INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
© VISHWASHANTI MULTIPURPOSE SOCIETY (Global Peace Multipurpose Society) R. No. MH-659/13(N)
www.vmsindia.org

ASSESSMENT OF THE QUALITY OF SEWAGE EFFLUENT AROUND SATARA AND PUNE DISTRICT OF MAHARASHTRA, INDIA.

S. H. Mane[1#] and B. S. Kamble[2]
[1]Department of Chemistry, G.K.G. College, Kolhapur, M.S. India.
[#]Research Scholar J.J.T.U. Rajasthan, India.
[2]Mudhoji College, Phaltan, Satara, M.S., India.
sudam_mane@rediffmail.com

Abstract:
The physico-chemical properties of domestic sewage effluents of in the river and streams around Satara and Pune District of Maharashtra were studied.The results indicated that the salt load (electrical conductivity) was in between 815 and 3530 u.Scm^{-1} Sewage effluents also showed the higher BOD above the BIS standard. Total viable count, E. coli and Coli form count mg/l were highest in the post monsoon season and ranged from 1000 to 45000 and 3000 to 62500. Such waters are non potable. The effluents contain hereby metals Pb, Cu, Cd, and Cr, an appropriate dilution can make them worth using in agricultural fields to minimize its hazardous effect. Long-term application of these effluents may increase concentration of heavy metals to considerable levels vis-à-vis in the agricultural crops and vegetation.

Keywords: Sewage effluent, BOD, COD. Total viable count, E. coli and Coli form, & Heavy metals

Introduction:

Due to more industrialization, environmental pollution is increasing day by day. The disposal of city waste, Sewage water and industrial effluents (here it is referred as municipal waste and domestic and industrial water) is becoming a major problem. Although, application of sewage effluents were reported to be beneficial in increasing crop yield and reduce fertilizer requirement[3] but some other studies showed that metals like Pb, Cu, Cd, Cr enter in the food chain through their application in soil and this ultimately causes health concern significantly[9].Disposal of raw sewage on land or in natural streams physical, chemical and biological hazards. The present study was planned to know the seasonal variation in the chemical and microbiological properties of untreated municipal waste water at different locations of Satara and Pune District, Maharashtra.

Material and Methods:

The River Nira is one of lotic drainage river which carries city drainage of small town and villeges in which about 9.7 MLD Municipal wastes including sewage is being discharged daily. After travelling a distance of 135km.through Satara District in enters Pune District. Municipal waste water was collected during the year 2007 and 2008 in the pre-monsoon (June) and post-monsoon (December) seasons from 10 sampling sites of the three different locations. The water samples were analysed for EC, p^{H}.TDS. Carbonates, bicarbonates, chloride, sulphate, nitrate, phosphorus, total hardness, turbidity. BOD and COD as per the method outlined by Gupta. Calcium, magnesium, sodium and potassium were determined by the methods suggested by Richards. The samples were analyzed for biological properties as mentioned in APHA (1995)[2].Heavy metals and micronutrients analysis was done with the help of Atomic Absorption Spectrophotometer (perkin – LS-2-150).The results (can of ten samples collected in one year) from three locations for the pre-monsoon (June) and post-monsoon (December) seasons are presented below and discussed in light of the different standards for discharge of waste water and sewage set by IS : 3307-1977.

Results and Discussion:

The Municipal waste water and domestic waste water containing sewage and industrial effluent was alkaline in reaction both in pre and post monsoon with p^{H} values ranging between 7.1-7.9 (Table I) and was within the permissible limits of p^{H} for irrigation which vary between 6 to 9 as laid down in IS : 3307-1977. Electrical conductivity (EC) values of these effluents ranged from 815-2010 and 1648-3530 u.Scm^{-1} in pre and post monsoon season respectively at different locations. The sodium adsorption ratio varied from 1.25-3.84 and 1.75-3.84 in pre monsoon sampling respectively and most of these were within the critical limits (3.0) for irrigation purpose (IS: 3307-1977).The sodium adsorption ratio (SAR) of the Municipal waste water sampled from Bhore location is around 3.84 during pre and post monsoon with EC above 2000 u.Scm^{-1}.Use of such waters for irrigation creates the problem of oil sodicity[8].Total dissolved solid in pre monsoon which ranged from 1055-2259 mgl^{-1} and 522-1286 mgl^{-1} during pre and post monsoon respectively. The turbidity in pre monsoon 137-920 and 250-1900 mgl^{-1}

respectively in post monsoon season. Comparatively lower BOD and COD were observed during monsoon due to dilution of the effluent, which is in agreement with the findings of Adhikari and Gupta.

