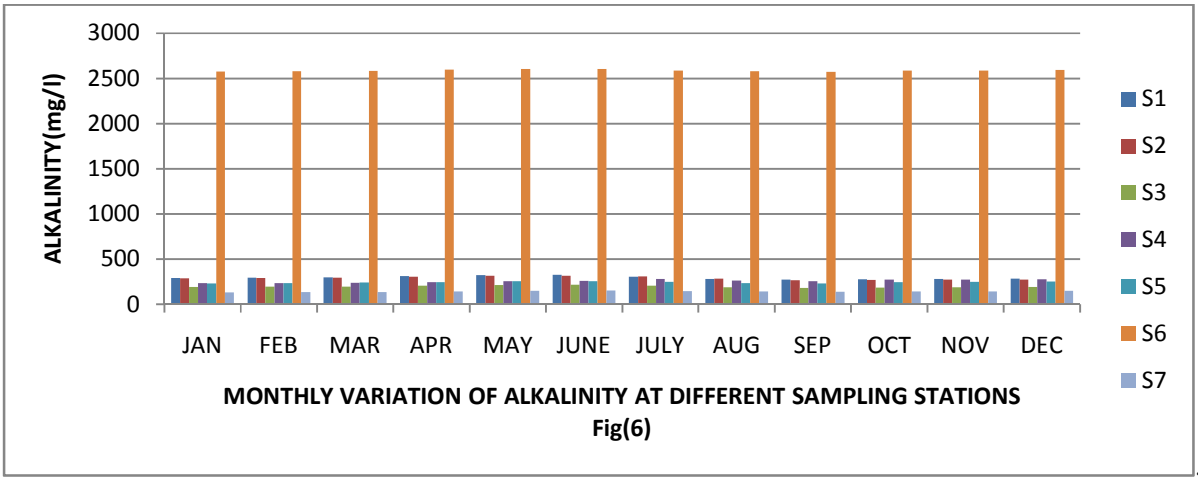
MONTHLY VARIATION OF DISSOLVED OXYGEN AT DIFFERENT SAMPLING STATIONS Fig(3)



MONTHLY VARIATION OF BIOCHEMICAL OXYGEN DEMAND AT DIFFERENT SAMPLING STATIONS Fig(4)



MONTHLY VARIATION OF CHEMICAL OXYGEN DEMAND AT DIFFERENT SAMPLING STATIONS Fig(5)



MONTHLY VARIATION OF ALKALINITY AT DIFFERENT SAMPLING STATIONS
Fig(6)

Table No(6)Monthly Variation of Alkalinity at different sampling stations

Sampling stations	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
S1	292	295	300	315	325	328	306	284	275	279	282	285
S2	290	294	298	306	316	318	310	287	264	268	271	276
S3	192	195	196	207	213	216	208	191	184	187	190	192
S4	233	234	237	245	256	258	282	262	255	272	276	279
S5	232	236	241	246	254	256	247	235	230	246	249	253
S6	2575	2579	2582	2596	2602	2604	2586	2580	2574	2587	2585	2594
S7	132	134	136	142	152	154	147	142	138	142	146	153

CONCLUSION

From the study it is revealed that, untreated sewage, Industrial waste ,hospital waste,Domestic waste and some other activities like washing,bathing are main causes of pollution in the river**[9].**

and industrial effluents are the main source of pollution to Machna river water body and irrigation with contaminated river water containing variable amounts of heavy metals leads to increase in concentration of metals in soil and vegetables, which is grown using the polluted water**[10].** Concentration of metals in vegetables will provide baseline data and there is a need for intensive sampling for quantification of results throughout the country.

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