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Case Study On Effluent Treatment Plant Of Acs Textiles (Bangladesh) Limited

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Abstract– The liquid effluents from textile industries are causing a major havoc to the environment, ecology, agriculture, aquaculture and public health as it discharged to the nearby water streams in the country. So, it is time to give a pause to the pollution and phase it out gradually to protect the surface water body specially rivers. It had become a prerequisite to set up ETP in each industrial establishment, particularly at dyeing industries that were discharging huge amount of liquid waste to the rivers every day. Since the highest number of factories is of textile category and these types of factories play a major role in polluting the nature, Government's main focus is on the textile mills and industries related to textile. But, for the successful implementation of ETPs, industry owners will have to be socially responsible and at the same time, government should provide the factory owners with logistic supports and relaxed timeframe to set up ETPs. This case study aims at observing and assessing current wastewater treatment process of ACS Textiles (Bangladesh) Ltd. Situated at Tarabo, Rupganj, Narayanganj. Though the medium and small scaled industries have a positive impact on the economy of Bangladesh, the increasing industrialization is highly contributing severe pollution to the environment by the toxic waste discharge.

Key Words: *Wastewater from textile industries, ETP, Effluent Charecterstics*

1. Introduction

As known, Bangladesh is a small developing country with a large number of increasing population. Industrialization is an inevitable feature of economic intensification in a developing country. In the way of employment-intensive industrialization, textile industries are playing an

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utmost important role offering tremendous opportunities for the economy of Bangladesh. But, rapid and unplanned clustered growth of industries leads to adverse environmental consequence in an alarming way. Large quantity of water associated with the production of a number of dyeing and textile industries, releases toxic wastewater rich in dye and chemicals to the environment that result in severe water-body pollution. These untreated industrial effluents not only deteriorate surface water quality, ground water, soil, vegetation, but also cause many water borne diseases that are threatening to public health. In developing countries like Bangladesh, where less attention is paid to environmental protection, environ- mental regulations are not effectively implemented and pollution control techniques are not yet fully developed. As, except the visited one a large number of factories are operating without the ETPs, violating the existing laws, it has be- come a challenge for Government and private sector to work together to promote ETP installation with clear understanding the gravity of the problem and to take necessary steps by giving proper attention to all aspects.

Water pollution due to discharge of untreated industrial effluent into water bodies is an alarming environmental crisis of Bangladesh. Most industries do not have effluent treatment facilities and few industries which have these facilities are either not properly designed or operated and monitored regularly. The Environmental Conservation Act 1995 (ECA) provides that all relevant industrial units will install Effluent Treatment Plant (ETP) to treat their waste water to achieve certain standard before releasing it into receiving environment. DOE is mandated to enforce this provision of law.[3]

2. Water Consumption in Textile Processing

The production of textile goods involves spinning (fibre to yarn), weaving / knitting (yarn to fabric), chemical (wet) processing, and garment manufacturing. The majority of the water consumption (72%) takes place in the chemical (wet) processing of textiles. The water is required for preparing the fabric for dyeing, printing and finishing operations, intermediate washing / rinsing operations and machine cleaning. Other major uses of water in the textile industry, as shown in Figure 2-1, are:

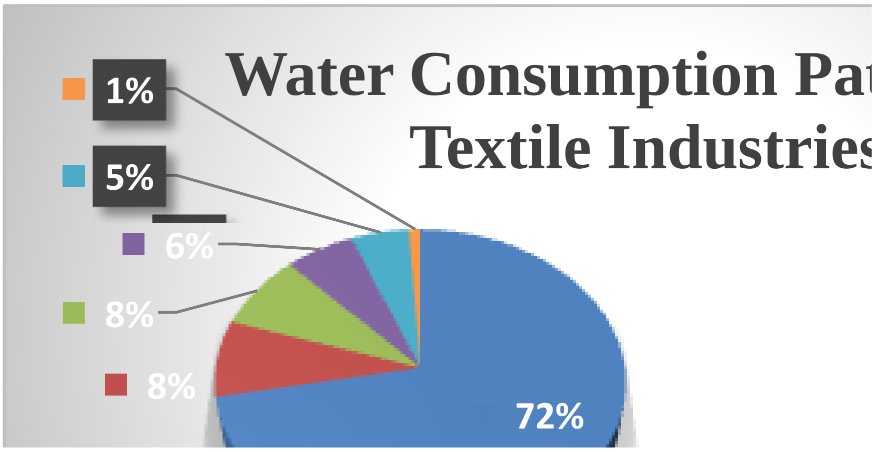

Figure 2-1: Water Consumption Pattern in Textile Industries

- Steam generation (boiler feed water);
- Water treatment plant (reject stream, periodic cleaning of reverse osmosis plant, regeneration and washing of demineralization, softener plant, back wash of media filters);
- Cooling (processing machines, cooling tower);
- Humidification (spinning process); and
- Domestic purposes ((irrigation of lawn and garden, sanitation, cleaning, drinking and miscellaneous uses).

Water consumption is dependent on the type of machines employed, the complexity of processing sequences, the type of dyes used and fabric processed. Many machines require a fixed volume of water regardless of the fabric load. The specific water consumption for cellulosic fabric processing ranges from 100 to 120 liters/kg of fabric processed, whereas for synthetic fiber, yarn and fabric it ranges between 25 to 70 liters / kg of the product processed [4]. Figure 2-2 shows the water consumption of the individual components of the wet processing stage.

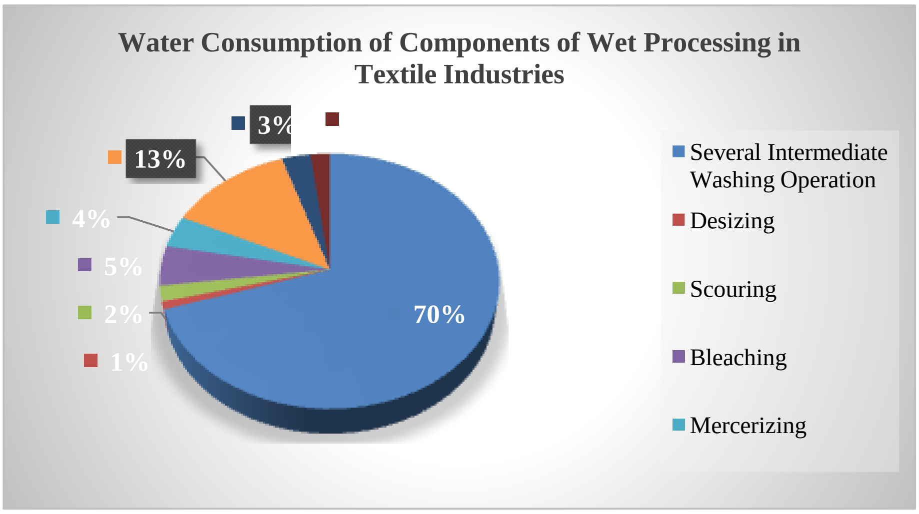

Figure 2-2: Water Consumption of Components of Wet Processing of Textile Industries

As demonstrated in Figure 2-2, 60-70% of the water is consumed in the washing stage. This effluent is light in color and contains low to moderate loads of pollutants such as biological oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids (SS). The major chemical or dyeing operations use 30-40% of the water. These effluents are intensively colored and contain a high pollutant load. Throughout the last decade, there has been a focus on decreasing the amount of water required in textile processing by minimizing waste through process control and adopting suitable end-of-pipe technology for recovery of water from the effluent, such as reed beds.

