International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

A Study of Human Activities with Type and Disposal of Wastes: Appraisal of Organic Load on Wainganganga River Water in District Bhandara (M.S.) India

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Abstract: ***Present study deals with the appraisal of water quality of Wainganga river, polluting due by organic wastes by localities. At station S-2 and S-3 increased biodegradable organic material, from sewage, decaying cow dung from farming in river basin, is responsible for increased values of BOD. Subsequently, the domestic activities performed at station S-3 and S-4, and discharge of temple wastes and cremation wastes at station S-4, contributes the most of biodegradable organic matter in the river. Hence, the increasing load of pollutants at downstream station has resulted in to higher values of BOD. Agrawal and Kannan, (1996). It is evident that the values of BOD in a river were minimum at all stations, during winter. This may be due to relatively more flow of river, which offers dilution to the pollutants. However, the increasing trend of values toward downstream is attributed to increasing the pollutant discharge in river stream at station S-2, S-3 and S-4. However the reduction of microbial activities in less temperature of water causes the decrease in values of BOD in river water. The Watermelon fields in the river basin covers the area around station S-2 and S-3. The mixing of decaying cow dung in stream increase the organic pollution. It is evident from data that, the lower concentrations of DO at sampling station S-4 in summer. This is due to many sources of pollutants that contaminate the river water at this station. Higher concentration of organic matter and increased rate of decomposition due to more temperature of river water during summer may be responsible to depletion of DO levels at down stream stations S-2, S-3 and S-4. However at station S-4, the discharge of crematory ashes forms the turbidity in river water and restricts the light to penetrate inside the water, which intern lowers the oxygen output from aquatic flora.***

Keywords: River; Organic waste; Human activities; BOD; DO; pH; Ammonia

1. Introduction

The changing nature, intensity of human activity and the pollutional loads generated in the basin are important aspects for formulating pollution control programmes and policies. Growth of industries, development of agriculture with intensive use of fertilizers, pesticides, herbicides and other chemicals, rapid industrialization and the associated increasing urbanization, introduction of sewage systems urban communities, piped water supplies in rural areas, etc. are all going to contribute significantly to the initial generation of pollution and subsequently increase in it's load. The construction of dams, reservoirs, canals, and other water management structures is bound to affect the river regime influencing thereby the flow and availability of water for dilution, dispersing and assimilation of the pollutants from different sources. To study the impact of pollution it would be necessary to analyze and develop inter-relationship between various aspects of human activities and development projects.

Biochemical Oxygen Demand (BOD) may be defined, as the amount required by microorganisms while stabilizing biologically decomposable organic matter in a waste under aerobic conditions. It is the rate of consumption of oxygen in aerobic degradation of the dissolved organic, ever-particulate organic matter in water. It has been used as an index of organic pollution in water. It has been reported that more oxidizable organic matter present in water, more the amount of oxygen required to degrade it biologically, hence more the BOD. The organic matter can serve as food for the bacteria since the energy is derived from its oxidation. On the average basis the demand for oxygen is proportional to the amount of organic waste to be degraded aerobically.

Pure or nearly pure water contains a BOD of 0 mg/L. to 3.0 mg/L BOD values. The higher value, more than 5.0 mg/L. indicates that the purity of water doubtful. Untreated city sewage has a BOD of 100 mg/L to 400 mg/L. Some industrial waste has values as high as 10,000 mg/L. The problems created, if these materials are dumped directly in to water supplies, are beyond imagination, (Sharma and Kaur, 1997). All domestic and agricultural wastes in stream would contribute BOD and organic matter. Since, such utilization of water takes place almost all along Indian rivers, BOD is added all along, not merely at the location of out falls. This is easily seen from the fact that BOD in Indian rivers is observed to be pretty high as compared to those in European rivers. The typical example would be Ganga at Hardwar, Garhmukteshwar and up stream of Kanpur. Since organic matter is continuously oxidized and assimilated by the river biota at a rate depending on temperature, DO deficit and other conditions of flow. BOD would not stay stable over long reaches unless there were equivalent input also as one went along (Agrawal, 1996).

In India, rural and urban areas present two contrast situations. In rural areas, a water body is normally used for all kinds of human requirements, such as bathing, washing, swimming, waste disposal and often for drinking tool in urban areas the situation is still worse, where the water body is subjected to still much greater human pressure including direct discharge of sewage and industrial wastes. A detailed investigation and documentation of the Indian fresh waters is the need of the day in order to identify the problem areas so that proper steps can be taken before the water bodies become marshy ponds, which would be hardly of any use. Studies on the rivers of urban areas of India have been undertaken by many satisfactory attempts and have yet been made to document the quality of freshwater bodies situated in rural areas where more than two-thirds of Indian population lives. The quality of riverine water is most important to the population residing near about, as most of the needs of population are fulfilled by riverine water. In India as villages and towns are mostly located near rivers or streams, this problem is of prime consideration.

