A Study of Ammonia Concentrations Due Effect of Organic pollution in River Waingnga at Pauni District Bhandara (M.S.) India

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Abstract

Present study deals with the investigation of level of organic pollution in a streatch of Wainnganga river in Bhandara district. Decaying cow dung 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 cow dung, 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 prepares artificial hiding places with the help of dry wooden branches of trees. A maximum concentration of ammonia observed during winter season in the month of January was 1.69 mg/L at station S-4. While minimum values of ammonia concentration noted, 0.25 mg/L during rainy season, in the month of August at station S-1.

Municipal sewage discharge at station S-2 and S-4, domestic activities performed by localities at stations S-3 and S-4 and discharge of decaying leaves and flowers from temple and dead bodies contributes the nitrogenous organic matter in river water. Values of ammonia mg/l in the study area are found well above permissible limits.

KEYWORDS : River water, Ammonia, BOD, Temperature, Human activities.

Introduction:

Ammonia is liberated in the water as an end product of decomposition of nitrogenous organic matter and also as an excretory product of some aquatic animals. Domestic wastes are generally rich in nitrogenous organic matter. Many industrial effluents add to the ammonia load in water, resulting in toxic levels at certain times. However, aquatic autotrophs are capable of utilizing ammonium ions at fast rate. Ammonia therefore appears in many grounds as well as surface waters. Higher concentrations of ammonia above certain level in water polluted due to sewage or industrial wastes, is toxic to fish. The proportions of the ammonia in safe surface waters depend on pH.

Sewage has large quantities of nitrogenous matter; thus its disposal tends to increase ammonia content of waters. Occurrence of ammonia in the water can be accepted as the chemical evidence of organic pollution. If ammonia is present, pollution by sewage must be very recent. The occurrence of nitrite with ammonia suggests a time lapse in the pollution that has occurred. The toxicity of ammonia increases with pH, because of high pH most of ammonia remains in the gaseous form. The decrease in pH subsequently decreases its toxicity due to the conversion of ammonia in to ammonium ions, which are less toxic than the gaseous form.

Feaces of animals contain appreciable amounts of unassimilated protein matter (Organic matter). This unassimilated protein matter from the bodies of dead animals and plants are converted in large measure to ammonia by the action of saprophytic bacteria under aerobic or anaerobic conditions. The ammonia released by bacterial action on organic matter may be used by plants directly to produce plant proteins. The excess of ammonia released is oxidized by autotrophic nitrifying bacteria, which convert ammonia to nitrites under aerobic conditions. Prior to the development of bacteriological test for determining the sanitary quality of water, environmental engineers and other concerns were largely dependent upon test of ammonia nitrogen. Waters, which contained mostly organic, ammonia and nitrogen, are considered as great potential danger (Sawyer and Mc Carty, 1978).

In stream waters ammonia arises from aerobic or anaerobic decomposition of organic matter present in it. It is one of the indicators of pollution. The decrease of ammonia indicates low organic pollution (Ajmal et.al, 1985). Concentration of ammonium ions derived mostly from wastes is associated with absence of aquatic plants, indicates that the ammonium concentration is toxic to aquatic plants (Onaindia et.al, 1996). Free ammonia is almost invariably originate from animal wastes in surface waters, (Harish Kumar, 1998).

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 in Pauni town in Bhandara district for the present investigation. Station ‘S-1’ is located at the site of Dam at village Gosikhurd, nine kilometers away from the sampling station S-2 of Pauni town.

Besides all these sources of pollution, the decaying cow dung 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 cow dung, 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. Samples from different sampling stations were collected for physical and chemical analysis. The sample analysis of nitrate were performed in the laboratory by titrimetric method. The weekly collection of samples of water from different spots and depths of river was done by Mayer’s sampler. The samples were preserved by refrigeration at 4 ^{o}C, in ice box for short interval of travel, which is most general accepted method. (NEERI, 1986).

Result and discussion:

From the values obtained, during summer, in the month of February, March, April, and May, ammonia concentration ranges, from 0.41 mg/L to 0.56 mg/L at station S-1, 0.51 mg/L to 0.76 mg/L at station S-2, 0.58 mg/L to 0.92 mg/L at station S-3 and 0.72 mg/L to 1.18 mg/L at station S-4. During the rainy season, in the month of June, July, August and September, it ranges from 0.25 mg/L to 0.42 mg/L at station S-1, 0.36 mg/L to 0.58 mg/L at station S-2, 0.42 mg/L to 0.62 mg/L at station S-3 and 0.51 mg/L to 0.74 mg/L at station S-4. The result of the analysis carried out during winter, in the month of October, November, December and January, reveals that the concentration of ammonia ranges from 0.60 mg/L to 1.03 mg/L at station S-1, 0.80 mg/L to 1.18 mg/L at station S-2, 1.10 mg/L to 1.40 at station S-3 and 1.22 mg/L to 1.69 mg/L at station S-4.

