ASSESSMENT OF PHYSICO CHEMICAL CHARACTERISTICS AND NUTRIENTS IN HOSPITAL EFFLUENT OF BHOPAL CITY

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ABSTRACT

The study deals with comparative account of physico chemical characteristics of hospital effluents. Hospital which provide hospitality to the ailing, can also create hazards. Indiscriminate disposal of hospital waste is indeed one of the major sources for spread of pollution and infection. Samples of effluent collected from five hospitals (Govt. & Private) to analyse physico chemical characteristics and nutrients. The amount of turbidity, TSS, BOD, COD are above the permissible limit.

A pollutant is nothing but a misplaced resources. It is very true in the case of nutrient. Excessive fertilization of natural water is becoming one of the most important causes of water quality deterioration. Hospital effluent contain Total nitrogen, total phosphorus, Ortho phosphate, organic phosphate ammonia etc. which stimulate the growth of flora. When these effluents find their way into water bodies, increase the amount of nutrients. Now the Eutrophication becomes a threat to the existence of water bodies.

Keywords: Hospital effluent, physico-chemical characteristics, eutrophication, Oligotrophic lake and algal blooms.

INTRODUCTION

Bhopal, the capital of Madhya Pradesh has numerous Government and private hospitals and many hospitals are going to set up here. Effluents from some Government and private hospitals have been analyzed to observe the impact on water bodies. The quality of effluent usually depends on its physical and chemical characteristics. Hospital effluent also contain some nutrients which leads to eutrophication.

Eutrophication is a process, which means well nourishment or enrichment. This enrichment leads to abundant bottom vegetation, algal blooms and a decreased in population of fauna due to oxygen depletion. N and P are two important nutrients that lead to eutrophication and convert oligotrophic water to intensely productive eutrophic condition. Oligotrophic lakes are relatively unproductive and receive small amounts of aquatic plant nutrient, while eutrophic lakes are highly productive and experience high fluxes of aquatic plant nutrients Hospital effluent of some Government and private hospitals which are situated in different locations of Bhopal city have been analysed to determine the amount of nutrients by following the standard methods prescribed by APHA. Anonymous (1961), Hasler (1970), Hutchinson (1957, 1967) and Sauyer (1966) studied the eutrophication of lakes in different parts of the world. Eutrophication can be classified into two classes a) Natural eutrophication and b) Cultural eutrophication on the basis of process by which the eutrophication took place. When lakes and other surface water bodies receive nutrients naturally eutrophication known as Natural Eutrophication on the other hand lake ageing by human activities known as cultural or artifical Eutrophication. In India Kashmir lakes and Nainital lake are undergoing a rapid Eutrophication.

MATERIAL AND METHODS

Sampling was carried out on bimonthly basis, during morning time from Jan. 03 to Nov. 03. The Standard methods as prescribed by APHA (1995), Adoni (1985) and NEERI (1986) were

followed during the Collection Preservation and analysis of samples. For temperature, pH, turbidity and DO samples were analysed at the spot, immediately after collection and rest of the parameters were detected in the laboratory. Nitrogen is analysed by Kjeldahl method. Total phosphorus and Ortho phosphate was analysed by ammonium molybdate and intensity of developed colour was read by UV-Visible spectrophotometer (HACH DR 4000 U). Ammonical nitrogen was analysed by multiparameter kit "WTW" with the help of electrodes.

Study area Bhopal city

MR1 :   Ayushman hospital, at dense populated area Shahpura

MR2 :   Hamidia hospital, at dense populated area, Royal market

MR3 :   Hajela hospital, at new city area, Kotra Sultanabad

MR4 :   Vardan hospital, near slum area of Jehangirabad

MR5 :   Kasturba hospital, at new city area, BHEL

RESULTS AND DISCUSSION

The results are summarized in Tables 1 and 1.1 to 1.6 and graph 1 to 5 are showing the comparative representation of nutrients.

