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STUDIES ON SEWAGE POLLUTION IN SOME RESIDENTIAL AREAS OF SRIKAKULAM, A.P

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ABSTRACT

Sewage is water-carried wastes, in either solution or suspension that is intended to flow away from a community .This study comprises of analysis of domestic sewage from ten different residential sampling stations of Srikakulam town, Andhra Pradesh. This study includes the determination of physico- chemical parameters of the water samples in those selected areas during the pre-and post monsoon periods .The values of BOD, NH_4-N in certain cases and TDS (nearly approaching the upper limit) obtained as per the prescribed standards.

KEY WORDS

Domestic Sewage -- Pollution- Srikakulam town

INTRODUCTION

Sewage is water-carried wastes, in either solution or suspension that is intended to flow away from a community. It is more than 99.9% pure water and is characterized by its volume or rate of flow, its physical condition, its chemical constituents, and the bacteriological organisms that it contains.

Domestic or sanitary sewage is the spent water from residential areas -- body wastes, washing water, food preparation wastes, laundry wastes, and other waste products of normal living. Wastes that result from an industrial process or the production or manufacture of goods are classed as industrial wastes. Their flows and strengths are usually more varied, intense, and concentrated than those of sanitary sewage. These waste waters carry pathogenic organisms that can transmit disease to human beings and other animals; contain organic matter that can cause odor and nuisance problems of receiving water bodies; and can lead to ecotoxicity. Excessive deposition of chemical nutrients in water bodies is called eutrophication. Degradation of water quality, reduction in the number of fish and increase in BOD, are the effects of eutrophication. Proper collection and safe, nuisance-free disposal of the liquid wastes of a community are legally recognized as a necessity in an urbanized, industrialized society [1]. Sewerage being the pipes, pumps and infrastructure through which sewage flows [2]. Power can also be obtained from sewage water. The technique uses Microbial fuel cells. Characterization of the sewage becomes essential for an effective and economical waste management program and to choose the treatment processed, deciding the extent of treatment methods and assessing the beneficial uses of the wastes. Some, which are present in lower concentration or below detection limits in supply water, tend to increase more than 98% in used water (i.e., domestic sewage). Reasons for the increment in heavy metals (in sewage) such as Zn, Pb are not only because of domestic uses, but also from other sources. For example, lead (Pb) may be entering into the sewage system

through dust fall, soil erosion, leaching, urban waste discharges and runoff from streets and other surfaces. This toxic metal may cause anemia, kidney disease and nervous disorders above the tolerance limits 0.05 mg/L. Similarly, zinc (Zn) is an essential element in human metabolism. A child requires 0.3 mg of Zn/kg of body weight, the deficiency of which may cause growth retardation. But excessive concentration in the drinking water may cause undesirable aesthetic effects. Characteristics of drinking water as well as discharge of effluents are shown in **Table 1**.

Table 1: Analysis of sewage waters collected in pre monsoon period (2012)

Parameter	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	Effluent discharge std.	Drinking water std.(ISI)
pH	7.39	7.92	7.65	7.63	8.02	7.92	7.59	7.90	7.46	7.50	5.5-9.0	6.5-8.5
Electrical Conductivity	1.8	1.2	1.9	0.9	2.1	1.6	1.7	1.8	2.0	1.6	-------	-------
TDS	432.7	492.1	471.6	507.5	404.3	471.8	335.2	399.4	356.8	389.3	2100	500
TSS	76	68	73	89	62	91	69	72	83	61	100	NS
Hardness	223	290	226	208	276	203	185	269	197	273	NS	300
Chloride	114	108.6	104.1	98.7	101.5	113.3	88.6	72.7	87.2	98.4	1000	250
DO	5.1	5.3	4.8	5.2	4.9	4.9	5.0	4.7	4.8	5.2	NS	NS
BOD	55	61	72	58	77	68	82	65	78	64	30	NS
COD	102	114	98	87	103	71	82	116	123	139	250	NS
Iron	0.016	0.072	0.032	0.003	0.048	0.016	0.001	0.025	0.048	0.051	3	0.3
Lead	0.002	ND	ND	0.004	ND	0.002	0.003	ND	0.003	0.002	0.1	0.05
Zinc	0.198	0.219	0.237	0.142	0.319	0.414	0.450	0.297	0.272	0.402	5	5
NH4 -N	32	39	42	51	36	44	39	34	41	23	50	NS

All the parameters expressed in mg/lit. Except pH and EC (mmhos)

***All the data is based on average of five determinations.**

ND – non- detectable; NS- not specified

EXPERIMENTAL

The study has been carried out during the pre – monsoon and post –monsoon periods in 2012 in a residential area situated in Srikakulam town, A.P, India. The main source of water supply in this area is by deep bore wells and local municipality. The colony residents are having their individual overhead tanks. From this community, domestic or residential establishments contribute the main waste water portion. It is mainly the spent water from kitchens, bathrooms, lavatories etc. Domestic sewage water samples were collected from 10 different residential areas of the town S1- Balaga/Krishna Park, S2 - Gujarathi peta, S3 – Purushottam Nagar Colony, S4 - Hayathi Nagar, S5 – Navabharat Colony, S6 – Visakha A colony S7-Illisupuram Colony, S8 - Peddapadu, S9 – Aadhivaram Peta and S10 – Seepannaidu peta. The samples were stored in plastic bottles. Parameters like pH, conductivity. TDS, chlorides, hardness were determined as per standard methods [3]. The concentrations of Fe, Pb, and Zn were determined with the help of atomic absorption spectrophotometer). The results obtained are compared against standards.