At sampling station S-1 the mean values of ammonia varies from 0.25 mg/L in August to 1.03 mg/L in the month of January. At sampling station S-2 the mean values of ammonias ranges from 0.36 mg/L to 1.18 mg/L in the month of August and January respectively. At sampling station S-3, a mean value of ammonias varies from 0.42 mg/L to 1.40 mg/L in the month of August and January respectively. At sampling station S-4 mean values of ammonias ranges from 0.51 mg/L to 1.69 mg/L in the month of July and January respectively. A maximum concentration of ammonia observed during winter season in the month of January was 1.69 mg/L at station S-4. While minimum values of ammonia concentration noted, 0.25 mg/L during rainy season, in the month of August at station S-1.

The water analysis conducted in the month of February, March, April, and May, reveals that the values of biochemical oxygen demand (BOD) shows great variation during summer at all sampling stations. The value varies from 17.52 mg/l to 23.84 mg/l at station S-1, 36.1 mg/l to 59.11 mg/l at station S-2, 43.23 mg/l to 65.24 mg/l at station S-3 and 49.44 mg/l to 68.26 mg/l at station S-4. During rainy season in the month of June, July, August and September varies from 9.71 mg/l to 19.81 mg/l, 27.43 mg/l to 32.34 mg/l, 33.23 mg/l to 40.91 mg/l and 41.44 mg/l to 50.23 at stations S-1, S-2, S-3, and S-4 respectively. In the month of October, November, December and January, it varied from 4.01 mg/l to 8.55 mg/l at station S-1, 23.21 mg/l to 28.64 mg/l at station S-2, 26.03 mg/l to 34.63 mg/l at station S-3 and 30.24 mg/l to 38.13 mg/l at station S-4,

It is evident from the study, values of biochemical oxygen demand was maximum during summer season and were minimum during winter season. However in the months of summer and winter more variation of values observed from upstream station S-1 to downstream station S-4. During summer the gradual increase of BOD observed from upstream station to down stream with rise in temperature of water.

At sampling station S-1 the mean value of temperature varies from 26.13 ^{o}C to 35.13 ^{o}C in the month of January and May respectively. At sampling station S2 the mean value ranges from 26.76 ^{o}C to 35.45 ^{o}C, in the month of December and May respectively, At sampling station S-3, mean value varies from 26.71 ºC to 35.6 ºC in the month of December and May respectively, At sampling station S-4 mean value ranges from 26.93 ºC to 36.4 ºC in the month of December and May respectively.

Maximum temperature observed during summer in the month of May was 36.4 ^{o}C at station S-4 .While, minimum value of temperature was noted 26.13 ^{o}C during winter in the month of January at station S-1. The increase in temperature was observed during the study period from upstream station S-1 to down stream station S-2 with increasing load of pollutants.

The river is polluted by many sources of pollutants especially organic matter. 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. There was a considerable variation in concentration of ammonia from season to season in Waingangā river. However, it increases with increasing load of organic matter in river water. From present investigation it is concluded that, the concentration of ammonia remains maximum in the months of winter season and maximum during rainy season. It has been observed that, during the rainy season, in the month of June, July, August and September, minimum values were obtained. This fall in concentration of ammonia may be due to dilution of pollutants by rain water, (Sharma and Pande, 1998).

The data recorded during the summer revealed that, the concentration of biodegradable organic matter was high, in the months of summer. High temperature of water enhances the decomposition activities of microbes. On the other hand activity of nitrifying bacteria also increases due to increase in temperature of water in summer, which converts the ammonia in to inorganic nitrogen and causes the reduction of values to some extent. The high temperature of water induces the rate of nitrification. (Rath et.al, 2000).

The anaerobic decomposition of bottom organic matter and dissolved organic matter by microbial population was recorded during winter season. The increased activity of denitrifying bacteria in low temperature of river water raised the value of ammonia and obtained maximum value in winter. (Muller and Kirchesch, 1990) in river Danube, Pande and Sharma, 1998). The most of ammonia dissolved in water gets dissociated by high temperature of water in summer. The ammonia thus evolved finds its way to atmosphere. Hence, the lower levels of ammonia were obtained in the summer as compare to the winter.

Municipal sewage discharge at station S-2 and S-4, domestic activities performed by localities at stations S-3 and S-4 and discharge of decaying leaves and flowers from temple and dead bodies contributes the nitrogenous organic matter in river water. However, the sewage discharged at station S-2 shows the impact of pollution at station S-3 due to less distance between these stations. The analysis of river water during the study period of September showed, the concentration of ammonia increased from upstream station S-1 to downstream station S-4, with increasing load of pollutants. However, the less concentration was recorded at upstream station S-1. (Mishra and Jha, 1996). The maximum permissible level of ammonia in water for domestic uses is 0.5 mg/l. In Wainganga river water is well above the permissible level.

Table-1 : Variation of Ammonia with respective variations in Temperature and Biochemical Oxygen Demand in Wainganga river water.

