STUDY OF WATER POLLUTION AROUND SYLHET CITY

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Abstract Water is one of the basic needs of human being. Human beings needs it for drinking, bathing and use it for other household chores. Water is also required for the industrial and commercial operations. Due to urbanization and industrialization, pollution of water resources is taking place in different places of Sylhet City and thus affecting the environment. The purpose of the paper is to analyze the quality of water collected from different places in and around Sylhet City and to find out the current status of water pollution. The investigation is carried out to observe the water pollution parameter such as Biochemical Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen, and pH, Total Dissolved Solids, Total Suspended Solids. Finally suggestions for the treatment of wastewater have been described.

Keywords: Biochemical oxygen demand (BOD) pollution and Chemical oxygen demand (COD).

INTRODUCTION

Pollution is an undesirable change in physical, chemical or biological characteristics of water, air that may or will harmfully effect human, animal and plant life. (Kapoor S.B., 1997) Pollution can be natural caused by hydrological processes also in which the decomposed animal and vegetable materials and weathering products of rocks, minerals and soil ingredients are brought into the main water resources. Al these processes lead to degradation of the natural environment. The important role that environmental and public health engineers have played in providing us with pure and adequate water supplies, facilities for waste water and refuse disposal, safe recreational areas and healthy environment with in our homes and places of employment is not generally appreciated by the public at large. Man has made his environment polluted through urbanization and Industrialization. Increased production of goods and newer exotic industries have greatly increased the amount and type of Industrial wastes. The increased application of commercial fertilizers and the widespread use of a variety of new pesticides are resulting in a host of new pollution problems from land drainage. No wonder the sweet water fish population has been reduced dramatically. 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.

Water conditioning and wastewater treatment have long been essential functions of municipalities.

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However, the importance of suitably preparing water for the chemical industry is now fully recognized Moral and community considerations, laws prohibiting and limiting the pollution of streams and air require these problems to be considered as a necessary operating expense. Although the solution is specific with each industry, a few general principles may be observed: increasing reuse of wastewater, control of pollution and, if feasible, recovery of by-products at their source to lessen the expense of treatment, and lagooning of wastes to keep pollution at a minimum level or to effect a saving in neutralization costs [Austin G.T.,1994]. It is therefore necessary to evaluate the potential risks to more and the environment of these chemicals, and develop skill and master scientific methodology for the prevention of the pollution.

WATER POLLUTANTS & THEIR SOURCES

The wide range of Pollutants discharged to surface waters can be grouped into point sources and non-point sources. Domestic sewage & industrial wastes are called point sources and urban and agricultural runoff is called non-point sources (Davis,M.L. et al,1998) .

Natural pollution
This type of pollution is either accidental or occasional. Aerial contaminants, like gases and dusts get transferred to a body of water in the form of rainfall, soil silt stripped from the land by heavy rainfall or melting snow or as soluble salts, leached from the earth by surface streams.

Agricultural pollution

Use of fertilizers, insecticides, herbicides and weed killers in agricultural practices, poses serious pollution problems as most of them are resistant to natural degradation.

Mining pollution
Fines or tailing from ore washing are disposed off in water suspensions, which are ultimately transferred to the natural streams and which thus gets polluted. An outstanding example of this stream pollution is the acid drainage from coalmines.

Municipal pollution
Municipal wastes, mainly domestic sewage includes the discharges from toilets, wash rooms, kitchens and similar areas in dwellings, institutions and commercial and industrial buildings. Its principal pollutional characteristics are pathogenic bacteria, suspended solids and oxygen consuming organic matter.

Industrial pollution
Water is an essential raw material in almost all manufacturing plants, though only a small part of it may appear in the fine product. The remainder becomes a waste material contaminant, to a smaller or large degree depending on its usage in the plants. After entering the natural water resources it contaminants them. Industries, which are considered the principal sources of pollution, may be classified as apparel food and drugs, chemicals, materials and energy.