3. Effluent Generation and Characteristics

Wet processing of textiles involves, in addition to extensive amounts of water and dyes, a number of inorganic and organic chemicals, detergents, soaps and finishing chemicals to aid in the dyeing process to impart the desired properties to dyed textile products. Residual chemicals often remain in the effluent from these processes. In addition, natural impurities such as waxes, proteins and pigment, and other impurities used in processing such as spinning oils, sizing chemicals and oil stains present in cotton textiles, are removed during desizing, scouring and bleaching operations[1]. This results in an effluent of poor quality, which is high in BOD and COD load.

4. Effluent Treatment Pant (ETP) of ACS Textile Industry

Industrial wastewater treatment covers the mechanisms and process used to treat waters that have been contaminated in some way by anthropogenic, industrial or commercial activities prior to its release into the environment or for its re-use. Most industries produce some wet waste although recent trends of the developed world have been to minimize such production or recycle such waste within the production process. However, many industries remain dependent on processes that produces wastewater.

ACS Textiles symbolizes trust and quality in Home Textile Products manufacturing across Bangladesh. A 100% British investment, ACS takes pride in its state-of-the-art composite manufacturing facility with weaving, dying, and printing, finishing and packing services which are one of the largest of its kind in Bangladesh. Housed across a massive 550,000 square ft. our state-of-the-art manufacturing facility employs over 6000 people and averages about 30,000 pieces of superior quality textile products per day.

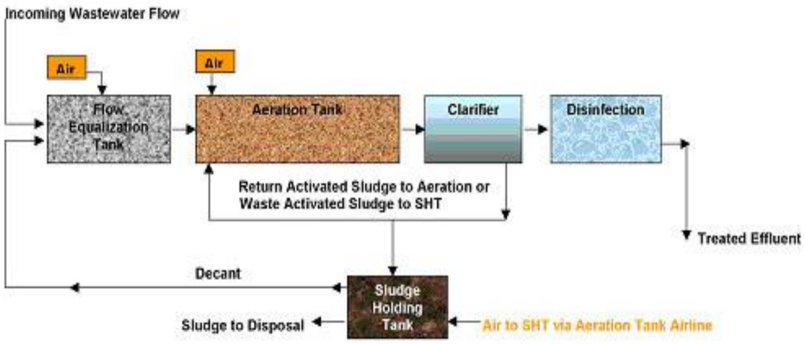

Figure 4-2: Generalized Diagram of Process of Effluent Treatment Plant

Figure 4-3: Geographical Location of ACS Textiles BD (Study Area) 23°45'13.98"N, 90°32'56.37"E]

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The premise of ACS textiles comprises of two factories. Following operations are currently going on the factories:

- Weaving
- Dyeing
- Printing
- Cutting
- Stitching
- Packaging

According to provided factory profile the Effluent Treatment Plant is Conventional Physio-Chemical & Biological Plant without tertiary treatment. The design considerations are as follows:

Table 4-1: Design Data

SL No	Description	Unit	Quantity (After modification)
1	Total Flow	m^3/day	4800
2	Flow Rate	m^3/hr	200
3	Operation Hours	hr	24
4	Homogenizing Tank Capacity	m^3	1899
	Retantion Time	HRT	9.5
5	No. of Reaction Chambers	No	6
	Size of each reaction Chamber	m^3	20
6	No. of primary Clarifier	No	4
	Capacity of Clarifier	m^3	770
	Retention time of Clarifier	HRT	3.85
7	Size of Biological Tank	m^3	7327
	Retention time of Biological Tank	HRT	36.6
8	No. of Secondary Clarifier	No	1
	Capacity of Secondary Clarifier	m^3	1884

SL No	Description	Unit	Quantity (After modification)
	Retention time of Secondary Clarifier	HRT	9
9	Total air Transfer Rate	nm#/min	51
10	Sludge Thickening Tank	m^3	350
11	No. of Filter Press	No	1
	Size of Filter Press	m^3	1
12	Intermediate Tank	m^3	72
13	Outlet tank	m^3	3

Characteristics of the untreated effluent are tabulated below. For this case study total 12 batches of sample were collected every week and brought to the lab without disturbing the sample quality. The below information has been extracted by testing sample of untreated effluent on 19 December, 2015.

