Project Report

On

STUDY ON CHEMICALS CONSUMPTION AND OPERATIONAL COST OF TEXTILE ETP PLANTS

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(This report presented in partial fulfillment of the requirements for the degree of Bachelor of Science in Textile Engineering)

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LETTER OF APPROVAL

November 30, 2014

To
The Head
Department of Textile Engineering
Daffodil International University
102 Sukrabad, Mirpur Road, Dhaka 1207

Subject: Approval of final year project report.

Dear Sir

I am just writing to let you know that, this project report titled as *"**Study on Chemicals Consumption and Operational Cost of Textile ETP Plants**"* is completed for final evaluation. The whole report is prepared based on proper investigation and interpretation though critical analysis of empirical data with required belongings. The students were directly involved in their project activities and the report becomes vital to spark off many valuable information for the readers.

Therefore, it will highly be appreciated if you kindly accept this project report and consider it for final evaluation.

Yours Sincerely,

Sumon Mazumder

Assistant Professor

Department of TE

FE, DIU

DECLARATION

We hereby declare that, this project has been done by us under the supervision of Sumon Mazumder, Assistant Professor, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

The aim of this project is to represent the chemical consumption and operational cost of ETP plant in textile industry. The main objective is to compare the cost of ETP chemical for different ETP plant to choose effective ETP chemicals with minimum cost. The data presented in this project is based on the reporting books of chemical consumption in ETP plant of different textile industries & suppliers of ETP chemicals. As we will be the future technologist at wet processing unit we have decided to gather a clear concept on effluent treatment. We think only technologists from wet processing unit can control the effluent pollution. For this reason we have decided that our project works should be **"Study on Chemicals Consumption and Operational Cost of Textile ETP Plants".** To accomplish this project we have chosen four reputed textile industries of Bangladesh named Divine Textile LTD, Divine Fabric LTD, Beximco Textile LTD and Raiyan Knit Composite LTD. First we have find out the different cost section of ETP operation like chemical cost, wages of employee and ETP utility cost. The textile industry use different types of ETP chemicals according to type of ETP plant. We have found 7 types of ETP chemicals they used. Operational cost for treating $1m^3$ effluent ranges from BDT 14.43 to BDT 25.66. Through this project work we gained a significant knowledge on the chemical consumption & operational cost of effluent treatment plants which will help us to supervise wet processing activities with caring our green environment.

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Introduction:

Textile wet processing unit involves a variety of chemicals comprising a various class of dyes and other chemicals along with huge amount of water. The waste water resulting from dyeing operation is various threats for aquatic life. About forty thousand to eighty thousands tons of dyes and 1500 to 1800 pigments are estimated to discharge in a year by textile processing units due to in complete exhaustion washing operation etc. Such waste streams generated from the process house needs suitable treatment prior to their disposal as a legal requirement, now the conservations of chemicals become a most important aspect for environment specially in consideration of the pollution phenomenon and increasing cost of chemicals in order to make the industry much more competitive in the globalize context. For that reason liquid waste management of textile wet processing industry approach calls for waste volume reduction by the product recovery and an identification of most appropriate treatment option. In the case of Bangladesh near about 550 wet processing industry present and 80% of these are cotton dyeing industry. On the other hand according to World Bank report more than 700 wet processing units are needed to feed the fabric in the garments industries. So a large amount of effluent will be produced from cotton dyeing industry. For these reasons effluent treatment planning is a burning question for a wet processing unit. In order to solve these problems as a textile technologist of our mother land our present study deals with chemicals consumption in ETP plants and also the operational cost ETP plants. The project title is "*Study on Chemicals Consumption and Operational Cost of Textile ETP Plants*".

In case of establishing an ETP plant and to run an ETP plant, operational cost is most important. The industries feel unwillingness to run an ETP plant due to its operational cost that includes chemical cost, wages of employee and utility cost. In past, there is no research on operational cost of textile ETP plant. In this project paper we would like to represent an overall view on operational cost of textile ETP plant.

CHAPTER 02

LITERATURE REVIEW

CHAPTER 02
LITERATURE REVIEW

2.1 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. This results in an effluent of poor quality, which is high in BOD and COD load. Table 2.2 lists typical values of various water quality parameters in untreated effluent from the processing of fabric using reactive, sulfur and vat dyes and compares these to the DOE effluent standards for discharge into an inland surface water body (e.g. river, lake, etc.). As demonstrated, the effluent from textile industries is heavily polluted.

Table 2.1: Characteristics of wastewater to be discharged into the environment (Recommended by the dept. of environment ob Bangladesh)

SL. No.	Effluent quality Parameters	Concentration Present
01	pH	7-8
02	BOD	<50 PPM
03	COD	<200 PPM
04	TSS	<100 PPM
05	TDS	<2500 PPM
06	Oil & Greases	< 10 PPM
07	Color	Clean
08	Temperature	< 30 °C

Table 2.2: Characteristics of wastewater of a typical textile wet processing industry.

SL. No.	Effluent quality Parameters	Concentration Present
01	pH	8-14
02	BOD	400-600 PPM
03	COD	800-1200 PPM
04	TSS	200-500 PPM
05	TDS	3000-6000 PPM
06	Oil & Greases	30-60 PPM
07	Color	Dark Mixed
08	Temperature	Up to 60°C

As mentioned textile wastewater may contain various types of contaminants but in most case the toxicity of the above eight parameters are considered important before discharging them into the environment

2.2 Water Quality Parameters:

Some of the main parameters listed in the water quality discharge standards are briefly discussed here to give a working knowledge of what they are and why they are important.

Color

Although color is not included in the Environment Conservation Rules (1997), it is an issue in dye house effluent because unlike other pollutants it is so visible. Reducing color is therefore important for the public perception of a factory. Consequently, international textile buyers are increasingly setting discharge standards for color. However, as a health and environmental issue color is less of a concern than many of the other parameters.

BOD and COD

Measurement of the oxidisable organic matter in wastewater is usually achieved through determining the 5-day biological oxygen demand (BOD5), the chemical oxygen demand (COD) and total organic carbon (TOC).

BOD5 is a measure of the quantity of dissolved oxygen used by microorganisms in the biochemical oxidation of the organic matter in the wastewater over a 5-day period at 20ºC. The test has its limitations but it still used extensively and is useful for determining approximately how much oxygen will be removed from water by an effluent or how much may be required for treatment and is therefore important when estimating the size of the ETP needed.

COD is often used as a substitute for BOD as it only takes a few hours not five days to determine. COD is a measure of the oxygen equivalent of the organic material chemically oxidized in the reaction and is determined by adding dichromate in an acid solution of the wastewater.

TDS and TSS

Wastewater can be analyzed for total suspended solids (TSS) and total dissolved solids (TDS) after removal of coarse solids such as rags and grit. A sample of wastewater is filtered through a standard filter and the mass of the residue is used to calculate TSS. Total solids (TS) are found by evaporating the water at a specified temperature. TDS is then calculated by subtracting TSS from TS.

Metals

A number of metals are listed in the national environmental quality standards for industrial wastewater, including cadmium, chromium, copper, iron, lead, mercury, nickel and zinc. Many metals, which are usually only available naturally in trace quantities in the environment, can be toxic to humans, plants, fish and other aquatic life.

Phosphorus, Total Nitrogen, Nitrate and Ammonia

These parameters are all used as a measure of the nutrients present in the wastewater, as a high nutrient content can result in excessive plant growth in receiving water bodies, subsequent oxygen removal and the death of aquatic life.

pH

pH is a measure of the concentration of hydrogen ions in the wastewater and gives an indication of how acid or alkaline the wastewater is. This parameter is important because aquatic life such as most fish can only survive in a narrow pH range between roughly pH 6-9.

Sulphur and Sulphide

Textile dyeing uses large quantities of sodium sulphate and some other sulphur containing chemicals. Textile wastewaters will therefore contain various sulphur compounds and once in the environment sulphate is easily converted to sulphide when oxygen has been removed by the BOD of the effluents. This is a problem because hydrogen sulphide can be formed which is a very poisonous gas, it also has an unpleasant smell of rotten eggs. The presence of sulphides in effluents can interfere with biological treatment processes.

Temperature:

Temperature of water is a very important factor for aquatic life. It controls the rate of metabolic and reproductive activities, and determines which aquatic species can survive. Different aquatic species require different quantity of DO to survive in the water. Temperature inversely affects the rate of transfer of gaseous oxygen into dissolved oxygen. On the other hand at higher temperature the metabolic rate of aquatic plants and animals increases producing an increase in oxygen demand.

International regulations related to water temperature and aquatic life classifies water, as "Class 1 Cold Water Aquatic Life" should never have temperatures exceeding 20°C, while waters classified, as "Class 1 Warm Water Aquatic Life" should never have temperatures exceeding 30°C.

Oil and Grease

This includes all oils, fats and waxes, such as kerosene and lubricating oils. Oil and grease causes unpleasant films on open water bodies and negatively affect aquatic life. They can also interfere with biological treatment processes and cause maintenance problems as they coat the surfaces of components of ETPs.

Table 2.3: List of some of the waste materials generated at each level of cotton textile processing.

