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Physico-chemical analysis of sewage discharged into Varuna river at Varanasi

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ABSTRACT

The present work deals with the analysis of physicochemical characteristics of municipal waste water of city Varanasi. Most of such water of city flow directly by means of a system of independent drains in river Varuna. Four major nalas in different areas were selected for analysis of waste water quality of city Varanasi during 2008-2009. The result revealed that physico-chemical parameters of city sewage discharged showed quite high values of pH, temperature, alkanity, BOD, COD, Chloride, nitrate , phosphate, potassium, calcium. and low level of dissolved oxygen which make the degradation of water quality of river Varuna.

Key words: Varura, Physico-chemical, Sewage discharge.

INTRODUCTION

Water is the prime necessity for all living beings. The study of degradation of water quality is prime importance because it affects both aquatic and terrestrial lives. Water of Varuna river flowing through Varanasi district of Uttar Pradesh, is extensively used for drinking, bathing, toilet flushing kitchen, laundry uses, lawn watering, automobile and washing etc. municipal, agricultural and industrial purposes. The average urban consumption of water in urban areas is estimated between 100-1500 lit/person/day (Lamb, 1985). About 80% of municipal water supply is ultimately discharged to drains as waste water. The waste water carries garbage from household, industries and business establishments, and is likely to contain many potential pollutants.

Although there is no any big industry yet the city covers a large number of cottage or small scale industries which producing huge amount of garbage and waste water with no any waste water drainage system. Most of the city waste water flow to river Varuna through few small channels and four major drains. The sewage and agrochemicals settling on river beds is acted upon bacteria which help in decomposition and nutrient release. But the increased population of bacteria require heavy biological oxygen demand (BOD) and reduces the dissolved oxygen to the lethal levels for aquatic organisms like fishes etc. Although water pollution is of major concern all over the world yet only few studies have been done on physico-chemical characteristic of various river water (cf. Agrawal et al. 2000, Sastry et al.1992, Arora et al., 1973, Singh & Singh , 2007, Singh & Singh, 2006,).

In view of paucity of information the present study has been undertaken to determine the physicochemical water quality parameters of the waste water from the city drains.

MATERIAL AND METHODS

In the present study four major nalas discharging variety of domestic, agrochemical and industrial wastes into the river Varuna were

identified and analysis of sewage was done. To study the impact of chemical pollutants on the chemistry of Varuna river water, four study sites were selected along the Varuna river corridor. The first site was control site, the second and third sites were the mixing point of sewage and effluents of minor industries , and the fourth one was at the confluence point of river Varuna with river Ganga at Rajghat.

The waste water samples were collected in precleaned plastic containers of two litres capacity in triplicate in first weak of each month during 2008-2009 between 10am to 12.00 noon. Sample storage analysis were done by selecting standard and suitable methods described in APHA(1985).

RESULTS AND DISCUSSION

The average values and range of measurements of one year for each parameters are given in table-1. The colour of wastewater in each nala was almost blackish. The results revealed that the maximum (29.2°C) temperature was recorded at site III where as minimum (26°C) at control site. Over all pH value was alkaline range and was maximum (8.6) at site IV and minimum (7.7) at site I . It may be due to direct addition of municipal & small industrial wastes in it. The alkanity was maximum (515) at site III followed by site II and site IV (Table 1) Biological oxygen demand also showed the similar trend, however, dissolved oxygen showed reverse trend, because of eutrophication (Table 1). The variation in DO value at various points, was in the accordance with the variation in the quantity and quality of municipal**/** domestic wastes discharged at those points. Increased organic wastes enhance the bacterial population which put a heavy bio-chemical oxygen demand and reduce the dissolved oxygen.

The quantity of nutrients in sewage varies at different region as also supported by Singh & Pandey (1995). Sikandar (1986), Anderson (1972), have reported that BOD values also depend on amount of sewage and effluents. The river drainage and the temperature also affect BOD (Tiwari 1983). Peterson *et al*. (1973) have related the depletion of dissolved oxygen with high phosphorus inputs from agricultural and natural drainage.

Table 1: Physico- chemical analysis of sewage, discharged into Varuna river (Annual average)

Physico-chemical	Sampling site							
	Site I		Site II		Site III		Site IV	
Parameters	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Temperature (^{0}c)	16.5-35.5	26	20.7-35.8	28.2	22.2-36.2	29.2	21.8-34.2	28
PH	6.9- 8. 5	7.7	7.4-9.0	8.2	7.8-9.4	8.6	7.7-9.3	8.5
Alkanity (mg/l)	205- 395	300	382-498	440	395-635	515	368-560	464
DO (mg/l)	1.0-2.50	1.75	.60-1.2	.90	.40-.90	.65	.30-.90	.60
BOD (mg/l)	32-85	63.5	70-295	182.5	85-300	232	102-280	191
COD (mg/l)	75-750	112.5	192-465	328.5	241-562	401.5	405-780	592.2
Chloride (mg/l)	16-23	19.5	35-45	40	47-68	57.5	63-75	74
Nitrate (mg/l)	.138-.280	.209	.389-.888	.638	.598-1.820	1.209	.580-.850	.715
Phosphate (mg/l)	1.50-.315	.232	.205-.385	.295	.585-.985	.790	.208-.425	.266
Potassium(mg/l)	.162-.305	.233	.395-.882	.635	.549-1.85	1.195	.460-.793	.626
Calcium(mg/l)	.301-.590	.445	.435-988	.711	.690-1.98	1.335	.352-.788	.570

The calcium content was recorded maximum (1.335) at site III followed by site II (.711) and minimum at control site (.445) (Table 1). It was also observed that calcium content was maximum in winter followed by rains and minimum in summer month. The lower value of calcium recorded in summer month may be attributed to the comparatively higher water temperatures which facilitate the decomposing activity and its utilization by decomposing bacteria (Shashikant 1990). The amount of phosphate in drains also had higher value in site III followed to site II due to their loading of much amount of organic matter as well as detergents from house holder. Chloride contents of all drains were increased with increased pollution load. It was maximum (74) at site IV and minimum (19.5) at control site. Nitrate concentration was increased with increase in sewage and agrochemical waste and was maximum (1.209) at site III (Table- 1)

From the physico-chemical characteristics reported in present study, it is evident that major nalas of Varanasi city flowing in river Varuna carry highly degraded water. This is responsible for decline of water quality of Varuna river. To check degradation of water quality of river Varuna immediate steps are necessary to prevent discharge of raw municipal and industrial waste water without any effective treatment.

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