The carbonate content in all the effluents was totally absent where as bicarbonate ranged from 255 to 981 mgl^{-1}which was marginal in both the seasons. Owing to the higher Ca & Mg concentration and lower alkalinity due to phenolphthalein and methyl orange ($CO_3 + HCO_3$) the residual sodium carbonate hazard was not observed. Chloride concentration was higher during post monsoon (202-501 mgl^{-1}) in comparison to pre-monsoon sampling (83-354mgl^{-1}) Chloride was at toxic level in all the points in post monsoon on the basis of maximum permissible limit for irrigation(IS:3307-1977).Adhikari and Gupta[1] also found that the raw sewage in the winter (post monsoon) was toxic in respect to chloride, sulphate, bicarbonate, BOD and COD, Nitrate content was also more in the post monsoon season as compared to tolerable limit of 45 mgl^{-1}.The phosphorus content in the effluent was also beyond the limits and ranged from 0.8 to 1.0 mgl^{-1}.It is one of the major causes of water deterioration and these sites may face serious water quality problem like depletion of dissolved oxygen and consequently impair water for both human and aquatic use[10].Higher phosphorus concentration was obtained in post monsoon season at all the locations. Among the actions, the concentration of Ca^{2+} tended to be the highest followed by Na^{+}, K^{+} and Mg^{+} in post monsoon season.

Among the micronutrients, Fe and Mn were found to be prominent and varied from 0.059-0.424 and .01-0.207 mgl^{-1} in pre monsoon and from 0.126-

he highest count of these parameters was recorded in the water collected from sewage farm Bhore. The lowest count of E-coli was recorded in su0.479 mgl^{-1} and 0.112-0.221 mgl^{-1} respectively during post monsoon period. Cu and Zn were present in small quantities. Concentrations of all these micronutrients are within the permissible limits for surface application.

Heavy metal concentration followed the order Pb>C0>Cr>Cd. Cadmium ranged from 0.018-0.073 mgl^{-1} and was beyond the maximum recommendation limit (0.01 mgl^{-1}) for land application (IS:3307-1977)[5].The content or Cr varied from 0.003-0.071 mgl^{-1} where as Co ranged from 0.054-0.132 mgl^{-1}.The upper limits of both the heavy metals (Cr and Co)was beyond the maximum recommended limit of 0.05 mgl^{-1} (IS : 3307 – 1977 and Juwarkar.)[6].

Total viable count E-coli and Coli form count ml^{-1} were highest in post monsoon season (Table II). Similarly lower count of coli form ml^{-1} was also observed in the in post monsoon. Salmonella and Shigella count were totally absent in all the waste waters.

TABLE -1 Quality of Sewage Water Effluent at different location of Satara & Pune District.