CONSEQUENCES OF WATER POLLUTION

Only 1% of the quantity of water on earth is available as sweet water to man. The consumption of water by man is increasing and we are faced with an ever-increasing demand for potable water. A wide variety of pollutants physical, chemical, biological and radiological have been identified in the environment consequent to urbanization, industrialization and new technological developments. Toxic organic compounds are pesticides used to kill insects, rodents and weeds. These substances are sprayed on foams and accumulate with repeated applications. The widely used synthetic detergents are difficult and expensive to remove from wastewater and they are toxic and produce foam. Furthermore with increased industrialization there has been a growing use of radioisotopes, which results in the discharge of radioactive wastes in the watercourses.

PROPERTIES OF POLLUTED WATER

The physical and chemical properties of water can easily be estimated by standard methods and are self-explanatory. Some important water quality characteristics are explained as follows:

Biochemical oxygen demand (BOD)

BOD is the amount of oxygen required for the biochemical degradation of organic material and the oxygen used to oxidize inorganic material such as sulfides and ferrous iron compounds and the test period is 5 days at 20C. Almost all-oxidizable compounds can be oxidized, by biochemical oxidation. Usually BOD is expressed in milligrams per litre. The BOD test may be considered as a wet oxidation procedure in which the living organisms serve as the medium for oxidation of the organic matter to carbon dioxide and water. (APHS,1995).

Chemical oxygen demand (COD)
The chemical oxygen demand (COD) test is widely used as a means of measuring the pollutional strength of domestic and industrial wastes. This test allows measurement of a waste in terms of the total quantity of oxygen required for oxidation to carbon dioxide and water. During the determination of COD test, organic matter is converted to carbon dioxide and water regardless of the biological assimilabilty of the substances. One of the main limitations of the COD test is its inability to differentiate between biologically oxidizable and biologically inert organic matter. The major advantage of the COD test is the short time required for determination. The test is done in about 3 hours rather than the 5 days needed for BOD measurement (Azad,1976).

Dissolved oxygen (DO)
Dissolved oxygen is required for the respiration of aerobic microorganism. Determination of dissolved oxygen serve as the basis of the BOD test; thus they are the foundation of the most important determination used to evaluate the pollutional strength of domestic and industrial wastes.

PH
pH is a term used rather undesirably to express the intensity of the acid or alkaline condition of water. It is a way of expressing the hydrogen-ion concentration or more precisely the hydrogen ion activity. pH must be controlled within a range favorable to the particular organisms involved

Total dissolved solids (TDS)
Total Dissolved solids also referred to as total filterable residue in natural waters consists mainly of carbonates, bicarbonates, chloride, sulfate, calcium, magnesium, dissolved metals and dissolved residue in water.

Total suspended solids (TSS)
The portion of the total solids retained by a filter i.e. the undissolved substances are usually refereed to as suspended solids.

Turbidity
The term turbid is applied to waters containing suspended matter that interferes with the passage of

light through the water or in which visual depth is restricted. The turbidity may be caused by a wide variety of suspended materials, which range in size from colloidal to coarse dispersions, depending upon the degree of turbulence. Water may contain toxic substances in solution. Some toxic substances are Arsenic, Barium, Cadmium, Chromium, Cyanides, Lead, Mercury, Selenium and silver.

MATERIAL AND METHOD

Due to urbanization and industrialization, water is becoming polluted in the Sylhet City. Six station points were selected around Sylhet City for collecting the wastewater and monitoring the water pollution parameters. Station point 1 is in the Shahjalal University Campus. The nature of the environmental pollution is both organic and inorganic. The liquid waste comprising of wastewater, organic particles which is comprised of household used water and sanitary sewage. Shurma River is around 2 miles away from sust campus. Station point 2 is selected in the Shurma River. The effluents of waste products from the Sylhet Pulp and Paper Mills are discharged on the adjacent Shurma River. Station point 3 is selected near Sylhet Osmani Medical college Hospital. Station point 4 is in the Kushiara River adjacent to the Fenchugang industrial area. Station point 5 is selected in the Upshahar area where some food processing industries are situated. Station point 6 is in the Akhalia. Samples collected from these station points were tested for six pollution parameters to study the pollution aspect of the effluent from the associated industries and municipality's wastes and household wastes. These parameters are pH, total suspended solid, and total dissolved solids, BOD, dissolved oxygen and COD (chemical oxygen demand). DO was measured by Winkler or modified iodometric method. The BOD test is based upon determinations of dissolved oxygen. Two or more BOD bottles are filled with sample; at least one is analyzed for dissolved oxygen immediately, and the others are incubated for 5 days at 20^0C. After 5 days, the amount of dissolved oxygen remaining in the incubated samples is determined, and the 5-day BOD is calculated by subtraction of the 5-day results from those obtained on day 0.

