

QUALITY ASSESSMENT OF INDUSTRIAL EFFLUENT IN CHITTAGONG INDUSTRIAL AREA, BANGLADESH

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ABSTRACT

Chittagong is the largest city of Bangladesh based on commerce and industries. Fish processing, detergent, dyeing & washing, Textile & pharmaceuticals, etc is now the most important and rapidly developing industrial sectors in Bangladesh. It has a high importance in terms of its environmental impact, since it produces large amounts of effluent. A major environmental problem of these industries is the discharge of untreated effluent to the environment, causing pollution of nearby soil and water. The aim of the present study is to determine the Physicochemical & Biological properties of waste water of some industries of Chittagong & to investigate their effects on natural environment. 5 (Five) waste water samples were collected from different types of industries (Fish Processing, detergent, dyeing, washing & pharmaceuticals) at two locations Sagorika & Fozdarhat industrial area under Chittagong and 13 water quality parameters were analyzed: Temperature (°C), Color, Turbidity, TDS, EC, pH, Iron (Fe), Total Hardness, Chloride (Cl⁻), Alkalinity, BOD, COD & DO. Among the 5 types of industries low pH (5.80) was found in the sample of Glaxco pharmaceuticals and low DO (0.0ppm) value was found in the waste water sample of SAR & Co fish processing, Glaxco pharmaceuticals, Unilever detergent & Reliance dyeing & washing. Although SAR & Co fish processing, Glaxco pharmaceuticals, Unilever detergent are using the ETP but it may not be 100% effective to treat the discharging wastewater. Maximum value of Color (275 TCU), pH (5.7), EC (3464 µS/cm), TDS (3260ppm), Turbidity (33.46 NTU), DO (0.0ppm), & BOD (144 ppm) were found in Reliance dyeing & washing industry which do not satisfy the Bangladesh national water quality standard. It has found that water quality parameters of those industries which are discharging effluent by using ETP are almost in acceptable range as per BECR 1997. So it is recommended that to sustain the safe ecological environment, industrial effluent should be treated before discharging on open land & water body.

Keywords: Industrial effluent; industrial area; discharge; water quality; effluent treatment plant

INTRODUCTION

Chittagong is the largest Bay of Bengal port city of Bangladesh based on commerce and industries. According to population census 2001, Chittagong City Corporation has 1.99 million populations. This growth rates represent on average 40,000 people a year being added by natural increase over the twenty year period 1991 to 2011 (MAPS [2011]). Being the country's major seaport much of Bangladesh's export and import passes through the port of Chittagong. The main industrial locations of Chittagong are concentrated in Kalurghat, Nasirabad, Sholashahar, Patenga, Kaptai, Bhatary, Barabkunda and Fozdarhat. The major types of industry include jute, pulp and paper, textiles, fertilizers, rubber and plastic, leather, food and beverages, sugar, cement, pharmaceuticals, tobacco, iron and steels, distilleries etc. Of these, the main polluting industries are tanneries, pulp and paper, fertilizer, distilleries, iron and steel, sugar and chemicals (Hashemi, Reza et al. [2011, 2010]).

The environment of Chittagong is being polluted because of growth of industries has been unplanned and most industrial units have no adequate facilities for treatment of wastes produced. So the industries discharge their liquid, semi-solid and solid, toxic gaseous, degradable and non-degradable substances in water, air and land. The highly toxic effluents discharged in nature or contaminated water, air and land and affect organisms and ultimately human health. It reduces economic

productivity and amenities. A majority of the industries are located near the banks of water bodies discharged by the industries (URL, Reza et al. [2011]).

METHODOLOGY

Site selection & sample collection

During the study period (January to July, 2015) a total of 5 samples were randomly collected from 5 different industries of Chittagong Metropolitan City as shown in location Fig. Sample numbers and sampling locations were selected based on the density of industry. Sampling points & number of collected samples is summarized in table. Sample is collected in a plastic bottle. The plastic bottle was first washed thoroughly using detergent and dried. Before taking wastewater sample the bottle were ringed with water. After taking the sample, the bottle labeled by mentioning the name and location of the sample site. The sample was transferred to the laboratory for analysis with minimal and acceptable changes & standard method.