Process	Wastewater	Residual wastes
Fiber preparation	Little or no wastewater generated	Fiber waste; packaging waste; hard waste.
Sizing	BOD; COD; metals; cleaning waste, size	Fiber lint; yam waste; packaging waste; unused starch-based sizes.
Knitting	Little or no wastewater generated	Packaging waste; yam and fabric Scraps.
Desizing	BOD from water soluble sizes; synthetic size; lubricants; biocides; anti-static compounds	Packaging waste; fiber lint; yam waste; cleaning materials, such as wipes, rags and filters; cleaning and maintenance wastes containing solvents.
Scouring	Disinfectants and insecticide residues; NaOH; detergents; fats; oils; pectin; wax; knitting lubricants; spin finishes; spent solvents	Little or no residual waste generated.
Bleaching	Hydrogen peroxide, sodium silicate or organic stabilizer; high pH	Little or no residual waste generated.
Singeing	Little or no wastewater generated.	Little or no residual waste generated.
Heat setting	Little or no wastewater Generated.	Little or no residual waste generated.
Dyeing	Metals; salt; surfactants; toxics; organic processing assistance; cationic materials; color; BOD; sulfide; acidity/ alkalinity; spent solvents.	Little or no residual waste generated.
Printing	Suspended solids; urea; Solvents; color; metals; heat; BOD; foam.	Little or no residual waste generated.
Finishing	BOD;COD; suspended solids; toxics; spent solvents	Fabric scraps and trimings; packaging waste
Product fabrication	Little or no wastewater generated	Fabrics scraps

Without these they use a lot of chemicals those vary due to order requirement. They use only two types of dyes; reactive dyes & disperse dyes. Dyes and chemicals are soluble in water or in colloidal state. Some of suspended solid like wastages are also flow with raw effluent. They are mainly cotton fibers flocks or the yarn. The raw color of effluent is brown/ blue / black. All the liquors are coming through same drain of wet processing unit. So rinsed liquor, dye liquor, soaping liquor, scouring liquor, acid liquor all are getting mixture from the very beginning. The temperature, pH, BOD & COD of raw effluent liquor is given in the following experimental procedure. In Bangladesh basically these four criteria are controlled for textile effluent.

Table 2.4: Waste Water Treatment Plant Standard.

Sl. No.	**Parameter**	**Unit**	**Department of environment Government of Bangladesh**	
			Inlet	**Outlet**
1	BOD	PPM	281	50
2	COD	PPM	730	200
3	TDS	PPM	3220	2100
4	TSS	PPM	204	150
5	EC	μδ/cm	6430	1200
6	DO	PPM	0.1	4.5-8
7	Chloride	PPM	-	600
8	Phosphate	PPM	2.6	8
9	Nitrate	PPM	0.9	10
10	Ammoniu	PPM	0.09	5
11	Sulphate	PPM	-	-
12	Arsenic	PPM	-	0.2
13	Cyanide	PPM	-	-

14	Nitrate	PPM	0.08	50
15	Cobalt	PPM	-	-
16	p^H	-	10.3	6-9
17	Temperatur	$^{\circ}C$	40	40 Summer or 45
18	Cadmium	PPM	-	0.05
19	Chromium	PPM	-	0.05

2.3 ETP Chemicals:

Table 2.5 List of ETP Chemical

SL. No.	Chemical Name	Details	Figure
01	Poly Aluminum Chloride	Aluminum chlorohydrate is a group of salts having the general formula AlnCl(3n-m)(OH)m. It is used in deodorants and antiperspirants and as a flocculent in water purification.	
02	Non Ferric Alum	Alum has been part of our lives ever since the time of early Egyptians, who used it in dyeing and purification. Today, it is one of the most widely used and versatile industrial chemicals	

03	Hydrated Lime	It increases the effectiveness of $FeSO_4$	
04	Ferrous Sulphate	It helps to separate colored effluent from water	
05	Defoamer	We are engaged in offering silicone defoamer - RE 0, which are formulated using advanced machines and stringently tested by our quality controllers to ensure maximum effectiveness	
06	Polyelectrolyte	Precession Polyelectrolyte's are polymers whose repeating units bear an electrolyte group.	

Decoloriser:

Decolor CA218 is a color removal chemical, which removes color of waste water generated by textiles process houses and dyes industries. It is high molecular weight polymeric coagulant.

The colored effluents, generated by the industries, when left untreated, play havoc with reusable water resources. For process houses, in water scarce areas, it comes as a heaven-sent facilitating recycling of the industrial effluent into process water.

Physical Properties

Decolor ca218 is effective cationic high charge density polyamine effective at wide ph range.

Form: Clear to light yellow liquid

- **Molecular Weight :** High Molecular Weight
- **Ionic Nature** : Cationic
- **Effective pH** : 5.5 - 9.5
- **Volatile Matter** : 50 ~ 60%
- **Specific Gravity** : 0.75 ± 0.05
- **pH** : 3.4 ± 0.5
- **Shelf Life** : 12 months
- **Solubility** : Completely soluble in water

Sodium Hypochlorite

Sodium hypochlorite solution, commonly known as bleach or liquid bleach, is frequently used as a disinfectant or a bleaching agent.

Sodium hypochlorite has been used for the disinfection of drinking water or water systems. Sodium hypochlorite is commonly used as a biocide in industrial applications to control slime and bacteria formation in water systems used at power plants, pulp and paper mills, etc. in solutions typically of 10%-15% by weight. It is finding applications in varied segments owing to their antiseptic and disinfecting properties. In domestic activities it is used for removing stains from fabrics and it is also used for water purification. As a disinfectant agent, it finds application in effluent and waste-water treatment plants.

These are used for:

- Water treatment.
- Effluent plants.
- Waste water treatment.

Calcium Hypochlorite/Bleaching powder

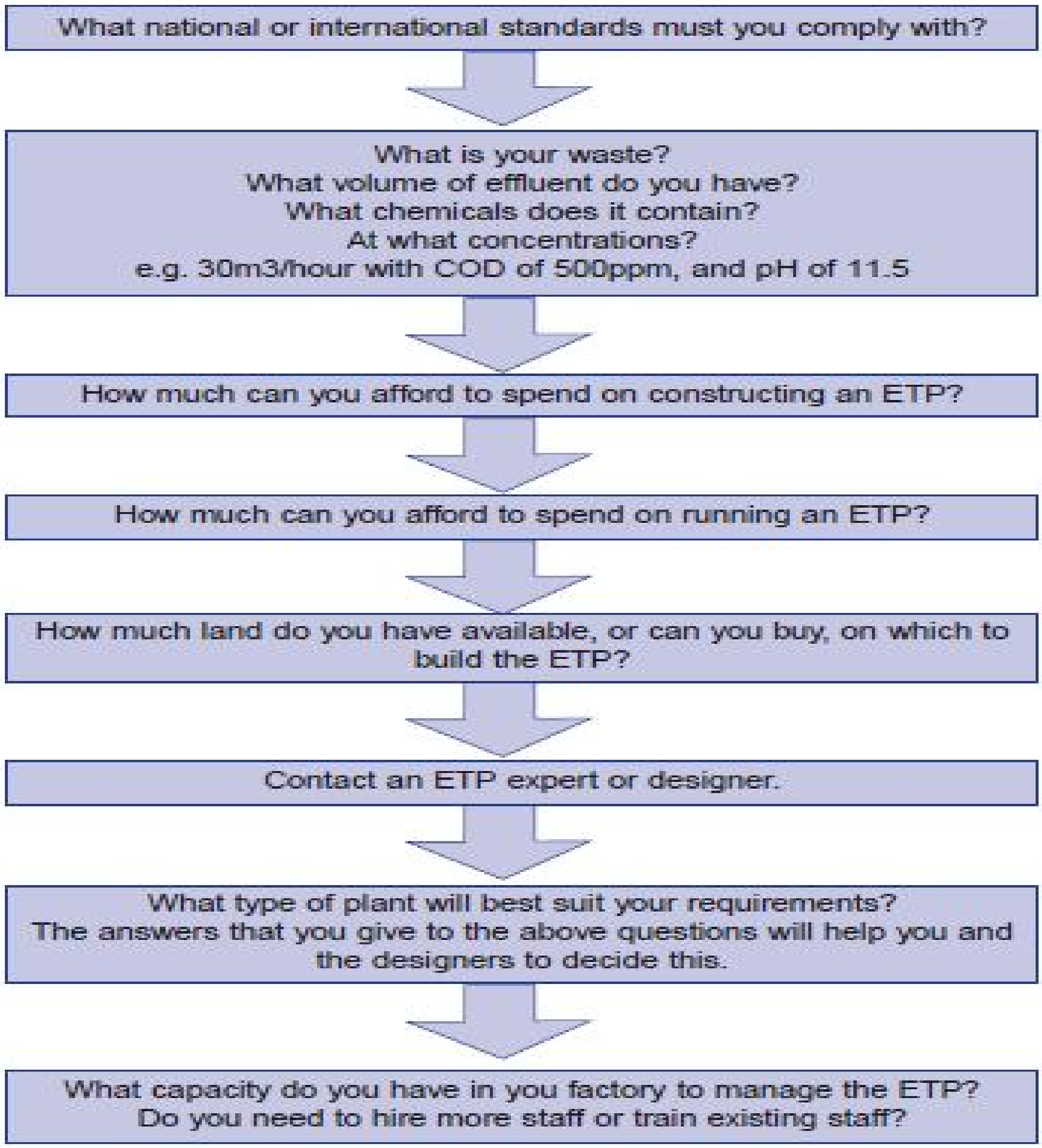
Calcium hypochlorite is widely used for water treatment and as a bleaching agent (bleaching powder). This chemical is considered to be relatively stable and has greater available chlorine than sodium hypochlorite (liquid bleach).Calcium hypochlorite is a yellow white solid which has a strong smell of chlorine. It is not highly soluble in water, and is more preferably used in soft to medium-hard water. It has two forms: a dry form and a hydrated form.