2. Material and Methods

A work plan has been conceived for the present investigation to study the water quality of "WAINGANGA RIVER". In view of the various domestic activities four sampling stations have been selected for the present investigation. Station 'S-1' is located at the site of Dam at village Gosikhurd, This station of river is considered to be pollution free. It is nine kilometers away from the sampling station S-2 of Pauni town.

The municipal sewage from some parts of town is discharged in to the river at the region called as 'Hattigota', which is selected as sampling station 'S-2'. The sewage is first discharged in to 'Kolasur' pond, which is 566.6 meters away from the river Wainganga. However, the overflow of this pond enters in to the river. At 100 meter down stream from station S-2, the municipal water pumping station is located. The water is distributed to the whole town, from the pumping station by municipality. The next sampling station is station 'S-3' which is used for bathing, cloth wash, cattle wash, etc. by the locality of Pauni town. As this station is located near station S-2, some quantity of sewage from station S-2 flows and contaminates the water at station S-3. The last sampling station 'S-4' is located at one kilometer down stream from station 'S-3'. This spot is called as 'Pateghat', which is used by locality for religious purposes. The only cremation ground for Pauni town is located on the bank of river at this station. All the religious rights are performed after cremation at this site S-4, on the bank of river.

The remaining ashes after burning of dead bodies are frequently disposed in the river water. Similarly the large quantity of flowers and garlands from dead bodies are also thrown at station 'S-4'. The wastes from temples like decaying flowers and leaves, etc., from temple are also discharged in to the river water regularly. A municipal sewage drain carries the wastes from the nearer locality, which also adds pollutants in the river at this station.

Besides all these sources of pollution, the decaying cowdung manure also pollutes the river water during summer. The dry regions of the river basin has been taken on lease, for farming the crops of Watermelon and Muskmelon, by some farmers during the months from February to May, The cowdung, which is used as fertilizers for these crop fields enters in the water current at stations S-2 and S-3. The fishing activities are carried at stations S-1, S-2 and S-3, the fisherman prepare artificial hiding places with the help of dry wooden branches of trees. The fishes use such places for shelter and are captured in to the net. Such artificially constructed site for hiding of fishes may contributes pollution of river during winter and summer months. The BOD from river water was determined by titrimetric method with incubation for 5 days.. (NEERI, 1986).

3. Result and Discussion

Analysis of Wainganga river water during the study period reveals that, the microorganisms require more oxygen for stabilizing the biodegradable organic wastes, during summer season. This is due to more concentration of biodegradable organic matter in river during summer. Activity of microbes enhances in the more temperature of river water and rapid process of stabilization of organic matter requires more oxygen. (Gambhir, 1999).

At station S-2 and S-3 increased biodegradable organic material, from sewage, decaying cow dung from farming in river basin, is responsible for increased values of BOD. Subsequently, the domestic activities performed at station S-3 and S-4, and discharge of temple wastes and cremation wastes at station S-4, contributes the most of biodegradable organic matter in the river. Hence, the increasing load of pollutants at downstream station has resulted in to higher values of BOD. Agrawal and Kannan, (1996). It is evident that the values of BOD in a river were minimum at all stations, during winter. This may be due to relatively more flow of river, which offers dilution to the pollutants. However, the increasing trend of values toward downstream is attributed to increasing the pollutant discharge in river stream at station S-2, S-3 and S-4. However the reduction of microbial activities in less temperature of water causes the decrease in values of BOD in river water. Koshy and Nayar, (2000). Mohanta *and* Patra, (2000),

The comparative seasonal data collected during rainy season indicates, the surface runoff, silting, suspended solids in stream and turbidity resulted in the increase of BOD in the river water. Jameel, (1998). The river carry organic matter from catchment area along with surface runoff may be responsible for the oxygen demand in river water at station S-2, S-3 and S-4. (Pande and Sharma, 1998). As the more water in river during the months of rainy season dilutes the pollutants. Hence, the lower values of BOD are recorded as compare to the summer values.The present investigation of Wainganga river water, it is concluded that, the values of biochemical oxygen demand shows inverse trend with the values of dissolved oxygen. This may be due to the effect of temperature on river water, which controls the efficiency of microorganisms for decomposition of organic matter. The presences of more DO in water lowers the BOD and less amount of DO in water creates the more biochemical oxygen demand. (Pande and Sharma, 1998). The permissible level of BOD for potable water is 6.0 mg/l. In Wainganga river water the values of BOD are well above the permissible limits at all stations.