RESULTS AND DISCUSSIONS

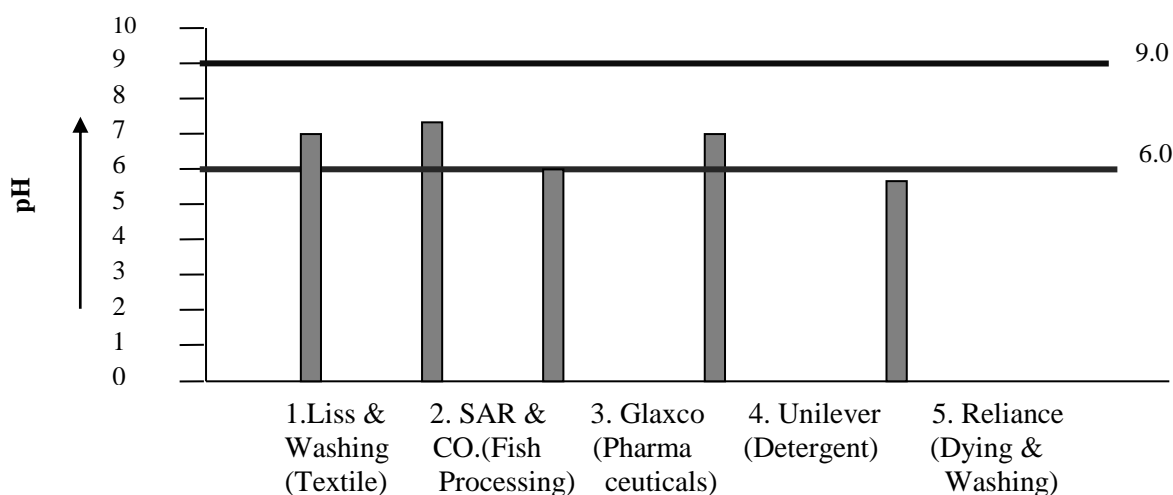


Fig. 1: Variation in pH range of “industrial waste water” in Chittagong

pH is a measure of whether a liquid is acid or alkaline. Lower pH water is likely to be corrosive. pH values of the water samples were determined directly by a digital pH meter. pH varied from acidic to alkaline where the maximum value 7.30 at SAR & Co Fish processing industries and minimum value 5.70 at Reliance dying Industries. Two industry pH are lower than the DoE standard which indicates the effluent is acidic & harmful

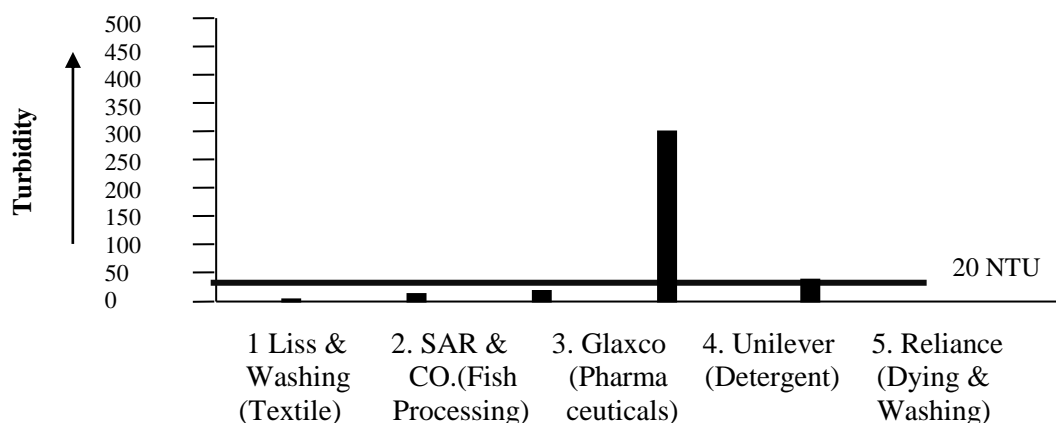


Fig. 2: Variation in Turbidity range of “Industrial Waste Water” in Chittagong

Turbidity or cloudiness in water is due to very small solid particles which tend to float because of their low weight. Turbidity of collected water sample measured by Electric Turbidity Meter. The maximum turbidity 33.46 NTU was found in a water sample collected from Reliance dyeing Industries & minimum 0.85 NTU found at Liss washing. Out of 5 Industries, 2 Industries effluent range exceed the national standard quality range 20 NTU.