Temperature

Temperature is one of the physical parameters, which is directly related with the chemical reactions in the water. Measurement of temperature determine the D.O. Temperature of effluent was recorded in range 28.2 to 35.0

pH

pH ranges from 7.1 to 7.8 which is within the permissible limit.

D.O.

D.O. was nil in all the samples reason for the depletion in D.O. may be due to the presence of organic matter, biological activity and decay of vegetation.

BOD and COD

COD is a measure of oxidisable impurities present in the effluent whereas the BOD measures the oxygen consumed by living organism while assimilating organic matter present in the effluent, the COD is measure of both the biologically oxidisable and biologically inert organic matter. Values of BOD were recorded higher than permissible limit.

In all the samples while the values of COD were higher in some samples. The minimum value of BOD (45) was recorded in month of July in sample of MR1 whereas the maximum value of BOD (280) was recorded in month of Jan. in the sample of MR2.

Total alkalinity

TA is caused by the presence of carbonates and bicarbonates. The values of TA ranges from 116 to 360.

Turbidity

High value of turbidity shows the presence of suspended or/ and colloidal organic and inorganic substances. High turbidity stop the penetration of light which affect the ecosystem adversely. Its ranges from 49 to 445.

TSS

Suspended solids interfere with the transmission of light, excess suspended adversely affect fish by reducing their growth and resistance to disease and preventing the successful development of fish eggs and larvae. The minimum value (50) of TSS was recorded in Jan. 03 in sample of MR2 and maximum value (540) was observed in sample of MR4 in the month of May.

Total phosphorus

During the course of study TP is found between range 11.10 to 34.80 gm/l. Minimum value of TP is found in January at sampling station MR3 and in the month of July at Sampling point MR1. Whereas maximum value is reported at sampling point MR2 in month of March.

Ortho phosphate

Ortho phosphate plays a dynamic role and it is readily taken by phytoplankton. In the present study, ortho phosphate is observed 05.46 to 23.48 gm/l. Higher values is recorded in the month of May at sampling point MR4 and lowest value is recorded in November at sampling point MR4.

Organic phosphate

Amount of organic phosphate is reported minimum 03.48 gm/l at sampling point MR1 and maximum amount of organic phosphate is recorded 16.46 gm/l at sampling point MR5.

Total nitrogen

Total nitrogen is an important factor which enhanced the growth of flora. The amount of TN is

Table - 1

Sampling point ↓	Amount of Nutrients ⟶				
MR1	**Total Phosphorus**	**Ortho Phosphate**	**Organic Phosphate**	**Total nitrogen**	**Amonical nitrogen**
Jan	13.39	09.91	3.48	13.60	06.00
March	23.50	19.20	4.30	15.75	05.70
May	14.40	10.02	4.38	30.05	15.50
July	11.10	6.77	4.33	13.40	04.52
Sep	15.07	08.85	6.52	25.78	07.52
Nov	22.40	18.55	3.85	19.56	08.50
MR2					
Jan	25.05	20.82	4.23	35.90	06.85
March	34.80	23.45	11.35	09.85	02.25
May	28.45	19.92	8.53	15.50	05.80
July	12.40	07.80	4.60	17.09	06.75
Sep	16.80	12.40	4.40	22.85	10.00
Nov	15.00	11.00	4.00	15.65	08.54
MR3					
Jan	11.10	07.30	3.80	16.76	08.45
March	14.60	08.80	5.80	33.50	14.55
May	26.08	20.65	5.43	27.35	07.04
July	23.55	18.67	4.88	25.80	16.06
Sep	13.45	03.48	9.97	11.09	03.35
Nov	12.35	07.65	4.70	16.78	09.75
MR4					
Jan	20.31	16.67	3.64	09.80	01.25
march	23.50	14.64	8.86	16.40	05.50
May	12.85	06.66	6.19	23.02	14.00
July	25.75	20.45	5.30	14.00	06.58
Sep	28.25	23.48	4.77	24.50	05.50
Nov	14.50	05.46	9.04	10.00	03.26
MR5					
Jan	22.05	17.00	5.05	12.35	06.54
March	23.75	12.70	11.05	23.08	14.05
May	27.80	11.34	16.46	28.00	09.66
July	15.65	09.55	6.10	13.45	4.65
Sep	15.06	06.00	9.06	16.80	04.50
Nov	20.00	7.51	12.49	18.00	06.00

