International Research Journal of Pharmacy and Medical Sciences
ISSN (Online): 2581-3277

A Study on Efficiency of Effluent Treatment Plants and Threat to Public Health in Context of Bangladesh

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Abstract— *Bangladesh is a developing country. Many industries are establishing day by day. Among them a huge number of industries do not have ETP plant and many of them has not efficient ETP plant which impact our environment and our public health directly. The liquid wastes of these industries are discharged into nearby natural stream, surface drain, low land or ditch. The effluents are usually characterized by low or high pH, high BOD and COD, high turbidity, high color, high suspended solids etc. As a result, discharge of untreated or poorly treated wastewater causes death of aquatic life and the resulting environmental pollution effects on plants, animals and human. So this current study work was carried out in few different industries of Bangladesh. These industries produce various types of products from different plants. Like every industry, wastes from different plants are discharged in surface drain and then flow combined and become treated by ETP before final discharging to the environment. This study has been carried out to find out whether some specific parameters of ETP outlet water treated by ETP can comply with the Standards for Waste from Industrial Units or Projects Waste (DOE, 1997) or not. These specific parameters are pH, TSS, TDS, BOD, COD, and DO. In this comparative study, it was found that pH, total solid, total dissolved solids, suspended solids and the selected of metal constituents of all Individual ETP treated waster are not within the limits of Industrial Effluent Quality Standards of Bangladesh. However BOD_5, COD and DO values of different industries are not within the allowable limit. BOD_5, COD were found higher and DO was found lower than the standard concentration set by DOE.*

Keywords— *Waste Product, Effluent Treatment, ETP, Environmental Impact.*

I. INTRODUCTION

Industry has grown in Bangladesh in the last three decades at a considerable rate. In Bangladesh industrial sector is one of the most developed hi-tech sector which is contributing in the country's economy. After the promulgation of Drug Control Ordinance - 1982, the development of this sector was accelerated[(1)] .Industries produce wastes, which are usually liquid having wide variation in physical, chemical and biological characteristics. These liquid wastes contain varieties of inorganic and organic substances and different pollution parameters like low or high pH, high color, objectionable odor, high turbidity, high ammonia-nitrogen, low dissolved oxygen, high total solids, toxic elements, heavy metals etc. Generally industrial wastes are discharged on the low land or into natural stream. Discharge of this waste on low land causes severe damage of fertility of the surrounding land and it may cause objectionable odor problem. It may cause contamination of ground water and surface runoff too. Discharge into the stream may cause the damage of aquatic life and microorganism, disease to human body and other animals and affects the treatment process of supply water. Industrial liquid wastes are harmful to the environment and it is hoped that all industrial liquid wastes should be treated before discharge at such a degree that nature can absorb them easily. But unfortunately, due to the lack of environmental cautiousness of people and financial and technological inability of the owners of the industries, from many of the industries, Industrial liquid wastes are discharged directly in the nature without any treatment. Treated effluent can be safely discharged into streams, rivers, cannel, bay, lagoon or wetland, or it can be reused for, irrigation of a golf course, landscaping, gardening, or groundwater recharge[(2)]. Therefore, these wastes should be treated properly before discharge**.**

Industry has grown in Bangladesh in the last two decades at a considerable rate. Its healthy growth supports development of auxiliary industries for producing glass bottles, plastic containers, aluminum collapsible tubes, aluminum PP caps, infusion sets, disposable syringes, and corrugated cartons. Some of these products are also being exported. Printing and packaging industries and even the advertising agencies consider pharmaceutical industry as their major clients and a key driving force for their growth. Following the Drug (Control) Ordinance of 1982, some of the local pharmaceutical companies improved range and quality of their products considerably. The national companies account for more than 65% of the pharmaceutical business in Bangladesh. However, among the top 20 companies of Bangladesh 6 are multinationals[(3)]. There are about 258 pharmaceutical industries have been developed. By now, there are around 484 Unani, Ayurvedic and Herbal manufacturing units and 79 Homeopathic manufacturers in Bangladesh too[(4)]. Many of them do not ETP. If a crude waste from an antibiotic waste discharged into a stream, it not only imparts an objectionable odor to the stream, but also adversely effects the biological population in it. This waste should not be allowed to discharge into a municipal sewer; unless the sewage treatment plant is properly designed to handle a widely varying and concentrated waste from such a plant .Penicillin waste is found to have a disturbing effect on the process occurring within the sludge digestion tank[(9)]It should be understood that the treatment concept may be used either singly or in combination either as pretreatment or complete

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treatment or may not be used at all depending on the treatment need before discharge to a sewer system or to the receiving waters[10] (Atlas and Mosby, 1995).