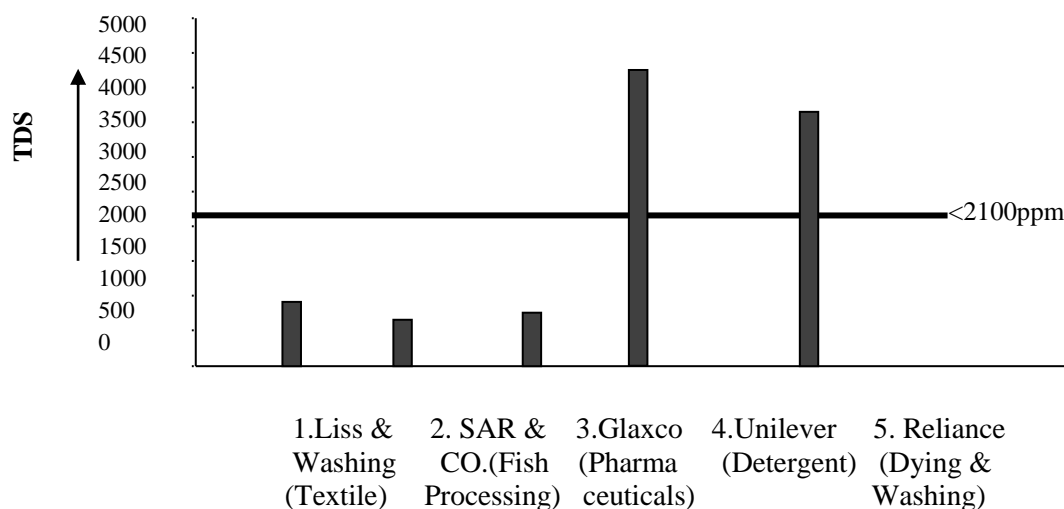


Fig. 3: Variation in TDS range of “Industrial Waste Water” in Chittagong

Total dissolved solids were measured within 5-10 minutes after collection of sample at the sampling site by TDS meter/combo meter. The maximum concentration of TDS was 4200 ppm at Unilever and minimum 680 ppm at SAR & Co. From 5 industries only 2 industries effluent exceed the national standards 2100 ppm as shown in fig. TDS effluent mainly consists of ammonia, nitrite, phosphate, calcium, some acids, metallic ions etc.

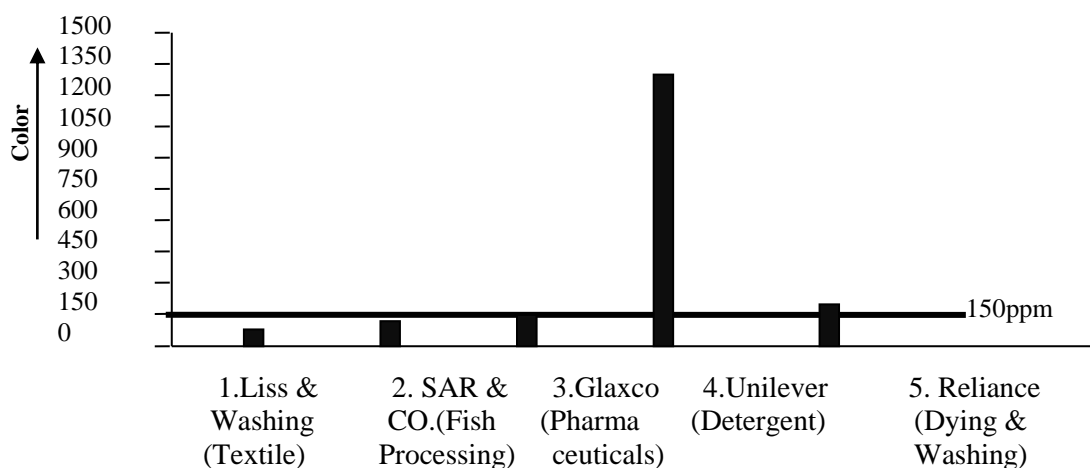


Fig. 4: Variation in Color range of “Industrial Waste Water” in Chittagong

Color concentration of water samples were determined by Platinum Cobalt method. Color concentration values in collected water samples were 47 TCU, 53 TCU, 146 TCU, 229 TCU and 275 TCU found in 5 Industries respectively. Unilever & Reliance dyeing industries effluent concentration value exceed the national standard value 150 TCU.