Table - 1.1 : Physico chemical characteristics of hospital effluent in Jan. 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	32.0	31.0	33.2	34.1	30.0
pH	7.2	7.5	7.3	7.5	7.4
Turbidity	125	240	100	85	175
Total alkalinity	212	280	260	236	198
TSS	140	50	460	720	110
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	88	280	275	120	155
C.O.D.	265	630	528	240	300

Table - 1.2 : Physico chemical characteristics of hospital effluent in Mar. 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	33.0	30.0	28.2	35.0	29.5
pH	7.1	7.2	7.2	7.4	7.7
Turbidity	49	157	56	155	75
Total alkalinity	360	250	218	274	200
TSS	120	360	100	300	100
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	85	185	178	180	95
C.O.D.	320	380	200	938	120

Table - 1.3 : Physico chemical characteristics of hospital effluent in May. 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	28.8	33.0	35.2	31.6	34.0
pH	7.4	7.1	7.5	7.5	7.8
Turbidity	255	340	160	138	150
Total alkalinity	218	310	185	275	96
TSS	250	80	174	540	125
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	86	190	250	90	85
C.O.D.	305	230	400	200	330

Table - 1.4 : Physico chemical characteristics of hospital effluent in July 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	32.0	34.0	30.1	32.0	32.1
pH	7.3	7.1	7.2	7.4	7.5
Turbidity	133	445	160	228	300
Total alkalinity	118	280	285	275	216
TSS	325	120	260	340	132
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	45	110	96	84	63
C.O.D.	114	202	230	195	100

Table - 1.5 : Physico chemical characteristics of hospital effluent in Sep. 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	30.8	34.0	33.3	30.0	31.0
pH	7.2	7.3	7.4	7.6	7.5
Turbidity	165	340	205	145	235
Total alkalinity	320	260	220	200	168
TSS	425	125	326	400	150
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	80	170	82	240	46
C.O.D.	198	230	120	135	230

Table - 1.6 : Physico chemical characteristics of hospital effluent in Nov. 03

Parameters	MR1	MR2	MR3	MR4	MR5
Temperature	30.2	28.0	32.0	30.0	33.0
pH	7.2	7.3	7.4	7.6	7.2
Turbidity	165	260	220	128	110
Total alkalinity	230	245	200	195	116
TSS	300	260	320	350	250
D.O.	Nil	Nil	Nil	Nil	Nil
B.O.D.	75	125	130	65	55
C.O.D.	285	260	210	240	250

According to Bio-medical waste (Management and handling) rule and BIS permissible limit (in Mg/l) pH - 6.6 to 9.0, TSS - 100, BOD - 30, COD - 250
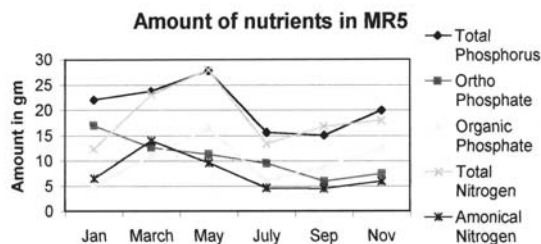
Graph No. 1