RESULTS AND DISCUSSIONS

The test shows that water is polluted in and around Sylhet City due to municipal waste and industrial waste, household waste, Use of fertilizers, herbicides, insecticides and weed killers in agricultural practices. Some of the major industries responsible for water pollution in Bangladesh are leather (Tanneries) Textiles (including dyeing and printing), Pulp & paper, Sugar and distillery, Fertilizer. Besides these, chemical, pharmaceuticals, pesticides, food processing, electroplating and galvanizing, industries are

responsible for water pollution. Samples of polluted water were collected in the winter and rainy season. The average data of the polluted water of different places of Sylhet City are given in the following table.

Table: Some water pollution parameter of different places around Sylhet city.

Station point	pH	TSS mg/l	TDS mg/l	DO mg/l
1	6.47	35	89.8	2.6
2	7.1	39	61.4	3.9
3	6.9	29	74.5	4
4	6.8	22	69.2	4.2
5	5.8	58	190.6	1.8
6	6.55	18.6	67.5	5.6

The table shows some water quality parameter of water in and around Sylhet City. The table shows that the pH level varied from 5.8 to 7.1 which is within the desirable range of drinking, fishing, industrial, irrigation and livestock water The variation of TSS is from 18.6 to 58 mg/l, which exceeded drinking water standard and fishing standard, but within the industrial water standard. From the analysis of the samples it is shown that the water are becoming polluted because of industrial and domestic pollutants. Most of the industries have no treatment plant so their wastes are discharged to the river in untreated form.
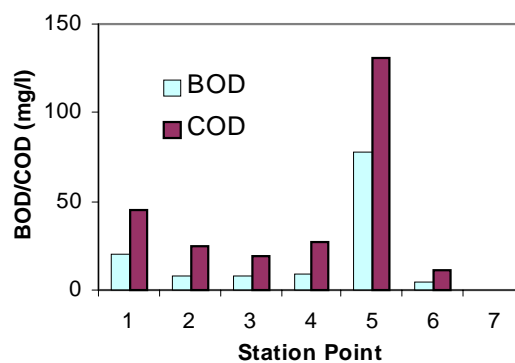

Fig 1: Variation of BOD/COD of different station points.

The graph shows the variation of BOD/COD of different places of Sylhet City. From the above figure it has been shown that the COD values are greater than the BOD values of the wastewater for the same station point. During the determination of COD, organic matter is converted to carbon dioxide and water regardless of the biological assimilability of the substances. As a result, COD values are greater than BOD values and may be much greater when significant amounts of biologically resistant organic matter is present (Sawyer, C. L. et al, 1994). The river water available in monsoon is considered enough to dilute the polluting loads

discharged in water for natural degradation but in the winter season the dilution factor and the reoxygenation characteristics are reduced tremendously. From the analysis it has been observed that the range of BOD and COD of the samples are beyond the drinking and fishing, industrial irrigation water levels. In terms of the water quality parameters that have been considered in this work, the overall ambient water quality in all the river is not good and sample collected from Station point 5 is the most polluted water. Wastes coming from the food processing industry are composed of both organic and inorganic material in high quantity, so the BOD and COD values are high.

CONCLUSIONS

The paper has described the amount of pollutants coming out due municipal waste and industrialization in the Sylhet City by testing the samples taken from different areas. Thus pointing out the rivers into which those pollutants fell. The pollution load in the water is found to be increasing. To avoid the worst condition from the water pollution it is necessary to control pollution. There are two options for the wastewater problem 1.to shift all the industries to a new industrial site and there should have facilities for collection, treatment, storage and disposal of liquid and solid wastes 2. To provide a common central waste water treatment plant for all the industries. Neutralization, ion exchange filtration, sedimentation, adsorption, emulsion breaking are the processes, can be used to control water pollution.

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