WATER QUALITY ASSESSMENT OF SURMA RIVER IN SYLHET CITY

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Abstract

Due to urbanization and industrialization in Sylhet City, the pollution of water in Surma River is taking place and thus affecting the water quality for its use in household and other purposes. This paper presents test results for the quality of water samples collected from four selected points of Surma River, where small canals meet with the river around Sylhet City. The water quality parameters such as pH, BOD_5, COD, TDS, Chloride and fecal coliform are reported for the period Jan'03 to Jan'04. The presence of fecal coliform makes the water unsuitable for drinking purposes. The causes of pollution and measures to be taken are discussed.

Introduction

Water pollution is an undesirable change in physical, chemical or biological characteristics of water that could harmfully affect human, animal and plant life [1]. A wide variety of physical, chemical, biological pollutants have been identified in the water as a result of urbanization, industrialization and new technological developments. In South Asian countries such as Nepal, India and Bangladesh, pollution of rivers is severe and critical near urban stretches due to huge amounts of pollution load discharged by urban activities[2].

Industrial pollution is one of the major types of water pollutions, as water is an essential raw material in almost all manufacturing plants. Industries that are considered as principal sources of pollution are chemicals, foods, pharmaceuticals, materials and energy. The increased application of commercial fertilizers and widespread use of a variety of new pesticides, insecticides, herbicides and weed killers in agricultural practices are resulting in a host of new pollution problems from land drainage. This type of agricultural pollution has severe impact on water pollution, as most of pollutants are resistant to natural degradation. Although concentrations of the pollutants are still rather low, many of these compounds are toxic to human or animal life; some of them are carcinogenic or have serious ecological implications[3,4,5,6].

Water conditioning and wastewater treatment have long been essential functions of municipalities[7]. Water quality criteria are developed on the basis of scientific information about the effects of pollutants upon a specific use of water. The criteria, therefore, are defined as the acceptable levels of concentrations of pollutants for a particular use and describe the water quality requirements for protecting aquatic life and maintaining an individual water use e.g., drinking, bathing, irrigation, industrial etc.[8]. Therefore the present study has been undertaken to assess water quality parameters such as BOD_5, COD, TDS, fecal coliform, pH and chloride to evaluate the potential risks as well as to suggest measures for the prevention of the water pollution.

Materials and Methods

During the study of the water quality of Surma river a laboratory test program was undertaken to monitor the different parameters, which were the main causes of water pollution.

Sample Collection

The most important task of water quality analysis is sampling. In order to get the information about the water quality of Surma River, grab sampling procedure is applied. Water samples were collected in plastic containers with stopper from surface and from two feet below the top of the water surface from different sampling points. Plastic containers of capacity greater than 2 liters were used for sampling, and 2 liters of each sample in each location was collected for the study. The duration of test program was one year ranging from Jan'03 to Jan'04 and its frequency was twice a month.

Sampling Locations

For this study four station points were selected where the small canals meet with the Surma River. The four station points were Kanishail, Topkhana, Kalighat and Masimpur and they were termed as S1, S2, S3 and S4 respectively. At every station, water samples were collected at two points: upstream and down stream of the river near the canals. The distances between upstream and downstream of the sampling station along the river were approximately 50 feet. The sampling points are shown in Fig-1.

Sample Analysis

Samples collected from these station points were tested for six pollution parameters to study the pollution aspects of the effluents from the associated industries and municipality's wastes and hospital wastes. The BOD_5 test was based upon determination of dissolved oxygen. Dissolved Oxygen was measured by modified iodometric method. Two or more BOD bottles were filled with sample, at least one was analyzed for dissolved oxygen immediately, and the others were incubated for 5 days at 20°C. After 5 days the amount of dissolved oxygen remaining in the incubated sample was determined and the 5-day BOD was calculated by subtraction of the 5-day results from those obtained from initial day. The fecal coliform was determined by using membrane filter method. And other parameters were measured by using the standard test procedures.