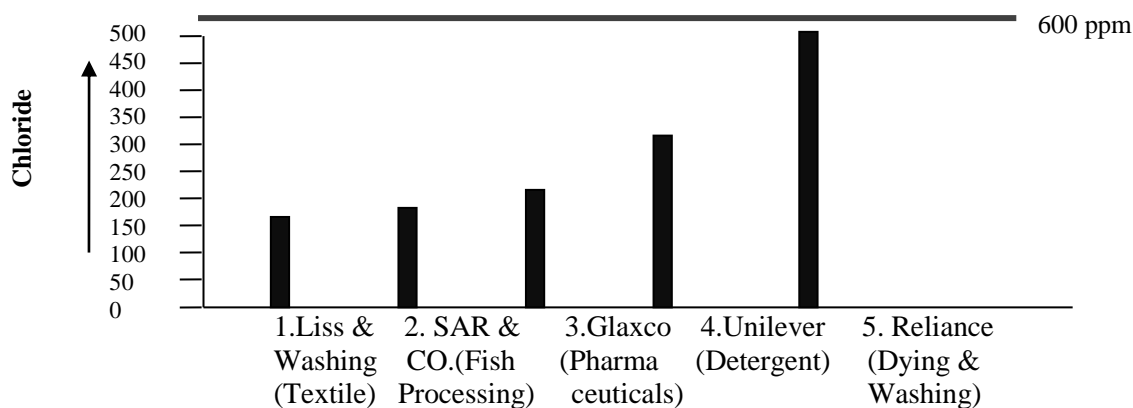


Fig. 5: Variation in Chloride range of “Industrial Waste Water” in Chittagong

Chloride concentration of water samples were determined by titration method. Chloride concentration values in collected water samples were 155 ppm, 180 ppm, 240 ppm, 332 ppm and 560 ppm found in 5 industries respectively. The effluent quality range with in national standard value is 600 ppm.

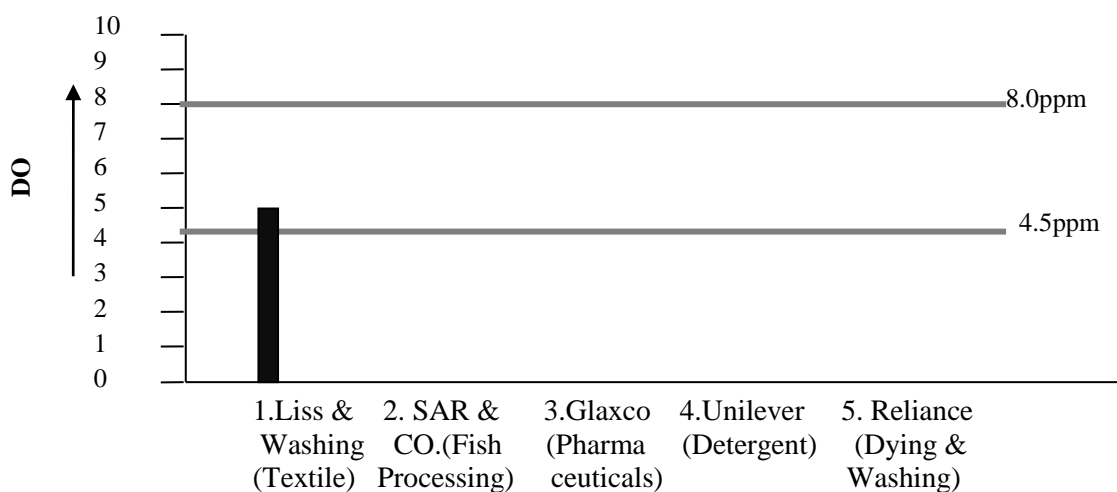


Fig. 6: Variation in DO range of “Industrial Waste Water” in Chittagong

DO is denoted as dissolved oxygen & measured by DO meter at the laboratory after four hours of collection of water sample from the sampling site. DO indicates the health of water. The maximum DO is 5.0 ppm found Liss washing effluent and minimum is 0.0 ppm found Other 4 Industry . So this 4 industries effluent concentration range are not satisfy the National standard (4.5 ppm - 8ppm) value of DoE . The lower value of DO may be due to the use of various organic chemicals in industry which is dangerous for aquatic life.