Season	station	Temp.(oC)	Mean variation	BOD(Mg/l)	Mean variation	Ammonia (Mg/l)	Mean variation
SUMMER (Feb., Mar. Apr. May.)	S-1	28.69-35.13	6.44	17.52-23.84	6.32	00.41-00.56	0.15
	S-2	29.04-35.45	6.41	36.10-59.11	23.0	00.51-00.76	0.25
	S-3	29.68-35.60	5.92	43.23-65.24	22.0	00.58-00.92	0.34
	S-4	29.65-36.40	6.75	49.44-68.26	18.8	00.72-01.18	0.46
WINTER (Oct.,Nov., Dec., Jan.)	S-1	26.13-28.14	2.01	04.01-08.55	4.54	00.60-01.03	0.43
	S-2	26.76-28.68	1.92	23.21-28.64	5.43	00.80-01.18	0.38
	S-3	26.71-27.91	1.20	26.03-34.63	8.60	01.01-01.40	0.39
	S-4	26.13-28.53	2.40	30.24-38.13	7.89	01.22-01.69	0.47
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	28.74-31.18	2.44	09.71-19.81	10.1	00.25-00.42	0.17
	S-2	28.91-32.40	3.49	27.43-32.34	4.91	00.36-00.58	0.22
	S-3	29.65-32.50	2.85	33.23-40.91	7.68	00.42-00.62	0.20
	S-4	30.20-33.04	2.84	41.44-50.23	8.79	00.51-00.74	0.23

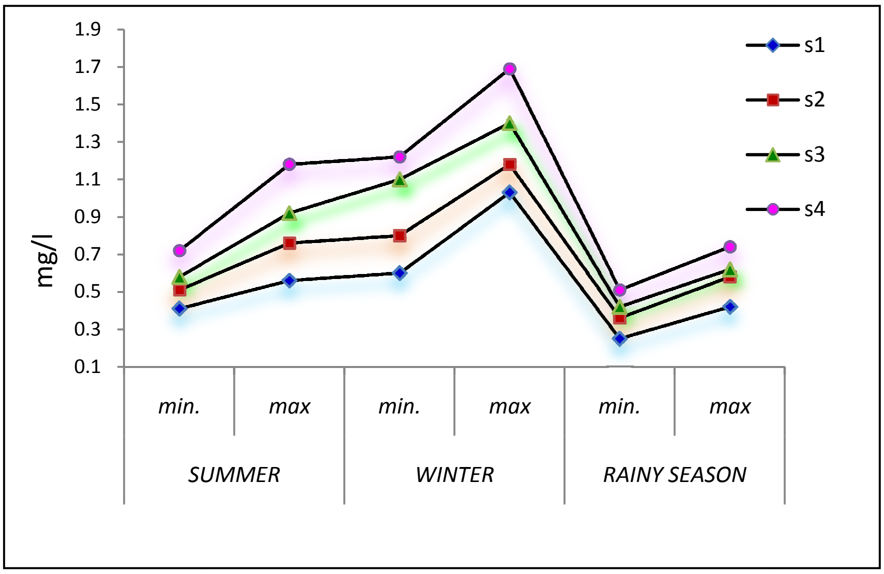

Fig.-1.

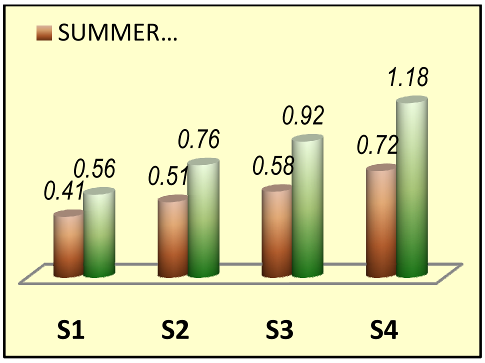

Fig.-2

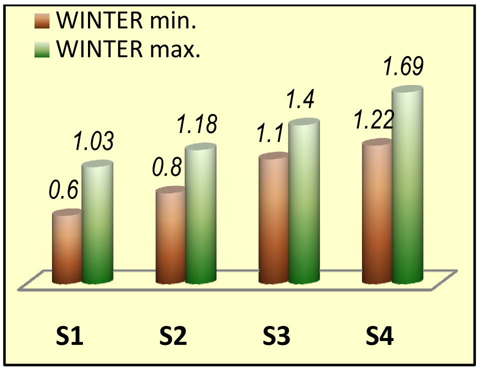

Fig.-3

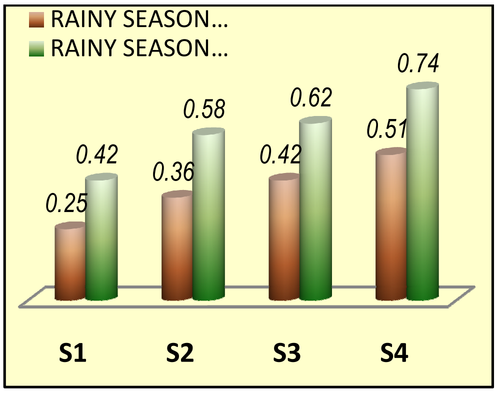

Fig.-4

Fig.- 1,2,3&4 : Seasonal variations in concentration of Ammonia in Wainganga river water

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