It is concluded that dissolved oxygen in Wainganga river water varies from season to season. Maximum concentrations of DO observed in the winter and minimum during summer season. It is also concluded that, increase in temperature of river water resulted in to decrease of dissolved oxygen. Most of the pollutants discharged in to the river contain organic matter, which enhance the decomposition activities of microorganisms. The consumption of oxygen by microorganisms in the process of biodegradation of organic matter causes the depletion of oxygen from river water. (Bhave and Borse, 2001), (Thomas et.al, 2001).

The Watermelon fields in the river basin covers the area around station S-2 and S-3. The mixing of decaying cow dung in stream increase the organic pollution. It is evident from data that, the lower concentrations of DO at sampling station S-4 in summer. This is due to many sources of pollutants that contaminate the river water at this station. Higher concentration of organic matter and increased rate of decomposition due to more temperature of river water during summer may be responsible to depletion of DO levels at down stream stations S-2, S-3 and S-4. However at station S-4, the discharge of crematory ashes forms the turbidity in river water and restricts the light to penetrate inside the water, which intern lowers the oxygen output from aquatic flora. (Sengupta et.al, 1987). During the of winter season relatively more flow of water dilutes the sewage and wastes in the river basin. Less temperature of river water influence the microbial activities to some extent and, the solubility of oxygen is also increases with the reduction in temperature of river water.

During rainy season large quantity of water in river basin dilutes the organic matter. Subsequently the more turbulence of water in flooded river adds the atmospheric oxygen in water on some extent. The organic matter from surface runoff, sewage discharge and domestic activities including cattle washing, lowers the levels of DO in the rainy season. It has been observed from the present study, the dissolved oxygen in Wainganga river decreases gradually from upstream station S-1 to downstream station S-4. The study during summer and winter months reveals that, artificial fish hiding places were located in the stream around the area between station S-2 and S-4. The decaying leaves and branches of tree may increase the organic pollutants on some extent. However, this will need further confirmation by carrying the specific experiments to ascertain its impact. It will be interesting to note if this has any significant role in the status of DO in the water of river Wainganga. The potable range of drinking water for DO is minimum 4.0 mg/l. In Wainganga river water the least values are observed below the permissible limits.

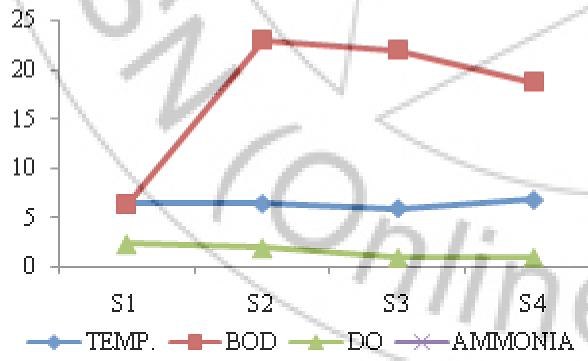

Figure 1: Mean variation in BOD in Wainganga river during summer.

Table 1: Ranges of temperature and conductivity at different stations during the months of Summer, Winter and rainy season.

Season	*station*	*Temp. (oC)*	*Mean variation*	*Conductivity umhos/cm*	*Mean variation*
SUMMER (Feb.,Mar. Apr. May.)	S-1	28.6-35.1	6.4	360-458	12.1
	S-2	29.0-35.4	6.4	563-608	44.4
	S-3	29.6-35.6	5.9	601-626	24.8
	S-4	29.6-36.4	6.7	628-702	74.2
WINTER (Oct.,Nov.,Dec., Jan.)	S-1	26.1-28.1	2.0	312-335	23.1
	S-2	26.7-28.6	1.9	416-450	33.4
	S-3	26.7-27.9	1.2	449-528	78.3
	S-4	26.1-28.5	2.4	497-562	65.6
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	28.7-31.1	2.4	346-368	22.1
	S-2	28.9-32.4	3.4	418-558	139
	S-3	29.6-32.5	2.8	457-598	140
	S-4	30.2-33.0	2.8	496-603	107

Table 2 : Ranges of pH and alkalinity at different stations during the months of Summer, Winter and rainy season

Season	*station*	*Hydrogen ion conc.*	*Mean variation*	*Alkalinity (Mg/l)*	*Mean variation*
SUMMER (Feb., Mar. Apr. May.)	S-1	7.4-7.5	0.1	35.5-43.9	8.4
	S-2	7.4-7.5	0.1	41.3-45.9	4.6
	S-3	7.5-7.7	0.1	44.6-47.4	2.8
	S-4	7.6-7.8	0.1	45.5-57.2	11
WINTER (Oct.,Nov., Dec., Jan.)	S-1	7.4-7.6	0.1	42.4-47.9	5.5
	S-2	7.5-7.8	0.3	47.3-52.1	4.7
	S-3	7.6-7.9	0.3	49.2-58.2	9.0
	S-4	7.8-8.1	0.2	56.4-64.2	7.7
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	7.2-7.4	0.2	34.9-40.0	5.0
	S-2	7.3-7.6	0.29	37.8-49.2	11
	S-3	7.3-7.7	0.3	40.6-53.3	12
	S-4	7.5-7.7	0.2	48.1-60.4	12