Results and Discussions

Sylhet is one of the big six cities in Bangladesh. Water pollution is possibly due to municipal waste and industrial waste, household waste, hospital waste, use of fertilizers and herbicides in agricultural practice. In this study water samples from various points of river Surma were collected for the physical, chemical and biological tests to determine the water quality and the degree of pollution. The test results are shown in Fig.2 for BOD_5, Fig.3 for COD, and Fig.4 for Pathogen (Fecal Coliform) and Table-1 provides all the other parameters: pH, TDS and Chloride during the time of monsoon (August) and dry season (January).

From Fig.2 it is shown that the BOD_5 values were varied at four station points as follows

- Kanishal 2.8 - 4.2 mg/l
- Topkhana 2.1 - 3.9 mg/l
- Kalighat 2.2 - 3.6
- Masimpur 2.6 – 5 mg/l.

According to Bangladesh standards the permissible limit of BOD_5 of inland surface water is 2 mg/l, 3 mg/l and 6 mg/l for drinking, recreational and fishing purposes respectively[5]. So the water of the Surma is satisfactory for fishing purposes, but at some location not suitable for drinking and recreational purposes.

Fig.3 represents the COD values of different station points from January '03 to January '04. The COD values at Kanishal 6.45 – 8.18 mg/l, Topkhana 4-8.7 mg/l, Kalighat 4.3 – 7.3 mg/l and Masimpur 4-9.5 mg/l respectively. It was found that the COD values were greater than the BOD_5 values of the river water for the same station point. During the determination of COD, organic matter was converted to carbon dioxide and water regardless of biological assimilability of the substances. As a result COD values were greater than BOD_5 values and might be much greater when significant amounts of biologically resistant organic matters are present[6]. The river water in the monsoon was considered enough to dilute the polluting loads discharged into the water for natural degradation but in the winter season the dilution factor and the reoxygenation characteristics were reduced tremendously.

The test results in Fig.4 show that the maximum value of pathogen is 35N/100mL and minimum value of 7N/100mL, where N is the number of fecal coliform. According to Bangladesh standard the drinking water shall be pathogen (fecal coliform) free. So, with respect to Fecal Coliform the water of river Surma is not suitable for drinking purpose.

The other water quality parameters such as pH, TDS and Chloride are given in Table-1 for the months Aug'03 (monsoon) and Jan'04 (dry season). Table-2 provides a comparison of these measured water quality parameters with the WHO and Bangladesh Standards for drinking water[9,10]. The Surma River is not suitable for drinking purposes due to presence of pathogen (Fecal Coliform). The test results of BOD_5 are higher (2-5) than the Bangladesh Standard and WHO Standard for drinking purposes. Further more water is slightly acidic (pH5.5-6.4) during the monsoon season (Aug'03), Table-1.

The main causes of the pollution of Surma River are due to the discharge of wastewater from different small canals. As mentioned earlier the water samples were collected from the four points where the small canals meet with the river. The canals carry wastewater from the small-scale industries, rice husks from rice mills and foodstuffs. The municipal and hospital wastes are also dumped near the riverside.

Proper management of solid waste from small-scale industries and municipal waste by land filling or incineration can reduce the water pollution. The medical waste from hospitals and private clinics are to be disposed in a proper way. The liquid wastes from the small-scale industries must be treated before discharging it into the river. All these measures can contribute towards maintaining the quality of Surma River water.