The chemical oxygen demand test (COD) is commonly used to indirect measure of the amount of organic compounds in water. It is useful to assess strength of waste which contains biologically resistance organic substances. The maximum values is found 436 ppm at Reliance Industries & minimum value is found 190 ppm at SAR & CO. The COD value of 5 industries water sample satisfy the Bangladesh national water quality standard.

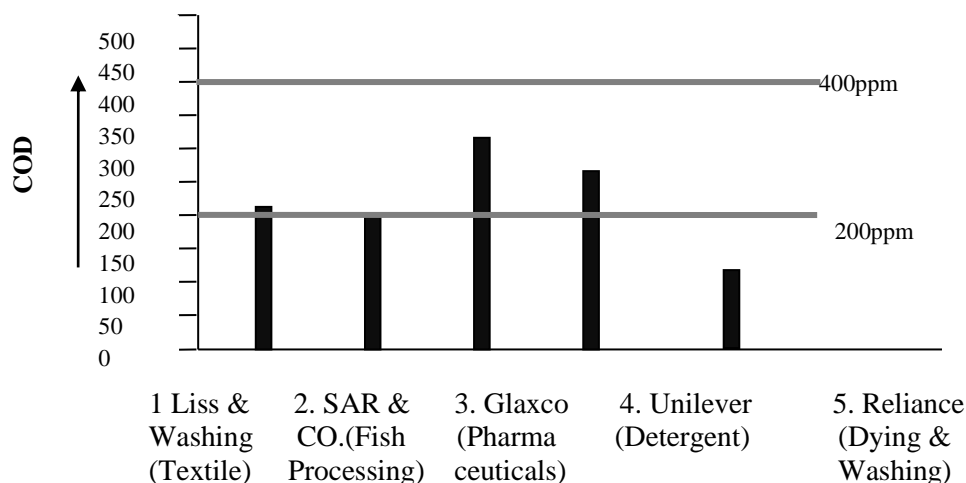


Fig. 7: Variation in COD range of "Industrial Waste Water" in Chittagong

Table 2: Summary of Test Result

Sl no	Parameter	Textile	Fish processing	Pharmaceuticals	Detergent	Dying & Washing
		1.Liss Washing	2. SAR & CO	3. Glaxco	4. Unilever	5.Reliance
01	Temperature °C	26	27	28.5	29.0	27.0
02	pH	7.10	7.30	5.80	6.80	5.7
03	EC (µS/cm)	1270	910	700	910	3464
04	TDS (mg/l)	930	680	690	4200	3260
05	Alkalinity (mg/l)	188	130	350	1375	178
06	Hardness (mg/l)	228	146	120	312.5	240
07	Turbidity (NTU)	0.85	5.11	12.85	238.8	33.46
08	Color (TCU)	47	53	146	1224	275
09	DO (mg/l)	5.0	0.0	0.0	0.0	0.0
10	BOD (mg/l)	90.0	58.0	132	228	144
11	Chloride (mg/l)	155	180	240	332	560
12	COD(mg/l)	228	190	320	256	436
13	Iron (mg/l)	0.01	0.05	0.01	0.21	0.01

CONCLUSIONS

This study was conducted by collecting waste water of different industries of Chittagong to assess the different physical, chemical & biological characteristics. For these purposes, samples were collected from 5 different types of industries (textile, food processing, pharmaceuticals, detergent, Dying & Washing) at two different locations (Sagorika & Hathazari I/A).

1. Among the 5 types of industries, low pH (5.80) was found in the sample of Glaxco pharmaceuticals and low DO (0.0ppm) value was found in the waste water sample of SAR & Co fish processing, Glaxco pharmaceuticals, Unilever detergent & Reliance dying & washing.

2. Although SAR & Co fish processing, Glaxco pharmaceuticals, Unilever detergent are using the ETP but it may not be 100% effective to treat the discharging waste water.

3. On the other hand Reliance dyeing & washing industry have no ETP & maximum value of Color (275 TCU), pH (5.7), EC (3464 $\mu\text{S}/\text{cm}$), TDS (3260ppm), Turbidity (33.46 NTU), DO (0.0ppm) & COD (436ppm) were found which does not satisfy the Bangladesh national water quality standard.

4. Out of 13 parameters, maximum parameters except EC & DO of Liss & washing textile, SAR & Co fish processing, Glaxco pharmaceuticals, Unilever detergent industries are within satisfactory level.

So it is evident from the study that waste water quality of the industries which have ETP is comparatively better than other industries.

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