Calcium hypochlorite is also an ingredient in bleaching powder, used for bleaching cotton and linen. It is also used in bathroom cleaners, household disinfectant sprays, moss and algae removers, and weed killers. In addition, calcium hypochlorite may be used to manufacture chloroform.

Bleaching powder is used also in sugar industry for bleaching sugar cane juice before its crystallization.

Figure 2.1: Calcium Hypochlorite

2.4: Considerations when Planning an Effluent Treatment Plant.



2.5: Types of ETP

There are basically three types of Effluent Treatment Plant. Like-

- Chemical ETP Plant
- Biological ETP Plant
- Chemical-Biological ETP Plant
- Electrical ETP Plant

Satisfactory disposal of wastewater, whether by surface, subsurface methods or dilution, is dependent on its treatment prior to disposal. Adequate treatment is necessary to prevent contamination of receiving waters to a degree which might be interfere with their best or intended use, whether it be for water supply, recreation, or any other required purpose.

Wastewater treatment consists of applying known technology to improve or upgrade the quality of a wastewater. Usually wastewater treatment will involve collecting the wastewater in a central, segregated location (the Wastewater Treatment Plant) and subjecting the wastewater to various treatment processes. Most often, since large volumes of wastewater are involved, treatment processes are carried out on continuously flowing wastewaters (continuous flow or "open" systems) rather than as "batch" or a series of periodic treatment processes in which treatment is carried out on parcels or "batches" of wastewaters. While most wastewater treatment processes are continuous flow, certain operations, such as vacuum filtration, involving as it does storage of sludge, the addition of chemicals, filtration and removal or disposal of the treated sludge, are routinely handled as periodic batch operations.

Wastewater treatment, however, can also be organized or categorized by the nature of the treatment process operation being used; for example, physical, chemical or biological. Examples of these treatment steps are shown below. A complete treatment system may consist of the application of a number of physical, chemical and biological processes to the waste water.

2.6 Description of Effluent Treatment Plant Process Sequence in Textile Industry:

Cooling & Mixing

After primary filtration, the liquor passes to cooling and mixing tank in which uniform mixing of effluents from various process takes place. A paddle mixer is provided for mixing. Cooling of the effluent may be done with the help of cooling tower.

Neutralization

The effluent is pumped to a tank in which it is neutralized by acid or alkali dozing. The tank has an automatic dosing controller which at automatically control the dose of acid or alkali to maintain the required P^H

Coagulation

Then the effluent is pumped to the coagulation tank. Chemical coagulation very effective for removal of color and suspended materials, aluminum, ferrous sulphates, ferric chloride, chlorinate copper etc. to increase the efficiency of coagulation, coagulation gain may be added for example polyacrylate.

Setting and separation of sludge

Some of the soluble organic matter and light suspended solids will form a blanket of flocculent matter with the coagulants. The blanket is skimmed of to another tank and the remaining solution is moved to pressure filter.

Pressure Filter

For pressure filtration vacuum pumps may be used to force through the filter and suspended flocks are collected in the pressure fine filter. Discharging to drain, after filtration the purified water sent to drain which eventually reach to the river or anywhere else.

2.7. 1 Chemical Wastewater Treatment Methods:

Chemical Wastewater Treatment Methods consists of using some chemical reaction or reactions to improve the water quality. Probably the most commonly used chemical process is chlorination. Chlorine, a strong oxidizing chemical, is used to kill bacteria and to slow down the rate of decomposition of the wastewater. Bacterial kill is achieved when vital biological processes are affected by the chlorine. Another strong oxidizing agent that has also been used as an oxidizing disinfectant is ozone.

Coagulation consists of the addition of a chemical that, through a chemical reaction, forms an insoluble end product that serves to remove substances from the wastewater. Polyvalent metals are commonly used as coagulating chemicals in wastewater treatment and typical coagulants would include lime (that can also be used in neutralization), certain iron containing compounds (such as ferric chloride or ferric sulfate) and alum (aluminum sulfate).

Certain processes may actually be physical and chemical in nature. The use of activated carbon to "adsorb" or remove organics, for example, involves both chemical and physical processes. Processes such as ion exchange, which involves exchanging certain ions for others, are not used to any great extent in wastewater treatment.

Chemical ETP Flow Chart

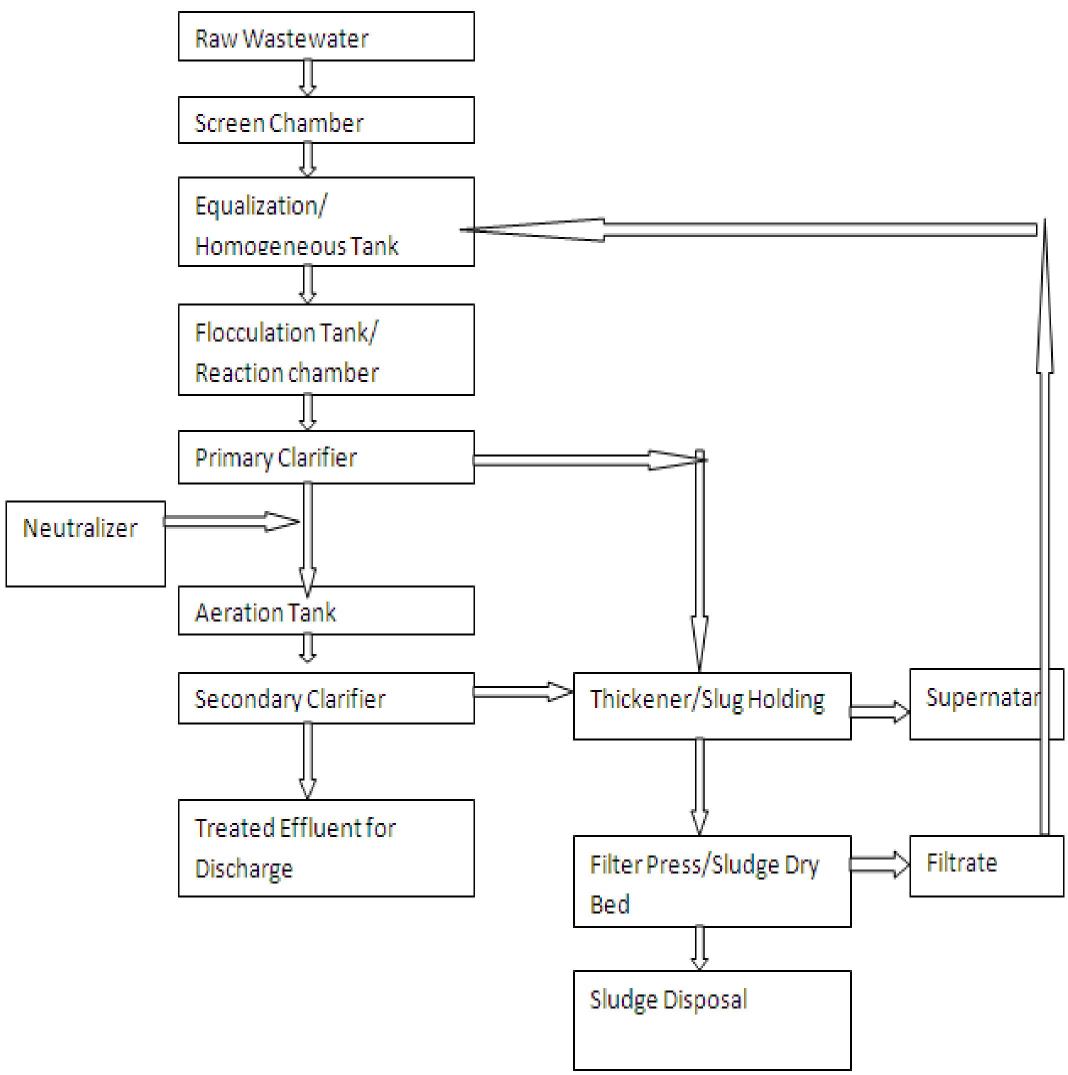


Figure 2.2: Chemical ETP Flow Chart

2.7.2 Biological Wastewater Treatment Methods:

Biological treatment methods use microorganisms, mostly bacteria, in the biochemical decomposition of wastewaters to stable end products. More microorganisms, or sledges, are formed and a portion of the waste is converted to carbon dioxide, water and other end products. Generally, biological treatment methods can be divided into aerobic and anaerobic methods, based on availability of dissolved oxygen.

The purpose of wastewater treatment is generally to remove from the wastewater enough solids to permit the remainder to be discharged to receiving water without interfering with its best or proper use. The solids which are removed are primarily organic but may also include inorganic solids. Treatment must also be provided for the solids and liquids which are removed as sludge. Finally, treatment to control odors, to retard biological activity, or destroy pathogenic organisms may also be needed.