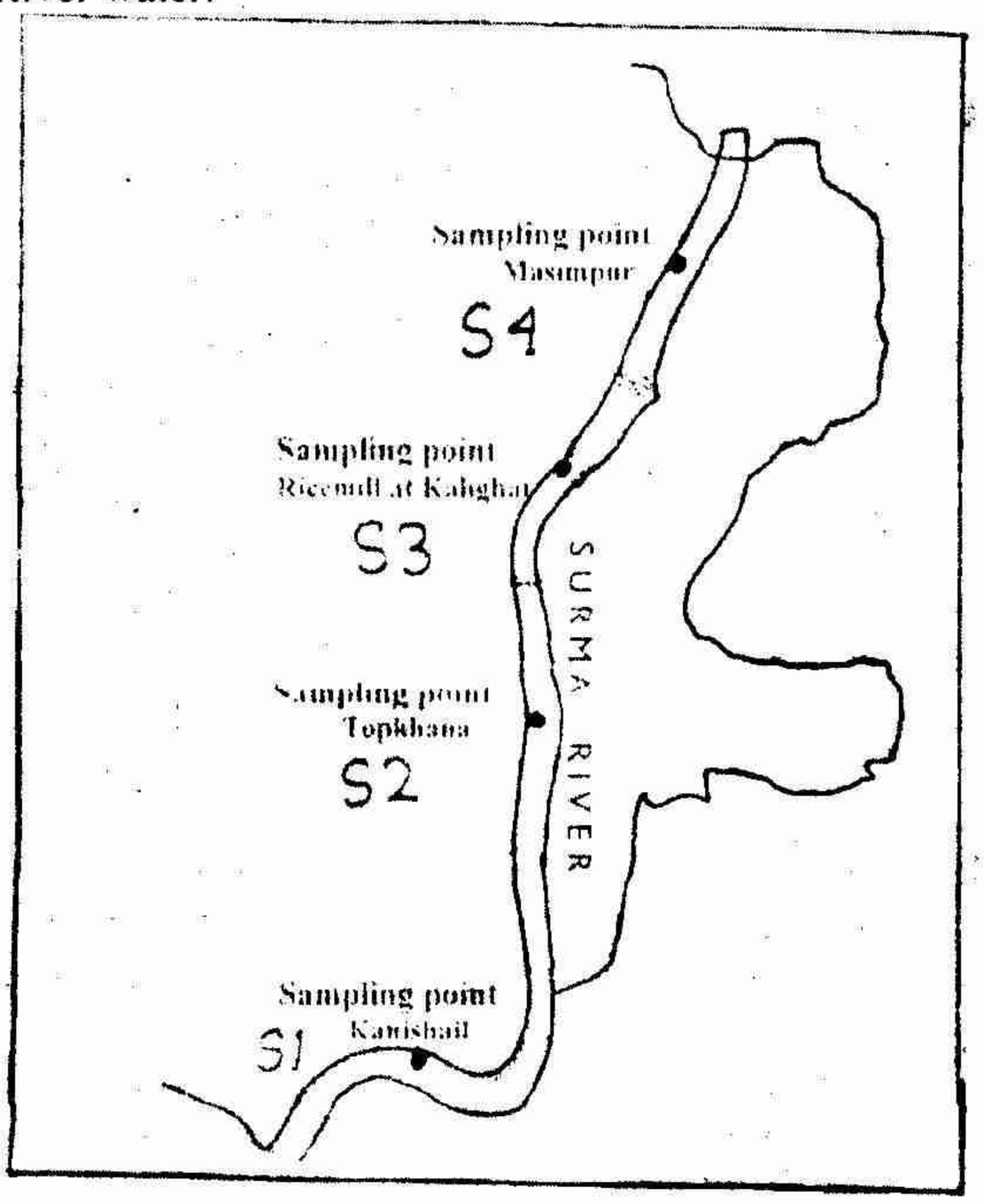

Fig.1: Sampling points

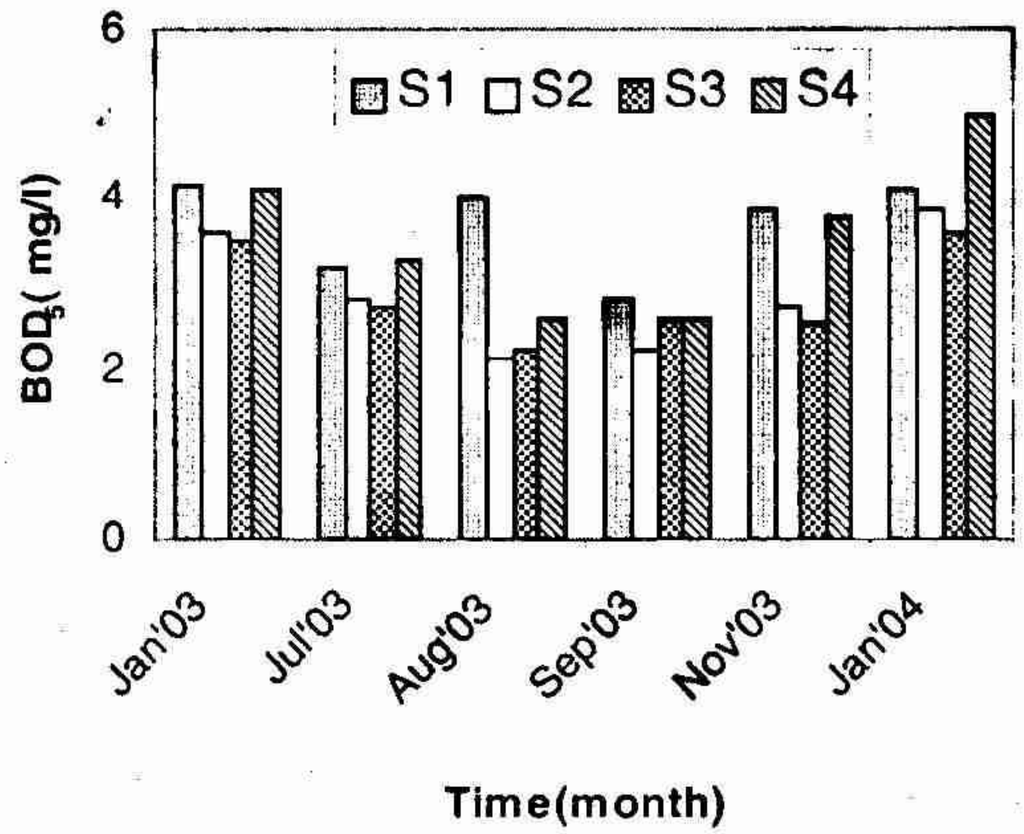

Fig.2: Variation of BOD_5 at different locations and time

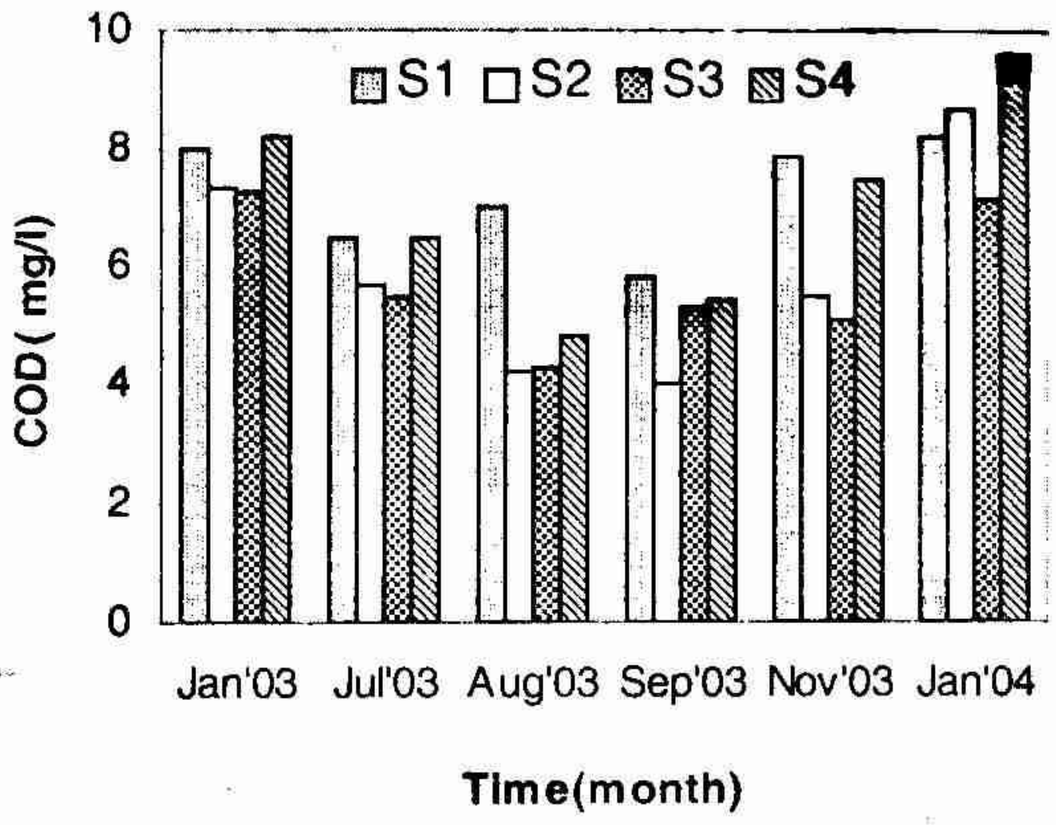

Fig.3: Variation of COD at different locations and time

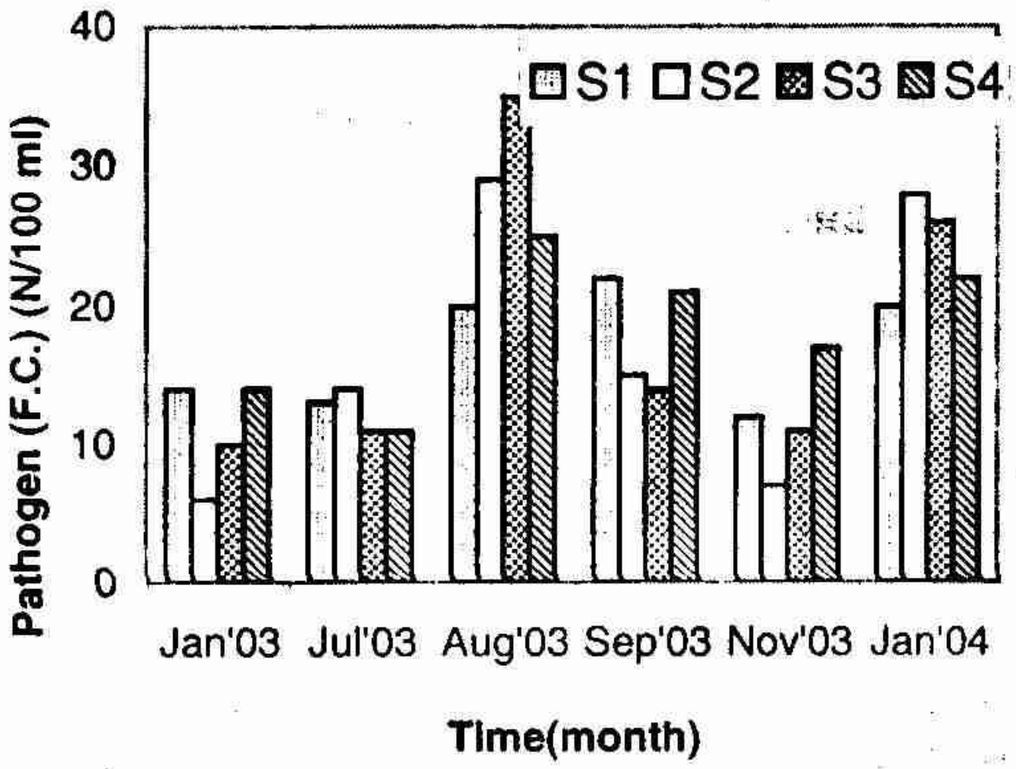

Fig.4: Variation of pathogen (fecal coliform) at different locations and time

Table-1 Test results of different pollution parameters of Surma River water

Sampling Point	pH		TDS (mg/1)		Chloride (mg/1)	
	Aug '03	Jan '04	Aug '03	Jan '04	Aug '03	Jan '04
Kanishal	6.40	6.69	88	130	21	14
Topkhana	6.20	6.01	83	112	33	22
Kalighat	6.12	6.79	82	100	11	22
Masimpur	5.50	6.15	91	140	5.89	18.5

Table-2: Comparison of water quality parameters of Surma River with the WHO standard for drinking water

Water quality parameter	Test results of Surma river water	WHO Standard[10]	Bangladesh Standard[5]
pH	5.5-6.8	6.5-8.5	6.4-7.4
TDS (mg/l)	82-140	500	1000
Chloride, Cl (mg/l)	6-33	250	250
Fecal coliform, N/100 ml	7-35	0	0
BOD_5, (mg/l)	2-5	0.3	0.2

Conclusion:

This paper has described the test results for the amount of pollutants in the water samples taken from different locations of Surma River. Fecal coliform is present in a considerable number, which indicates the pathogenic pollution. The pollution of river water can be attributed to the lack of management of the municipal, medical and industrial wastes in Sylhet city. However, the Surma River water can be used as an alternative source of water supply instead of ground water for Sylhet city if it is ensured that some degree of treatment should be provided.

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