Table 4-2: Characteristics of the untreated effluent

SL No	Sample Type	Water Quality Parameter	Unit	Concentration Present	ECR-1997		
					Discharge in Inland Water	Discharge Into Public Sewer	Discharge on irrigation Land
1	Composite Sample	COD	mg/L	987	200	400	400
2		Total Suspended Solid	mg/L	214	150	500	200
		Total Dissolved solid	mg/L	1685	2100	2100	2100
3		Iron	mg/L	2.42	2	2	2

SL No	Sample Type	Water Quality Parameter	Unit	Concentration Present	ECR-1997		
					Discharge in Inland Water	Discharge Into Public Sewer	Discharge on irrigation Land
4		PH	……	9.5	6 to 9	6 to 9	6to 9
5	Grab Sample	Dissolved Oxygen	mg/L	0.18	4.5 to 8	4.5 to 8	4.5 to 8
6		Temperature	ºC	43	S,W=40, 45	S,W=40, 45	S,W=40, 45

- *Note: S= summer, W= winter*

For a perfect biological growth aka bacterial growth following conditions are maintained:

Table 4-2: Standard Maintained for a Perfect Biological Growth

Parameters	Maintained Standards
MLSS	3000-3500
SVI	30%
DO (mg/l)	1.5 - 2
pH	6 - 8

Sludge Volume Index (SVI) type activated sludge settle ability measures are used in the design and control of secondary clarifier. The volume in ml occupied by a 1g of activated sludge from secondary clarifier after settling the aerated liquor for 30 minute is called SVI. In this SVI test, sludge volume is observed after a uniformly mixed sample of sludge has settled quiescently from thirdly minute is a conical flux. It is a measure of the settling characteristics of the sludge.

5. Characteristics of Treated Effluent

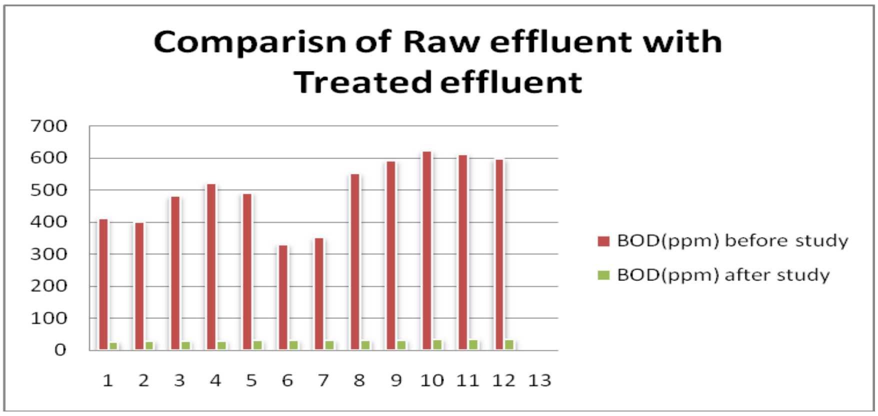
Treated effluents are tested daily to evaluate whether the BOD of it is meeting the standard or not. The characteristics of treated effluent are tabulated and graphically represented below:

Table 5-1: Standard Maintained for a Perfect Biological Growth (6 Dec, 2016- 11 Dec, 2016)

Test Report (Bacteriological analysis of Treated Effluent							
Sample ID	**Sample Collection Data**	**Water Quality Parameter**	**Unit**	**Concentration Present**	**ECR 1997**		
					Discharge in Inland Water	**Discharge into Public Sewer**	**Discharge on Irrigated Land**
Treated Effluent(composite)	6 Dec,2016	BOD_5	mg/L	30	50	250	100

Table 5-2: Standard Maintained for a Perfect Biological Growth (11 Dec, 2016- 16 Dec, 2016)