Parameters	NIRA (PUNE)		BHORE (PUNE)		GHOKHALI (SATARA)	
	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon
p^H	7.3	7.4	7.6	7.8	7.2	7.1
EC u.Scm^{-1}	1031	1725	2100	3115	782	1550
TDS mgl^{-1}	535	835	1125	2244	510	991
Turbidity mgl^{-1}	46	26	25	85	38	39
BOD mgl^{-1}	76	122	218	182	781	851
COD mgl^{-1}	180	215	1172	1880	190	132
HCO3(CaCo3) mgl^{-1}	211	310	399	786	242	287
Chloride mgl^{-1}	102	315	322	499	69	196
Sulphate mgl^{-1}	26	72	176	187	16	200
Nitrate mgl^{-1}	5	46	57	72	17.0	46
Phosphorus mgl^{-1}	0.7	.69	0.92	1.1	0.6	1.7
TH (CaCo3) mgl^{-1}	230	432	532	1365	195	427
Calcium mgl^{-1}	110	132	150	337	89	157
Magnesium mgl^{-1}	21.0	29	27	62.9	15.4	28
Sodium mgl^{-1}	62.4	176.2	188	32	43.1	88
Potassium mgl^{-1}	26	49	32	41	32	65
Iron mgl^{-1}	.180	.112	.051	.152	421	.376
Copper mgl^{-1}	.018	.001	.011	.005	.017	.07
Manganese mgl^{-1}	.160	.098	.011	.182	.197	.020
Zinc mgl^{-1}	.065	.003	.007	.058	.13	.028

TABLE – 2 Microbiological Properties of Sewage effluent collected from different locations

Location	Total Viable count/ml		Coli form count/ml		E.coli count /ml	
	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon
Bhore	125000	6000	62500	3000	37500	1000
Nira	125000	8000	37500	4000	25000	2000
Gokhali	137500	10000	62500	5000	45000	2500

Conclusion:

The study on the quality of Municipal waste water and domestic waste water reveals that the salt load (EC) is in between 815 and 3530 u.Sm^{-1}. The BOD of all these waters are above the IS standards and causes problem in long run. Due to continuous application of Municipal waste water and domestic waste water the ground water aquifer gets polluted resulting in increase in salt concentration and BOD. Total viable count E-coli and Coli form count ml^{-1} were highest in post monsoon season. Such waters are non-potable. The long term application of these effluents may increase concentration of heavy metals to considerable levels that will ultimately enter in the vegetation grown on such soils. Generally the average application rate of waste water per unit area is an excess of normally permissible application rates in any properly managed irrigation system. Therefore sewage effluents if treated properly to reduce BOD. Salt load and microbiological properties and used judiciously can provide an alternate source of water for irrigation.

Acknowledgements:

Our gratitude is due to the management of the research laboratory & library of NCL, IIT Bombay, Shivaji University, Kolhapur, G.K.G. College, Kolhapur and Mudhoji College, Phaltan, Satara, M.S.

Reference:

1) Adhikari S. and Gupta S.K. Assessment of the quality of sewage effluents from dry weather flow channel. Calcutta. Indian J. Environ. Health 44 (4). 08-1 (2002).

2) APHA, Standard Methods for the Examination of water and waste water. American Public Health Association, American Water Works Association and Water Pollution Control Federation 19th Washington D.C. (1995).

3) Feigin A and Kipnis T. Improving nitrogen uptake by Rhodes grass from treated Municipal effluents to reduce fertilizer requirements and prevent water pollution in Agrochemicals in Soils Eds. A Banin and U. Kafkafi, Pergamon Press, Oxford, 395-405 (1980)

4) Gupta P.K., Soil, Plant, Water and Fertilizer Analysis Agrobios (India) Publication, Jodhpur (2000).

5) IS : 3307-1977, Tolerance limit for industrial effluents discharged on land for irrigation purposes. ISI (Indian Standard Institute). New Delhi (1977).

6) Juwarkar A.S. Reuse of waste water for crop irrigation Jal Vigyan Sameeksha Technical Committee on Hydrology, 3(1) : 88 (1988).

7) Richards L.A. Diagnosis and Improvement of Saline and Alkali Soils. Agriculture Handbook No.60. United States Department of Agriculture, Washington D.C. USA (1954).

8) Sharma O.P. et al. Effect of saline water irrigation on crop yield and soil properties. Curr. Agric, 5:48-53 (1981).

9) Sidle R.C. Hook J.E. and Kardos L.T. Heavy metal application and plant uptake in a land disposal system of waste water Journal of Environmental Quality. 5:97-102(1976).

10) Tyagi A. Sharma M.K. and Bhatia K.K.S. The study of temporal and spatial trends of water quality of river Kshipra using water index Indian Journal of Environmental Health 45 (1) : 15-20 (2003).