Table 3: Ranges of TDS and chlorides at different stations during the months of Summer, Winter and rainy season

Season	**station**	**TDS (Mg/l)**	**Mean variation**	**Chlorides (Mg/l)**	**Mean variation**
SUMMER (Feb., Mar. Apr. May.)	S-1	186-340	154	29.8-32.8	3.4
	S-2	209-336	127	33.2-36.7	3.5
	S-3	312-639	327	35.3-37.8	2.5
	S-4	393-658	264	44.2-47.1	2.9
WINTER (Oct.,Nov., Dec., Jan.)	S-1	178-306	128	24.5-27.0	2.4
	S-2	192-348	156	27.5-34.3	6.7
	S-3	219-353	133	30.2-35.0	4.7
	S-4	231-402	171	31.3-39.3	8.01
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	302-498	196	21.9-26.2	4.33
	S-2	314-627	312	26.3-30.8	4.49
	S-3	423-644	220	26.3-32.3	5.98
	S-4	440-670	230	31.0-37.9	6.85

Table 4: Ranges DO and BOD at different stations during the months of Summer, Winter and rainy season.

Season	*station*	*DO (Mg/l)*	*Mean variation*	*BOD (Mg/l)*	*Mean variation*
SUMMER (Feb., Mar. Apr. May.)	S-1	4.0 – 6.3	2.3	17.52-23.84	6.32
	S-2	3.9 – 5.8	1.9	36.10-59.11	23.0
	S-3	3.5 – 4.4	0.9	43.23-65.24	22.0
	S-4	3.1 – 4.0	0.9	49.44-68.26	18.8
WINTER (Oct.,Nov., Dec., Jan.)	S-1	7.6 – 8.1	0.5	04.01-08.55	4.54
	S-2	5.8 – 6.4	0.6	23.21-28.64	5.43
	S-3	4.7 – 5.2	0.5	26.03-34.63	8.60
	S-4	4.4 – 5.1	0.7	30.24-38.13	7.89
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	4.2 – 6.8	2.6	09.71-19.81	10.1
	S-2	4.0 – 6.1	2.1	27.43-32.34	4.91
	S-3	3.0 – 5.9	2.9	33.23-40.91	7.68
	S-4	2.9 – 5.4	2.5	41.44-50.23	8.79

Table 5: Ranges CO2 at different stations during the months of Summer, Winter and rainy season

Season	station	CO2 (Mg/l)	Mean variation
SUMMER (Feb., Mar. Apr. May.)	S-1	7.8-10	2.00
	S-2	11-18	6.78
	S-3	13-18	5.00
	S-4	21-24	2.40
WINTER (Oct.,Nov., Dec., Jan.)	S-1	5.9-10	3.99
	S-2	8.9-12	3.60
	S-3	11-16	5.66
	S-4	14-23	9.40
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	3-5.4	2.50
	S-2	5-7.6	2.80
	S-3	10-13	2.58
	S-4	16-22	6.22

4. Conclusion

On the basis of data collected from the present investigation, it is concluded that, each parameter shows the seasonal variations in their concentrations. The upstream station S-1 is characterized by the absence of any significant source of pollution. At down stream stations, the variations are observed due to discharge of domestic pollutants in the river water. The pollutants contaminate the stretch of river along the Pauni town; that are originated from the human activities. The sources of pollutants are municipal sewage, the wastes from domestic and religious activities performed by the locality on the bank of river, such as mass bathing, cloth washing, cattle washing, discharge of temple wastes and flower and garlands from the dead bodies, cremated ashes and the pollutants from river basin agriculture. Biological degradation of organic matter results in to the production of ammonia in river water. However, during winter, the reduced activities of nitrifying bacteria due to low temperature of water, causes maximum values of ammonia in water. In the months of rainy season, the large quantity of water in river basin dilutes the biodegradable wastes; hence the lower values are recorded. The concentration of biodegradable organic matter in river water is more in summer. High temperature of water enhances the decomposition activities of microbes. On the other hand activity of nitrifying bacteria also increases due to increased temperature of water in summer, which converts the ammonia in to inorganic nitrogen and causes the reduction of values to some extent. Anaerobic decomposition of bottom organic matter and dissolved organic matter by microbial population and increased activity of denitrifying bacteria in the lower temperature of river water during winter, increase the values of ammonia and hence, maximum values were obtained in winter.

5. Acknowledgement

Author is thankful to Dr. Prakash G. Puranik, former head dept. of zoology, D'peth college, Nagpur. Thankfulness is due to Dr. Arvind P. Sawane for his untiring help during the research work.

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