While the devices used in wastewater treatment are numerous and will probably combine physical, chemical and biological methods, they may all be generally grouped under six methods:

1. Preliminary Treatment.
2. Primary Treatment.
3. Secondary Treatment.
4. Disinfection.
5. Sludge Treatment.
6. Tertiary Treatment.

Degrees of treatment are sometimes indicated by use of the terms primary, secondary and tertiary treatment. Tertiary treatment, properly, would be any treatment added onto or following secondary treatment.

Preliminary Treatment

At most plants preliminary treatment is used to protect pumping equipment and facilitate subsequent treatment processes. Preliminary devices are designed to remove or cut up the larger suspended and floating solids, to remove the heavy inorganic solids, and to remove excessive amounts of oils or greases.

To affect the objectives of preliminary treatment, the following devices are commonly used:

1. Screens -rack, bar or fine
2. Comminuting devices - grinders, cutters, shredders
3. Grit chambers
4. Pre-aeration tanks

In addition to the above, chlorination may be used in preliminary treatment. Since chlorination may be used at all stages in treatment, it is considered to be a method by itself. Preliminary treatment devices require careful design and operation.

In this treatment, most of the settle able solids are separated or removed from the wastewater by the physical process of sedimentation. When certain chemicals are used with primary sedimentation tanks, some of the colloidal solids are also removed. Biological activity of the wastewater in primary treatment is of negligible importance.

The purpose of primary treatment is to reduce the velocity of the wastewater sufficiently to permit solids to settle and floatable material to surface. Therefore, primary devices may consist of settling tanks, clarifiers or sedimentation tanks. Because of variations in design, operation, and application, settling tanks can be divided into four general groups:

1. Septic tanks
2. Two story tanks - inhoff and several proprietary or patented units
3. Plain sedimentation tank with mechanical sludge removal
4. Upward flow clarifiers with mechanical sludge removal

When chemicals are used, other auxiliary units are employed. These are:

1. Chemical feed units
2. Mixing devices
3. Flocculators

The results obtained by primary treatment, together with anaerobic sludge digestion as described later, are such that they can be compared with the zone of degradation in stream self-purification. The use of chlorine with primary treatment is discussed under the section on Preliminary Treatment.

Secondary Treatment

Secondary treatment depends primarily upon aerobic organisms which biochemically decompose the organic solids to inorganic or stable organic solids. It is comparable to the zone of recovery in the self-purification of a stream.

The devices used in secondary treatment may be divided into four groups:

1. Trickling filters with secondary settling tanks
2. Activated sludge and modifications with final settling tanks
3. Intermittent sand filters
4. Stabilization ponds

The use of chlorine with secondary treatment is discussed under the section on Secondary Treatment

Chlorination

This is a method of treatment which has been employed for many purposes in all stages in wastewater treatment, and even prior to preliminary treatment. It involves the application of chlorine to the wastewater for the following purposes:

1. Disinfection or destruction of pathogenic organisms
2. Prevention of wastewater decomposition --

   (a) Odor control and (b) Protection of plant structures

3. Aid in plant operation -

   (a) sedimentation,

   (b) trickling filters,

   (c) activated sludge bulking

4. Reduction or delay of biochemical oxygen demand (BOD)

While chlorination has been commonly used over the years, especially for disinfection, other methods to achieve disinfection as well as to achieve similar treatment ends are also used. Among the most common is the use of ozone. In view of the toxicity of chlorine and chlorinated compounds for fish as well as other living forms, ozonation may be more commonly used in the future. This process will be more fully discussed in the section on disinfection.

Sludge Treatment

The solids removed from wastewater in both primary and secondary treatment units, together with the water removed with them, constitute wastewater sludge. It is generally necessary to subject sludge to some treatment to prepare or condition it for ultimate disposal. Such treatment has two objectives - the removal of part or all of the water in the sludge to reduce its volume, and the decomposition of the putrescible organic solids to mineral solids or to relatively stable organic solids. This is accomplished by a combination of two or more of the following methods:

1. Thickening
2. Digestion with or without heat
3. Drying on sand bed -- open or covered
4. Conditioning with chemicals
5. Elutriation
6. Vacuum filtration
7. Heat drying
8. Incineration
9. Wet oxidation
10. Centrifuging

2.8 Required Chemicals and Their Functions in Biological Effluent Treatment Plant (ETP):

The effluent generated from different sections of a textile industry must be treated before they are discharged to the environment. Various chemicals and physical means are introduced for this purpose. Some chemicals are used to treatment those wastage polluted water. Here chemicals name are given which are used in effluent treatment plant.

H_2SO_4:

Function: Neutralize the waste water controlling the PH. It is auto dispensed in the neutralization tank.

Polyelectrolyte:

Function: Used for sedimentation / sludge coagulation and also killing bacteria.

Antifoaming Agent:

Function: Used for reduction / controlling foam. It is used auto / manually in the distribution tank.

De-colorant:

Function: Used for removing color. It is used auto / manually in the sedimentation feeding tank.

Sodium Hypochlorite:

Function: It is used to kill the harmful bacteria. It is used in the biological oxidation tank.

Product Quality Checked:

1. Biological Oxygen Demand (BOD)
2. Chemical Oxygen Demand (COD)
3. Total suspended solids
4. Total dissolved solids
5. Color
6. p^H etc.

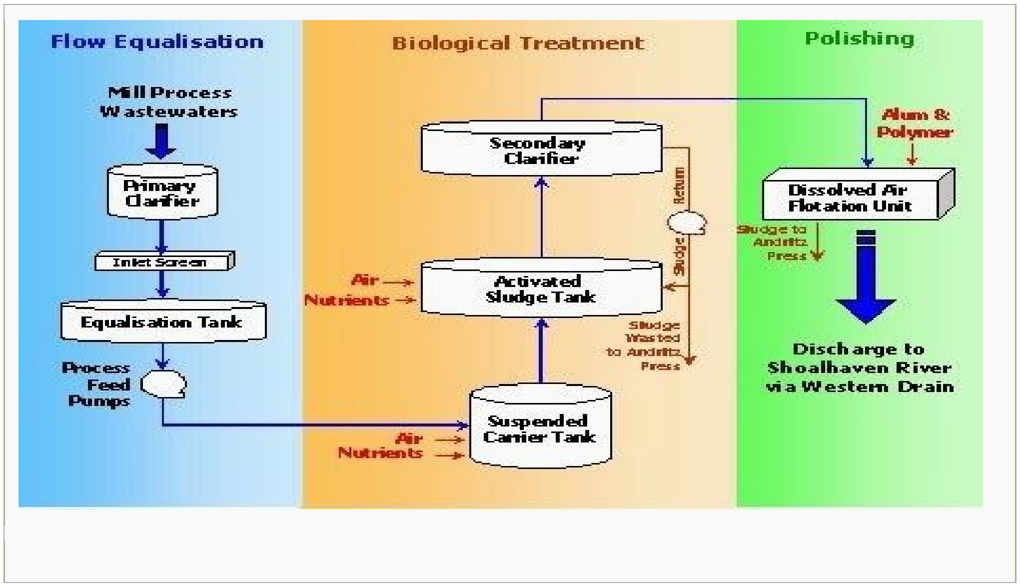


Figure2.3: Biological ETP Flow Chart

Process Description

1. Inlet Launder

The purpose of launder is to flow the effluent of gas scrubber to distribution chamber. Inlet channel is designed for a surge flow of 1950m3/hr @ slope of 2%. So water flows at 1.5m/s (self cleaning velocity).Self cleaning velocity is that velocity at which if the sludge flows it will not get accumulated in the launder.

2. Distribution on chamber

Purpose of distribution chamber is to divide the flow (design flow of 1140m3/hr) into two equal flows. In case if one of the thickeners is closed then there would be no distribution so selection of pipes is done on this criteria. The size of gates is designed such that there is equal distribution always.

3. Flash Mixer

There are two flash mixers designed for a flow of 1140m3/hr with a retention time of 60 sec. So its volume must lie around 19m3. In flash mixer alum (coagulant) acts upon sludge so that suspended solids settle down. In addition pH of sludge is also raised by lime as it is required to have a pH of 7-9. Polyelectrolyte (flocculants) also acts upon to fasten the process of coagulation.

2.9 Effective effluent management:

The five steps to effective effluent management are:

1. Characterize all effluents produced on-site;
2. Implement a waste minimization programme to reduce the volume and strengths of effluents;
3. Incorporate in-process conditioning and treatment, where appropriate;
4. Determine and install segregation facilities to tailor treatment options;
5. Optimize performance of ETP.

To comply with discharge consent conditions and reduce the environmental burden of their discharges, companies often need to modify their processes and/or install an effluent treatment plant (ETP). Effective management of an ETP has a number of benefits, including:

Waste minimization

Waste minimization will save you money - typically up to 1% of turnover, either as extra profit or in reduced operating costs. In terms of pollution control, it will minimize - or even eliminate - the waste streams requiring treatment.

An effluent treatment plant will cost less to run if the site produces less effluent in the first place.

Significant cost savings can be achieved by reducing both the amount and strength of the raw effluent entering the plant. Considering the effluent treatment plant as an integral part of the company's operations, and not just as an end-of-pipe necessity, will help to maximize savings. This approach also offers greater opportunities for chemical and water re-use within the site.

Investigating where and how effluent arises, and its composition, will give you a more detailed understanding of how your process affects the operation of effluent treatment plant. However, the first stage is to take action to reduce the site's water consumption and effluent generation. Don't forget that effluent can be lost product or raw materials.