Sedimentation is the separation from water, by gravitational setting, of suspended particles that are heavier than water it is one of the most widely used unit operation in wastewater treatment. The terms sedimentation and settling are used interchangeably. A sedimentation basin may also be referred to as a sedimentation tank, settling basin, or settling basin, or settling tank. Sedimentation issued for grit removal, particulate-matter removal in the primary settling basin, biological-floc removal, particulate matter removal in the activated sludge settling basin, and chemical-floc removal when the chemical coagulation process is sued. It is also used for solids concentration in sludge thickness. In most cases, the primary purpose is to produce a clarified effluent, but it is also necessary to produce sludge with a solids concentration that can be easily handed and treated in the design of sedimentation basin, consideration smut be given to production of both a clarified effluent and a concentrated sludge[13] (Metcalf and Eddy, 1991).

Since about 1970, the need to provide more complete removal of the organic compounds and nutrients (nitrogen and phosphorus) contained in wastewater has brought about renewed interest in chemical precipitation. Chemical process, in conjunction with various physical operations, has been developed for the complete secondary treatment of untreated wastewater, including the removal of either nitrogen or phosphorus or both [12] (Metcalf and Eddy, 1991).Over the years a number of different substances have been used as precipitants. The degree of clarification obtained depends on the quantity of chemicals used and the care with which the process is controlled. It is possible by chemicals used and the care with which the process is controlled. It is possible by chemical precipitation to obtain a clear effluent, substantially free from matter in suspension or in the colloidal state from 80 to 90 percent of the total suspended matter, 40 to 70 percent of the BOD_5, 30 to 60 percent of the COD, and 80 to 90 percent of the bacteria can be removed by chemical precipitation. In comparison, when plain sedimentation is used, only 50 to 70 percent of the total suspended matter and 30 to 40 percent of organic matter settles out [13].In the activated sludge process the microorganisms are dispersed throughout the water phase. While in trickling filters or biodiscs the microorganisms are attached to a fixed surface forming a biological film. In either, the microorganisms are doing the treatment and therefore all precautions must be taken to assure a favorable environment for their life cycle [14] (Secondary Treatment, http://water.me.vccs.edu). In biological treatment, wastewater contaminants are reduced or removed or stabilized using microorganisms (predominantly bacteria) with or without the presence or oxygen. Toxic materials, both organic and inorganic are discharged into many sewage collections systems. When these materials are present in sufficient quantities to be toxic to bacteria, it will be necessary to remove them prior to biological treatment. In other cases, it is necessary to remove even small amounts of these materials prior to discharge to protect receiving waters or drinking water supplies. Thus, advanced wastewater treatment processes have been used in cases where conventional secondary treatment was not possible due to materials toxic to bacteria entering the plant as well as in cases where even trace amounts of toxic materials were unacceptable in plant effluents[17] Sufficient oxygen must be available for nitrification to occur. Approximately 4.5 pounds of dissolved oxygen are required for the conversion of 1 pound of ammonia to nitrate. Dissolved oxygen sufficient to satisfy the remaining BOD is also required. However, sufficient oxygen must be provided for the organic demand and organic shock loads must be avoided [18]Granular media filtration to remove those suspended and colloidal solids which are carried over from previous unit processes is a common unit process in advanced wastewater treatment. Effluents of less than 10 mg/L BOD and 5 mg/L suspended solids are not uncommon for effluents from biological treatment processes after filtration. [21]

II. Materials & Methods

Types of study: It was descriptive type of cross sectional study with one step satisfaction.

Place of study: The present study was carried out in the Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd, KB Chemical industry and Albion Pharmaceutical Laboratories Limited

Study period: From 5th September 2017 to 10th April 2018.

Sample and sampling technique: Sample were collected from inlet waste water and outlet water of different industries. During data collection all pre cautions were taken in consideration. A copy of chart containing Standards for Waste from Industrial Units or Projects Waste (DOE, 1997) was also collected from department of Environment, People's Republic of Bangladesh for comparative study purpose.

Procedure of Data Collection

Data of different industries regarding ETP were collected. The data shows the value of following parameters of waste water and treated water:

1. Chemical oxygen demand (COD)
2. Biochemical oxygen demand (BOD)
3. Dissolved oxygen((DO)
4. pH
5. Total dissolved solid (TDS)
6. Total suspended solid(TSS)
7. Arsenic

III. Results & Discussion

Comparative analysis of different parameter of ETP outlet water among Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd, KB Chemical industry and Albion Pharmaceutical Laboratories Limited is given below:

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P^H:

Table: Comparison of ETP outlet pH values with standard

Sl. No.	Name of plant	Before treatment	After Treatment	Standard value of Dept. of Environment, Bd.
1.	Coats Bd. Ltd.	9.78	8.58	**8.00**
2.	Pacific Jeans limited	8.32	7.73	
3.	Albion Laboratories Limited	8.80	8.13	
4.	KB Chemicals Ltd.	12.75	No ETP, Not treated	

Comments: From the upper table we can see that that the pH values of ETP discharge point of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd, and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals ltd.