Amount of nutrients in MR1

Graph No. 2

Amount of nutrients in MR2

Graph No. 3

Amount of nutrients in MR3

Graph No. 4

Amount of nutrients in MR4
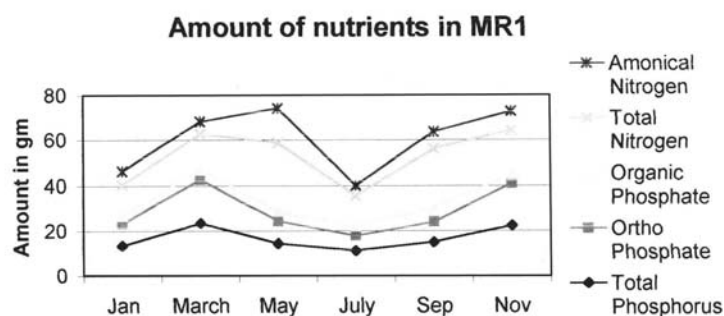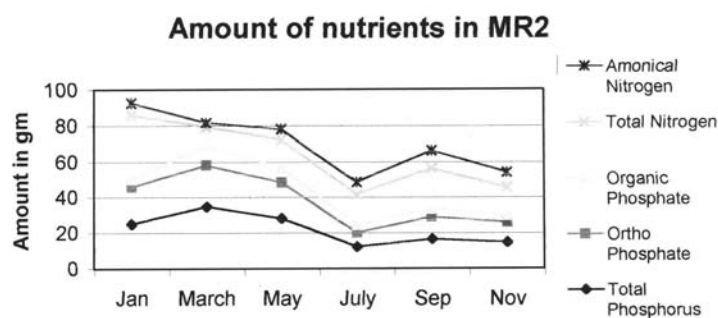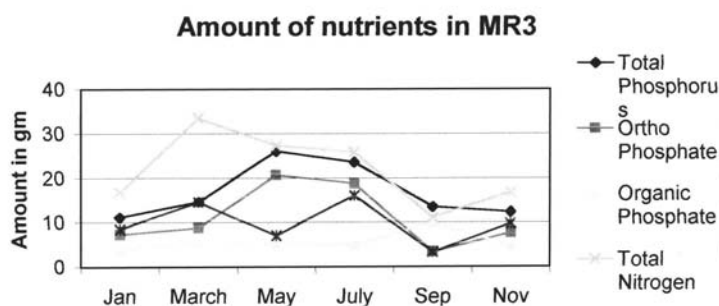
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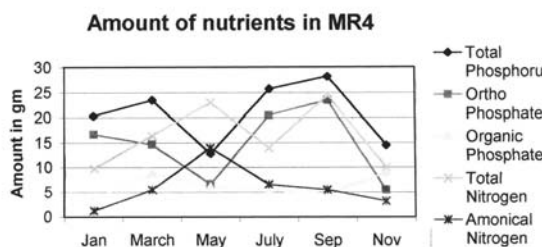
Amount of nutrients in MR5

lowest at sampling point MR4 in month of January which is 09.80 gm/l and highest amount is recorded at sampling point MR2 in the same month which is 35.90 gm/l.

Ammonical nitrogen

In the present analysis, lowest amount of ammonical nitrogen is recorded at sampling point MR4 in January where as highest amount is reported at sampling point MR3 in July. Amount ranges from 01.25 to 16.06.

Algae and diatoms attains a high degree of dominance due to over fertilization. During eutrophication algal blooms release toxic chemicals which kills fishes, birds and other aquatic animals causing water to sink. Algae and

rooted weeds retard the water flow clog the filters and affect the water quality and water work. Prolonged eutrophication conditions leads to dystrophic state. In India, Dal lake, Nagin lake and Hussain sagar are seriously chocked by aquatic weeds.

Several techniques along with prevention of further inflow of effluents have been used to control eutrophication. The hospital effluent must be treated before discharge into water streams to limit the nutrient value. Recycling of nutrient can be checked through harvest. Algal blooms should be removed upon their death and decomposition. Physico-chemical methods can be adopted to remove dissolved nutrients.

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