2.10 Area Requirement Comparison:

The area needed for an ETP depends mostly on the quality of wastewater to be treated, flow rate, the type of biological treatment to be used and the orientation of different treatment units. In general physicochemical treatment plants require the least area and biological treatment plants requires the largest area (Table 5), but good civil engineering can greatly reduce the land area required and some factories in Bangladesh have had ETPs designed on several levels to minimize the land area used. This will require a few extra pumps and piping, and stronger tank walls, so construction costs may be higher for tall structures.

Table 2.6: Example of the Area Requirement of Some ETPs.

	Physico-chemical	**Biological**	**Combined physicochemical and Biological**
Area required (for 30 cubic meter)	80 sq meter	170 sq meter	140 sq meter

Note: The area requirement values given in this table are not absolute and depend on the exact design of the ETP but they provide a broad comparison of the possible area requirements.

2.11 Cost Comparison:

The installation costs of ETPs can vary greatly depending on such factors as the materials used including the quality and source of the equipment (e.g. pumps and air blowers) and land area and dimensions for construction, the quality and quantity of wastewater to be treated, and the quality of the required output. In addition, the operating costs of ETPs also depend on quality and quantity of inputs such as chemicals and energy, the method of treatment and the efficiency of ETP management.

Table has gives an idea of the potential costs. These are based on examples of costs provided by industrialists with ETPs or who are planning to install ETPs1 in Bangladesh.

Table 2.7: Installation and Operational Costs Comparison of ETPs in Bangladesh

	Capacity (m^3/month)	**Installation cost (BDT)**	**Running cost (BDT/month)**	**Running cost (BDT/m^3/month)**
Normal Range	20,000	4,000,000- 6,000,000	6,000,000- 8,000,000	30-40
Possible Range	20,000	3,000,000- 12,000,000	400,000- 3,000,000	20-150

Note: These figures were provided by designers and industrialists and may vary considerably from plant to plant.

CHAPTER 03

SIGNIFICANCE AND SCOPE OF THE STUDY

CHAPTER 03
SIGNIFICANCE AND SCOPE OF THE STUDY

3.1 Significance of the Study:

i) Visiting four knit dyeing industries to observe their ETP capacity and its' activities.

ii) Observation and collection of data entail chemicals consumption within two months by the ETPs. Observation of chemicals types and calculation of their consumption per day for different industries.

iii) Calculation of operational cost of four ETPs considering chemicals cost, wages of the employees and utilities cost.

iv) Drawing bar diagrams to show comparisons of chemicals consumption, operational cost of four ETPs and selecting the industry which has economic ETP activities.

3.2 Scope of the Study:

The scope of the present work includes-

Chapter-1 contains the introduction part of the project report.

Chapter-2 presents literature review or the relevant information required to do the research works.

Chapter-3 includes significance and scope of this project report.

Chapter-4 contains research methodology that includes specification of four ETPs, their chemicals consumption, operational costs etc.

Chapter-5 includes the analysis of collected data and bar diagrams here to interpret the research results in organized way.

Chapter-6 finally covers the conclusion part of the report.

CHAPTER 04

RESEARCH METHODOLOGY

CHAPTER 04

RESEARCH METHODOLOGY

4.1 Methodology:

To accomplish this project research on "study on chemicals consumption and operational cost of textile ETP Plants" all the information were collected from four renowned textile industry of Bangladesh. We have collected a complete data of 60 days on chemical consumption, wages of employees and utility cost from each industry. The industries are-

1. Divine Textile LTD.
2. Divine Fabric LTD.
3. Beximco Textile LTD.
4. Raiyan Knit Composite LTD.

4.2 Chemicals used in different industries:

First we have visited the ETP plants of those industries. Then we collected information about chemicals used in ETP plants.

Table 4.1: List of chemical used in different industries.

Divine Textile LTD.	Poly Aluminum Chloride, Poly Electrolyte, Urea, Decolorant
Divine Fabric LTD.	Poly Aluminum Chloride, Poly Electrolyte, Decolorant
Beximco Textile LTD	Ferrous Sulphate, Lime, Poly Electrolyte, Sulpheuric Acid
Raiyan Knit Composite LTD.	Poly Aluminum Chloride, Poly Electrolyte, Decolorant

View of chemical used in different industries:

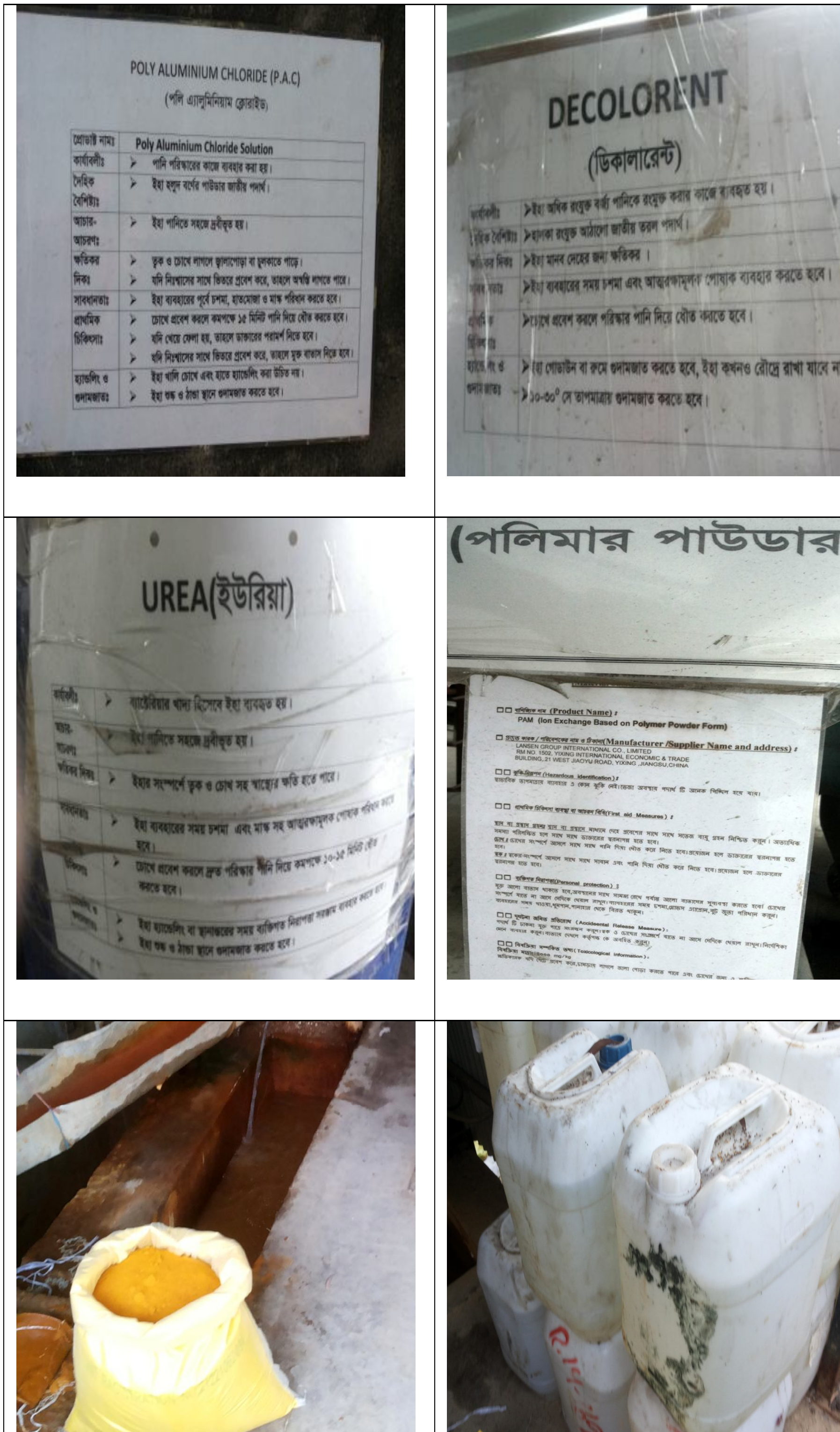


Figure 4.1: chemicals used in different industries

4.3 Consumption of Chemicals:

Consumption of chemicals for each ETP plant was collected from each industry from the respected personnel. All the data were taken from chemical consumption reporting book.