Total Dissolved Solid (TDS):

Table : Comparison of ETP outlet water TDS values with standard

Sl. No.	Name of plant	Before treatment (Mg/l)	After Treatment (Mg/l)	Standard value of Dept. of Environment, Bd. (Mg/l)
1.	Coats Bangladesh ltd	1063	1139	<2100
2.	Pacific Jeans limited	1453	712	
3.	Albion Laboratories Limited	496	490	
4.	KB Chemicals Ltd.	24690	No ETP, Not treated	

Comments: From the previous table and chart we can see that that the TDS values of treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals ltd.

Total Suspended Solid (TSS):

Table: Comparison of ETP outlet water TSS values with standard

Sl. No.	Name of plant	Before treatment (Mg/l)	After Treatment (Mg/l)	Standard value of Dept. of Environment, Bd. (Mg/l)
1.	Coats Bangladesh ltd	219	25	
2.	Pacific Jeans limited	236	150	<150
3.	Albion Laboratories Limited	112	54	
4.	KB Chemicals Ltd.	349	No ETP, Not treated	

Comments: From the previous table and chart we can see that that the TSS values of treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals.

Dissolved Oxygen:

Table: Comparison of ETP outlet water DO values with standard

Sl. No.	Name of plant	Before treatment (Mg/l)	After Treatment (Mg/l)	Standard value of Dept. of Environment, Bd. (Mg/l)
1.	Coats Bangladesh ltd	3.50	7.01	5.00
2.	Pacific Jeans limited	2.18	6.95	
3.	Albion Laboratories	4.90	5.03	
4.	KB Chemicals Ltd.	3.30	No ETP, Not treated	

Comments: From the upper table we can see that that the DO values of treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals.

Biochemical Oxygen Demand (BOD)

Table: Comparison of ETP outlet water BOD5 values with standard

Sl. No.	Name of plant	Before treatment (Mg/l)	After Treatment (Mg/l)	Standard value of Dept. of Environment, Bd. (Mg/l)
1.	Coats Bangladesh ltd	98	53	<50
2	KB Chemicals Ltd.	394	No ETP, Not treated	
3.	Pacific Jeans limited	90	60	
4.	Albion Laboratories Limited	110	27	

Comments: From the previous table and chart we can see that that the amount of BOD5 of treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals.

Chemical Oxygen Demand (COD):

Table: Comparison of ETP outlet water COD values with standard

Sl. No.	Name of plant	Before treatment (Mg/l)	After Treatment (Mg/l)	Standard value of Dept. of Environment, Bd. (Mg/l)
1.	Coats Bangladesh ltd	344	183	<200
2.	Pacific Jeans limited	348	80	
3.	Albion Laboratories Limited	876	160	
4.	KB Chemicals Ltd.	1436	No ETP, Not treated	

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Comments: From the previous table and chart we can see that that the amount of COD of treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals.

Arsenic:

Table: Comparison of amount of arsenic ETP outlet water with standard

Sl. No.	Name of plant	Before treatment (µg/l)	After Treatment (µg/l)	Standard value of Dept. of Environment, Bd. (µg/l)
1.	Coats Bangladesh ltd	1.24	0.4	0.2
2.	Pacific Jeans limited	0.89	0.29	
3.	Albion Laboratories Limited	Not detected	--	
4.	KB Chemicals Ltd.	4.68	No ETP, Not treated	

Comments: From the previous table and chart we can see that that the amount of arsenic in treated water of Coats Bangladesh Ltd (Dying Industry), Pacific Jeans ltd and Albion Pharmaceutical Laboratories Limited are within the limits of Industrial Effluent Quality Standards of Bangladesh but not KB Chemicals.

Discussion

From the above comparative study it is seen that pH, total dissolved solids, suspended solids and the selected of metal constituents of all Individual ETP treated waster are within the limits of Industrial Effluent Quality Standards of Bangladesh. However BOD_5, COD and DO values of some industries are not within the allowable limit. BOD_5, COD were found higher and DO was found lower than the standard concentration set by DOE. The effluent should be treated prior to discharge into the environment.

IV. CONCLUSION

On the basis of analysis, study and discussion mentioned above, the following conclusions may be drawn:

1. To meet the required amount of Dissolved Oxygen (DO) in treated water, continuous air supply in every unit may help.
2. BOD_5, COD and DO values of PHARMACEUTICALS LTD. are not within the allowable limit. The effluent should be properly treated prior to discharge into the environment.
3. Though comparatively area requirement is high, treatment by aerated lagoon process is more preferable than existing ETP as physicochemical treatment is expensive to install and operate [(31)].

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