RESULTS AND DISCUSSIONS

The results obtained in the present investigation are provided in **Tables 1&2**

Table 2: Analysis of sewage waters collected in post monsoon period 2012

Parameter	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	Effluent discharge std.	Drinking water std.(ISI)
pH	7.15	7.42	7.30	7.75	7.02	7.72	7.35	7.59	7.28	7.23	5.5-9.0	6.5-8.5
Electrical Conductivity	1.6	1.0	1.8	0.9	2.0	1.3	1.7	1.6	2.0	1.5	-------	-------
TDS	458.2	466.8	458.3	373.4	352.4	459.5	303.5	379.4	365.7	503.9	2100	500
TSS	72	68	106	56	77	95	69	72	83	66	100	NS
Hardness	218	268	249	315	269	206	202	272	174	253	NS	300
Chloride	101.4	79.8	85.2	90.7	91.2	99.1	73.5	65.2	92.7	95.8	1000	250
DO	4.7	5.0	4.6	5.0	4.9	4.7	5.1	4.9	4.8	5.0	NS	NS
BOD	52	68	79	57	73	74	80	69	62	59	30	NS
COD	98	84	108	78	102	62	71	116	121	92	250	NS
Iron	0.012	0.052	0.002	0.002	0.008	0.021	0.005	0.005	0.008	0.031	3	0.3
Lead	0.001	ND	ND	ND	ND	0.002	0.003	ND	0.002	ND	0.1	0.05
Zinc	0.124	0.301	0.183	0.171	0.312	0.405	0.510	0.322	0.295	0.352	5	5
NH4 -N	30	49	29	62	42	37	26	40	38	21	50	NS

Colour and Odour: Domestic sewage has a slightly alkaline condition and earthy odor and a cloudy appearance. With lapse of time, due to microbial action, it darkened in colour and the smell of the sewage became more pronounced.

pH and Conductivity: The pH of domestic sewage from different Indian cities has specified by WHO standards vary from 7.0 to 7.5. In the present investigation the pH of the fresh well water samples are within the limits (**Table 1**) [4]. The conductivity of the present water samples found varied between 0.9 – 2.1mmhos. The reason of this is the contamination of the sewage effluents by ionic pollutants like NaCl etc. in some stations.

TDS and SS: The total dissolved solids (TDS) in the domestic sewage are found in the range 321.9-507.5 and 61-106 mg/L. A comparison between the two results clearly indicates that the sewage effluents are contaminated with water insoluble solids more than water-soluble, solids.. Knowledge of the classification of these solids is important, as it constitutes lad on biological treatment processes.

Chlorides, and Nitrates Chloride content of the water samples found in the range 65.2-108.6 mg/L after domestic use. The reason for the sharp increment is that the human excretions contain chlorides equal to the chlorides consumed (commonly NaCl as common salt) with food and water. This amount averages from 8gm of chloride/person/day. The nitrate - nitrogen concentration in the water samples was found out to be in the range 21-62 mg/L after domestic use (**Tables 1 & 2**). This may be due to the presence of urea [CO $(NH_2)_2$] which is the major source of nitrogen in the domestic sewage. Generally, the nitrate pick-up in the

Indian domestic sewage has been reported as 20-40mg/L [5].

Hardness:

The total hardness of the water samples was found in the range of 174 to 315mg/L. This may be due to addition of certain compounds (which may impart hardness) after domestic use of the water. This parameter also does not pose problems in the congenital water treatment process. It can be considered that the sampling was dined during pre-monsoon period, so the sewage was raw and highly concentrated.

Biochemical oxygen demand (BOD):

The BOD of the present studies are found in the range of 52 to 80 mg/L (present investigation), which is above reported value for different domestic sewage is 45-54 g/capita-day[6]. The probable reasons for this slightly higher value may be that the sampling was conducted in the pre monsoon period, so the sewage was raw and concentrated. A high BOD value may pose a great problem for the conventional water treatment processes, as it constitutes a high load.

Chemical oxygen demand (COD):

The COD of the domestic sewage comes found in the range of 71 to 139 mg/L in the present study. Generally the range of the COD for the Indian domestic sewage is about 1.6 to 1.9 times the value of BOD. In the present study, COD coming to be in the range of 1.4 to 1.7 times the value of BOD. If the ratio between COD to BOD is known, it becomes easier to assume the value of BOD of the sewage in a very short time. The ratio will vary from one waste to other and will change for the same waste as it is subjected to various treatment operations.

Heavy Metals:

A high iron (Fe) content of >2 mg/L imparts a taste to drinking water besides leaving stains on laundry and plumbing fixtures. In the present study, the Fe content in the drinking water measured is ranged between 0.001 and 0.072 mg/L, which is not very high. In the domestic sewage the iron content is < 0.006mg/L [7]. The reason of such increment can be attributed due to the fact that water being stored in the overhead iron tanks before being supplied. The maximum permissible limit of Zn in the drinking water is 5 mg/L. In the present study, the Zn as well as Pb contents lie within the prescribed limits (**Tables 1&2**).

CONCLUSIONS

The data presented in **Tables 1 & 2** indicates that the sewage becomes polluted with ionic and organic pollutants. Organic pollutants like NH_4-N and BOD show slightly higher concentration which actually implies that these parameters are generally absent in drinking water and even a slight increment would result in higher value. The movement of these ionic and organic pollutants through the soils enhances the possibility of the contamination of the underground water resources also. Therefore, it is very much needed to take necessary measures to treat and dispose the sewage properly and safely to prevent pollution.

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