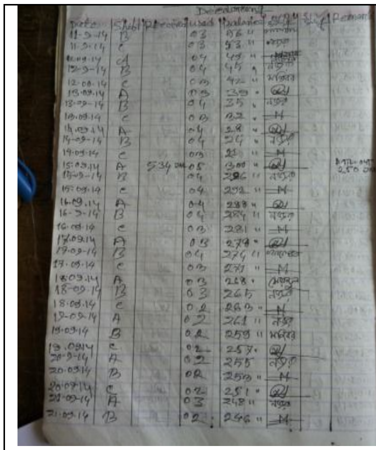
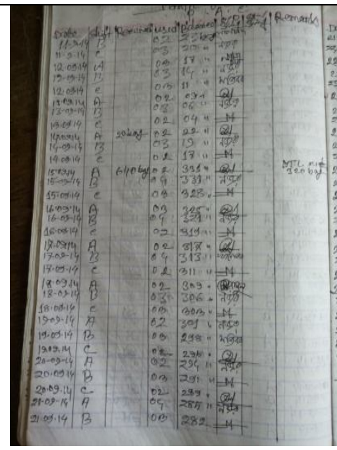
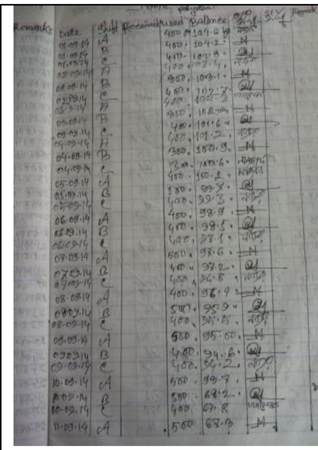
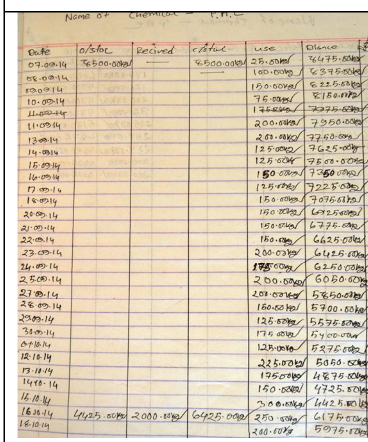
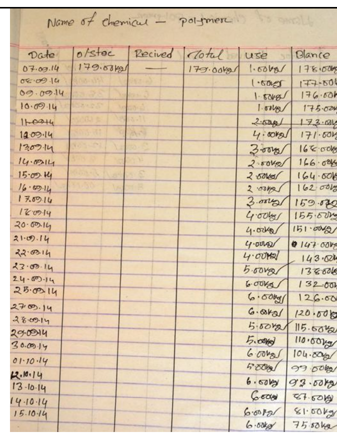
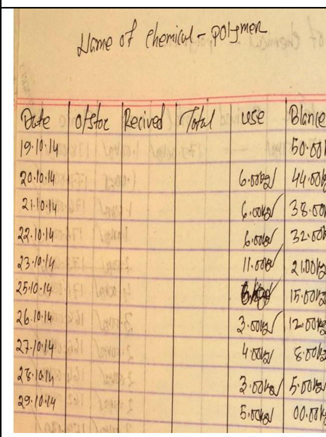
		
Decolorant Consumption	**P.A.C. Consumption**	**P.E. Consumption**
		

Figure: 4.2 Chemicals Consumption

4.4 Cost of Chemical:

Cost of chemical which is the main concern of our research project was collected from the management personnel of the industry and different suppliers of ETP chemical.

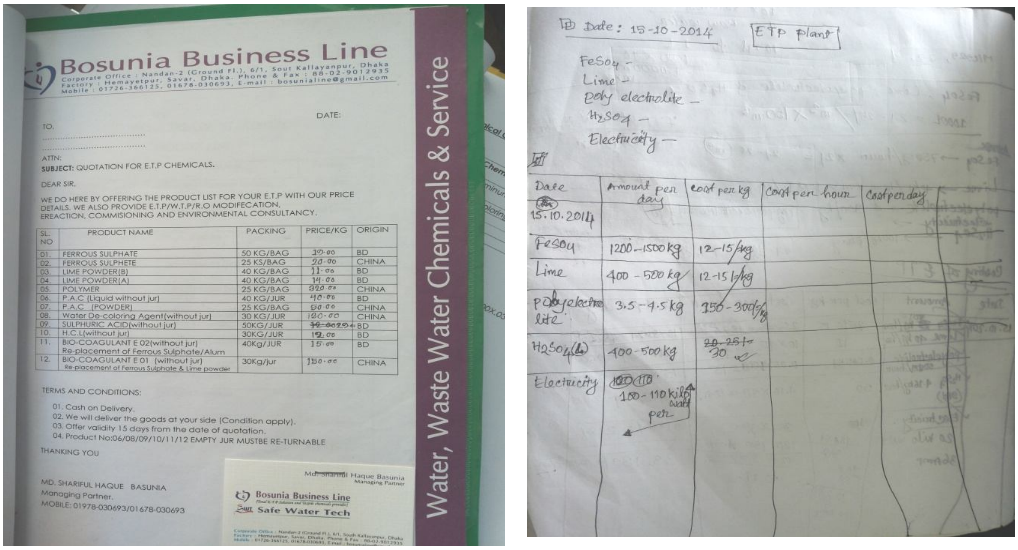


Figure: 4.3 Cost of different chemicals

Table 4.2: Specification of Textile ETP in different industries.

Sl. No.	**Name of the Industry**	**Type of ETP**	**Capacity of ETP/ Hour (in m^3)**	**Chemicals Used**
1.	Divine Textile Ltd.	Bio-chemical	100	PAC, Polyelectrolyte, Urea/DAP, Decolorant, NaOCl
2.	Divine Fabric Ltd.	Bio-chemical	100	PAC, Polyelectrolyte, Decolorant
3.	Beximco Textile Ltd.	Chemical	150	$FeSO_4$, Lime, Polyelectrolyte, H_2SO_4
4.	Raiyan Knit composite Ltd.	Bio-chemical	80	PAC, Polyelectrolyte, Decolorant

Table 4.3: Chemicals used in Textile ETP of different industries.

Sl. No.	Name of the chemicals	Purpose of Use	Price in BDT/Kg
1.	Di-amonium phosphate (DAP)	It is used as food for bacterial growth.	30-40
2.	Sodium Hypo Chloride (NaOCl)	It is used to destroy the harmful bacteria.	12-15
3.	Poly electrolyte	It is used to clean the water by the sedimentation.	350-450
4.	Poly Aluminum Chloride (PAC)	It is used to clean the water.	50-60
5.	Urea	It is used as food for bacterial growth.	20-30
6.	Decolorant	It is used to make colorless of textile effluent.	130-150
7.	Sulphuric Acid-(H_2SO_4)	It maintains the pH of the discharged water.	30-40
8.	Green Vitriol-($FeSO_4.7\ H_2O$)	It helps to separate colored bodies from the effluent water.	18-20
9.	Lime-$Ca(OH)_2$	To remove the turbidity of colored effluent and make it transparent.	14-18

4.5 Pictorial View of Different Textile ETP Plants

Pictorial View of ETP plant of Divine Textile LTD.

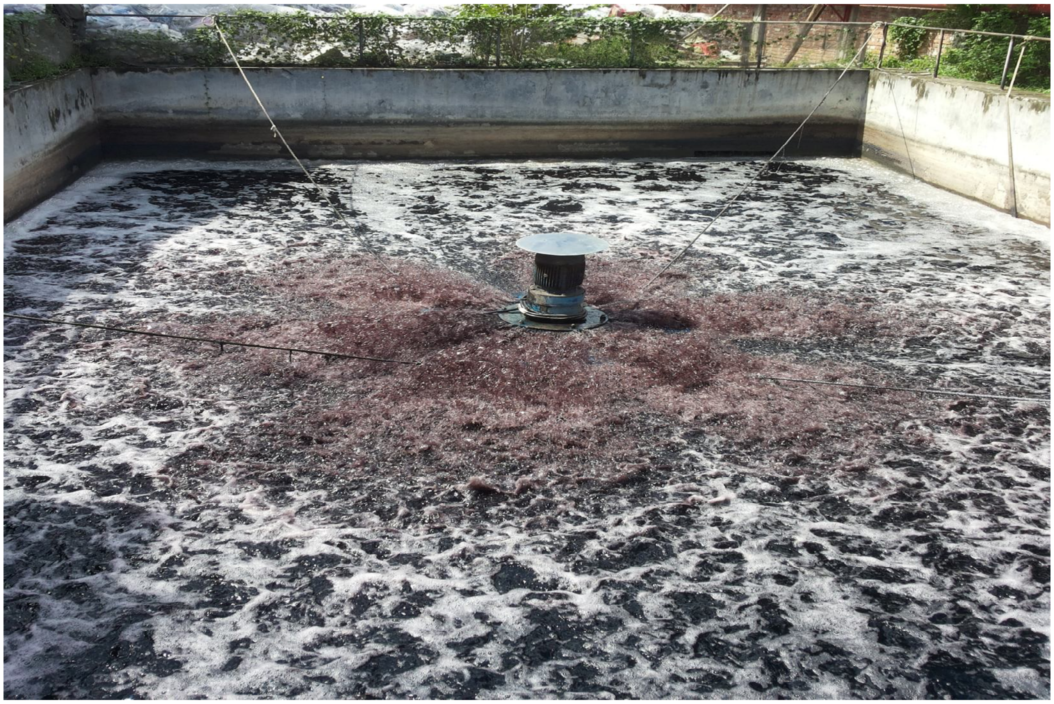


Figure 4.4: Pictorial View of ETP at DTL

Figure 4.5:Pictorial View of ETP at DTL

Figure 4.6: Chemical Mixing Tank

Figure 4.7: Flocculation Tank

Pictorial View of ETP Plant at Divine Fabric LTD.