Sample ID	**Sample Collection Data**	**Water Quality Parameter**	**Unit**	**Concentration Present**	**ECR 1997**		
					Discharge in Inlad Water	**Discharge into Public Sewer**	**Discharge on Irrigated Land**
Treated Effluent(composite)	11-Dec-16	BOD_5	mg/L	34	50	250	100



6. Sludge Treatment

Sludge treatment is an important and final step of waste water treatment process. Very often residuals management or sludge disposal is overlooked and sludge is disposed of without any significant environmental consideration. The process followed by liquid sludge handling could not be observed. There was no sludge drying bed or any other method followed by the industry. However, ACS Textile Industry is following a method of disposal of solid sludge with the help City Corporation. The composition of sludge could not be obtained. Alongside solid sludge handling procedure of the industry is quite acceptable as it is well stacked and dehydrated before final disposal by Dhaka City Corporation.

Figure 6-1: Solid Sludge Dumping Area

7. Conclusion and remarks

The rapid growth of textile industries creates environmental pollution, mainly surface water pollution of effluent from textile dying and washing units. In Bangladesh many industries having ETP are not properly used for wastewater treatment due to excessive operational and maintenance cost. As a result, textile industries dump effluent directly into the surface water body without considering the effect on aquatic life as well as human. The principal objective of this case study was to observe physically how waste water treatment is done in an industry. As part of the study requirement, it was intended to visit an industry where the ETP remains operational always and tries to maintain standard set by ECR 1997. ACS Textile Industry is a 100% export oriented industry and following a combined system of both chemical and biological processes. From equalization tank, different coagulants i.e., Alum, FeSO4 and poly electrolyte were applied to augment the removal efficiency before transferring the waste water to primary clarifier for biological treatment. In fact, chemical unit processes are more efficient and provide satisfactory performance in combination with physical and biological process than alone. As per the given data of treated waste water, after biological treatment the parameter closely meets the ECR standard. However, there are some key information missing from the given data such as reduction of color and suspended solids concentration. Alongside, there was no tertiary treatment process before final disposal of the water. Activated carbon as low cost adsorption media for the tertiary treatment of treated effluent is found quite effective to control wastewater parameters which could have been followed by the industry. Activated carbon polishes the effluent finally and reduces COD by 8-10 percent, color reduction is 6-10 percent of initial. For a textile industry the following considerations would help treat the effluent with required standard:

- As biological processes reduce organic matters also dissolved solids, it is applicable followed by primary treatments rather than chemical treatment which the ACS Textile Industry is following.
- Although biological process is economic, effective and less energy consumptive, combination of biological and subsequent chemical process is much more effective and less time consuming due to the low rate of degradation of organic matter with time that could have been followed by ACS.
- If the treated wastewater does not follow the limit set by the Department of Environment (DoE), addition of tertiary treatment

becomes necessary. ACS Textile may consider this aspect to maintain quality waste water treatment process.

- Adsorption by Activated Carbon is one of the most common and useful options of tertiary treatment. Adsorption is very effective after secondary treatment and it reduces residue of metals/chemical compounds, COD, BOD, TDS, EC etc.
- Finally, the sludge treatment of the industry or residuals management should be given equal attention like the waste treatment process which is often overlooked.

8. References

[1] BCAS and SEI (2005). Choosing and Effluent Treatment Plant. BCAS: Dhaka, Bangladesh.

[2] Guide for Assessment of Effluent Treatment Plants in EMP/EIA, Reports for Textile Industries, Department of Environment, Ministry of Environment and Forest, Bangladesh, June 2008, First Edition

[3] Metcalf & Eddy, inc. (2003). "Wastewater Engineering: Treatment and Reuse," (4th Edition), McGraw-Hill Book Company, New York.

[4] Ahmed, F., Tofa, T.S. & Saha, B.N. (2014), Applicability of chemical process in textile dye wastewater treatment, *Journal of Civil Engineering (IEB)*, 42 (2) (2014) 233-247.