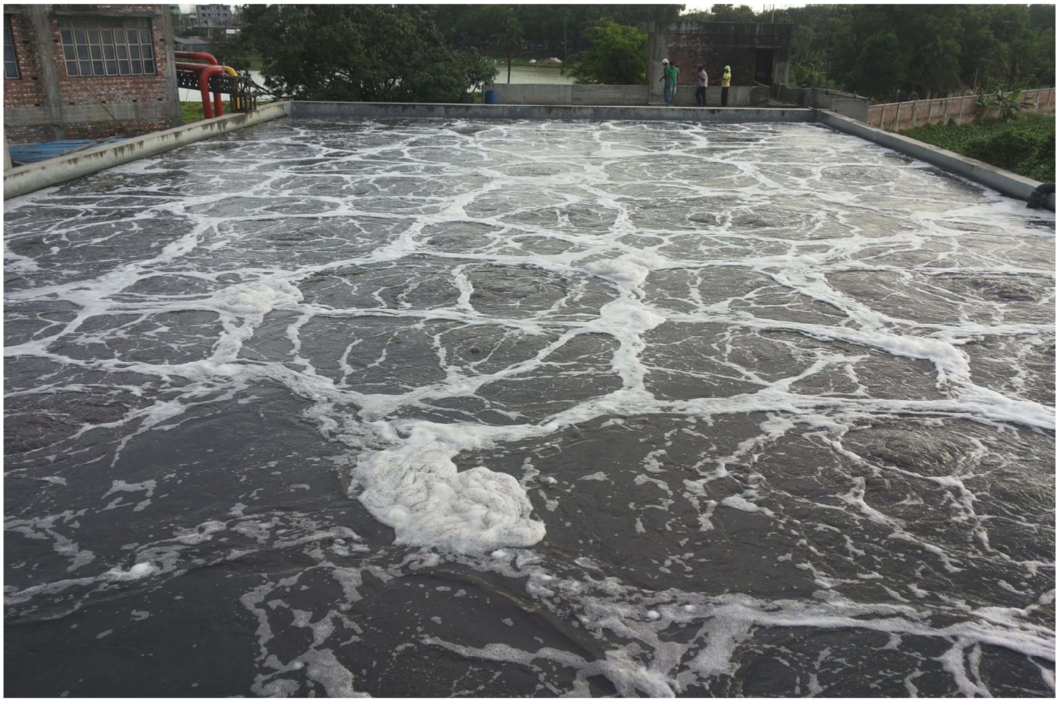


Figure 4.8: Ecolization tank at DFL

Figure 4.9: Effluent source at DFL

Figure 4.10: Pictorial View of ETP at DFL

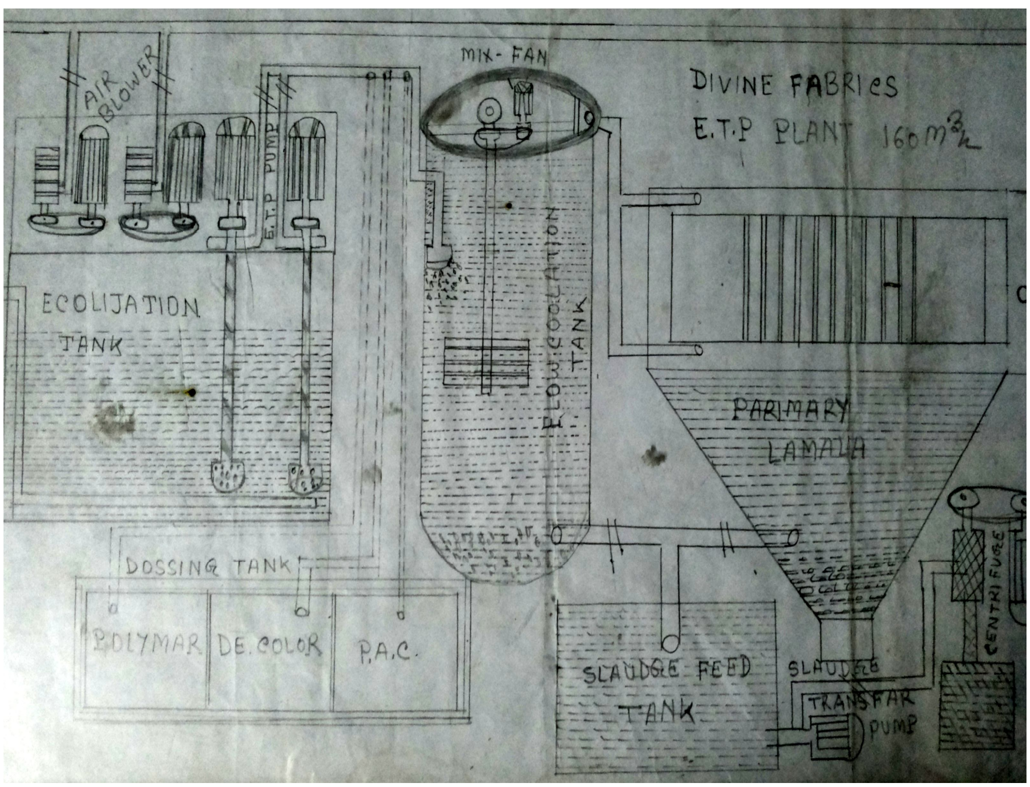


Figure 4.11: Diagram of ETP of DFL

Pictorial View of ETP Plant at Beximco Textile LTD.:

Figure 4.12: Pictorial View of ETP at BTL

Figure 4.13:Pictorial View of ETP at BTL

Figure 4.14: Pump Station of ETP at BTL

Figure 4.15: Pictorial View of ETP at BTL

Pictorial View of ETP Plant at Raiyan Knit Composite LTD.:

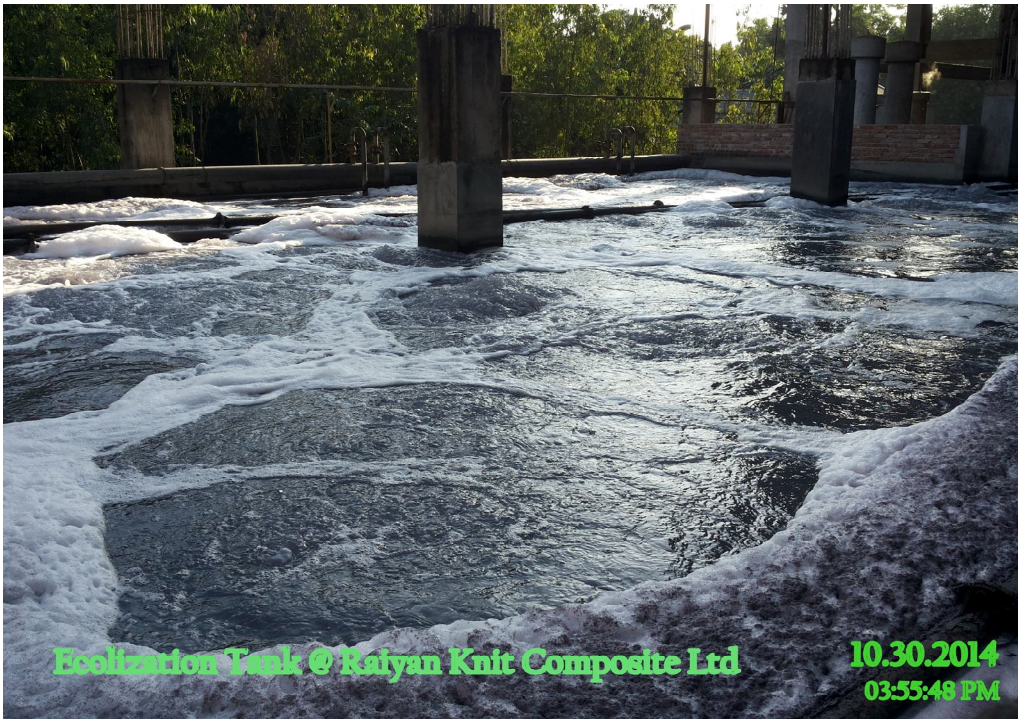


Figure 4.16: Ecolization Tank at RKCL

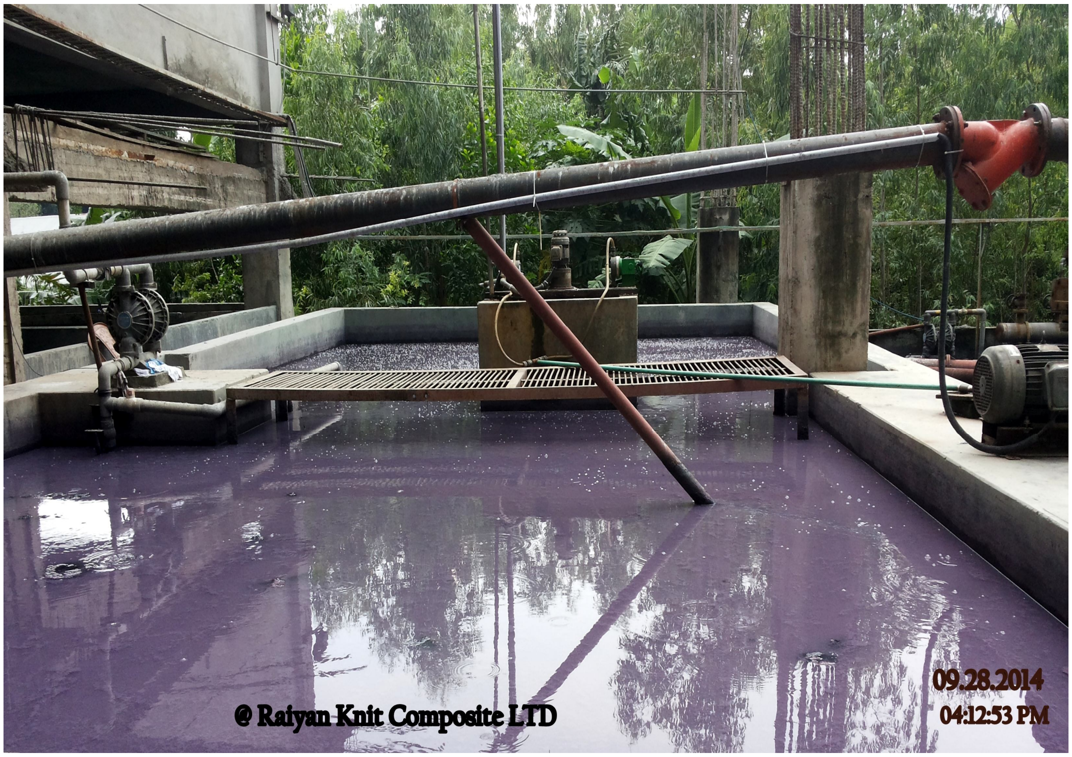


Figure 4.17: Bacteria culture

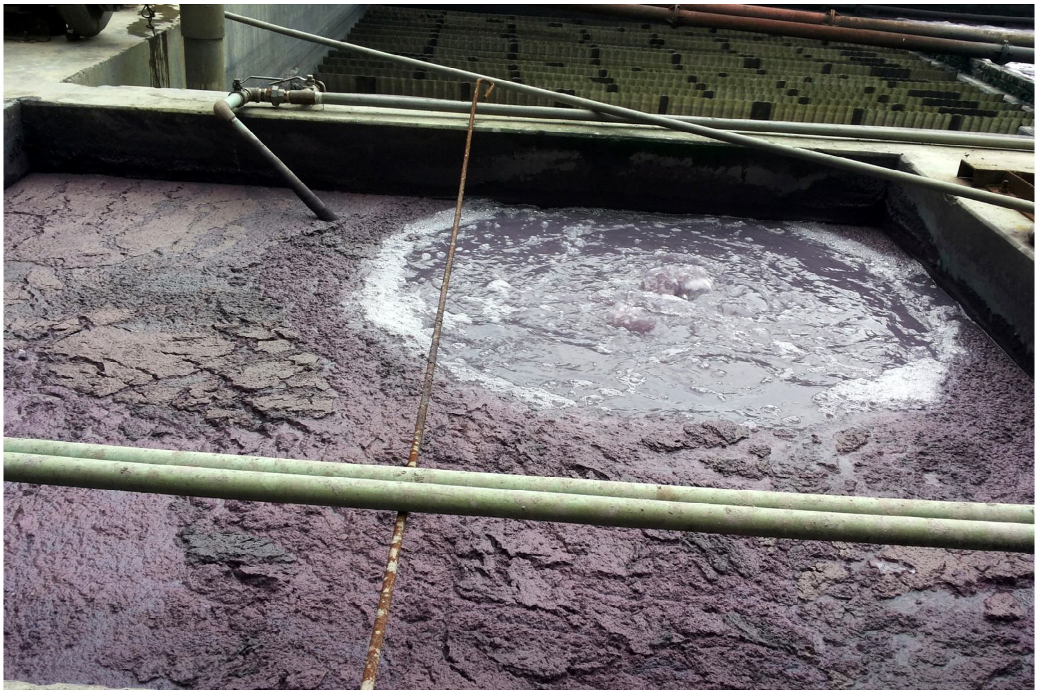


Figure 4.18: Sludge

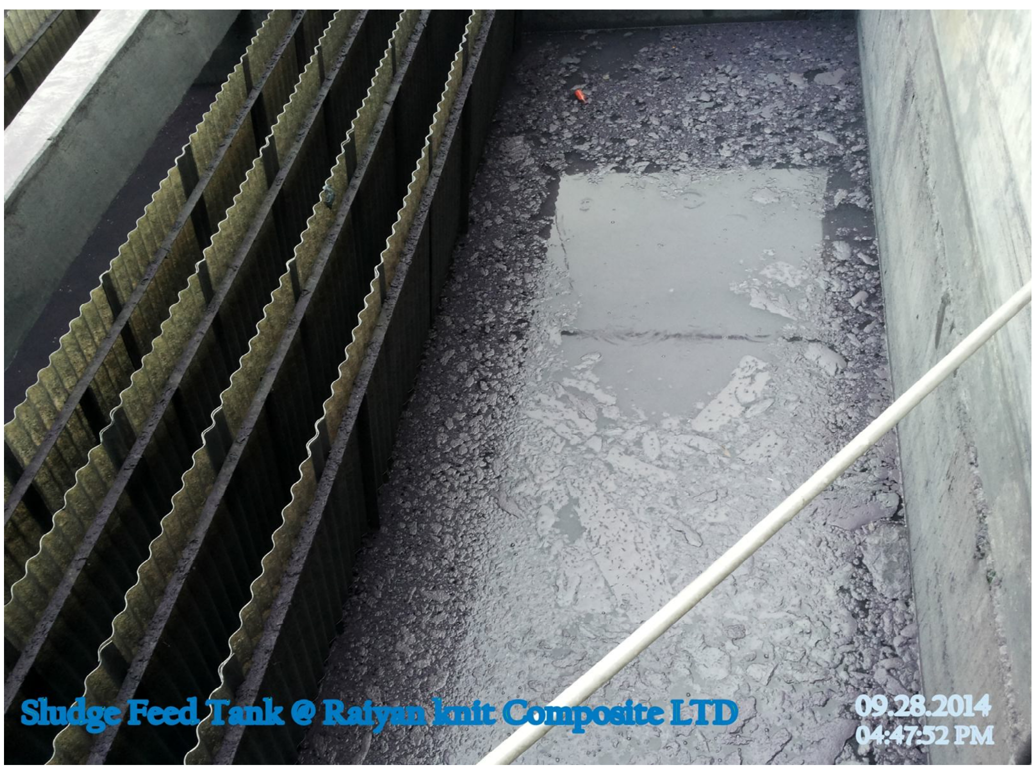


Figure 4.19: Sludge Feed Tank

CHAPTER 05

DATA ANALYSIS & FINIDINGS

CHAPTER 05

DATA ANALYSIS & FINIDINGS

5.1 Calculation of ETP Operational Cost in Divine Textile Ltd.:

Table 5.1: Calculation of ETP Chemicals Cost in Divine Textile Ltd/day.

Type of Chemicals	Amount of Total Chemicals Consumption in 60 days period	Amount of Chemicals Consumption/Day	Cost/Unit Amount (BDT)	Cost/Day (BDT)
Poly Electrolyte	68.1 kg	1.135 kg	350	397.25
PAC	13780 kg	229.67 kg	50	11483.5
Urea	83kg	1.39 kg	20	27.8
Decolorant	15529 liter	258.82 Liter	130	33646.17
Total				**45554.72**

Per Day Total Chemical Cost = **45554.72 BDT.**

Table 5.2: Total Personnel & Monthly Expenses in DTL.

SL. No.	Personnel	Monthly wages (BDT)
1	Operator-3	36000
2	Assistant-6	42000
Total	9	78000
Per day total wages		**2600**

Per day utility cost = **1200 BDT.**

Per day total operational cost = (45554.72+2600+1200) BDT. = **49354.72 BDT.**

Amount of treated textile effluent/day = (100x24) m^3= (100x1000x24) liter = **24, 00,000 liter**

- Cost for one liter effluent treatment = **0.020564 BDT.**
- Cost for one m^3 effluent treatment = **20.55 BDT.**

5.2 Calculation of ETP Operational Cost in Divine Fabric Ltd.:

Table 5.3: Calculation of per day ETP chemical cost in DFL.

SL. No.	**Total used chemical for 60 Days**	**Per day chemical use(Average)**	**Cost per unit (BDT.)**	**Cost per day (BDT.)**
Poly Electrolyte	82.2 kg	1.37 kg	350	479.5
PAC	13175 kg	219.59 kg	50	10798.5
Decolorant	14240 Liter	237.34 Liter	130	30854.2
Total				**42132.2**

Table5.4: Total personnel & monthly wages in DFL.

SL. No.	**Personnel**	**Monthly wages(BDT)**
1	In charge 1	18000
2	Supervisor 3	33000
3	Assistant 6	42000
Total	10	93000
Per day wages		**3100**

Per day utility cost = **1350 BDT.**

Per day total operational cost = (42132.2+3100+1350) BDT. = **46582.2 BDT.**

Amount of treated textile effluent/day = 100x24 m^3 = (100x1000x24) liter = **2400000 liter**

- Cost for one liter effluent treatment = **0.019409 BDT.**
- Cost for one m^3 effluent treatment = **19.41 BDT.**

5.3 Calculation of ETP Operational Cost in Beximco Textile Ltd.:

Table 5.5: Calculation of per day ETP chemical cost in BTL.

SL. No.	**Total used chemical for 60 Days**	**Per day chemical use(Average)**	**Cost per unit (BDT.)**	**Cost per day (BDT.)**
$FeSO_4$	82275kg	1371.25 kg	18	24682.5
Lime	27375 kg	456.25 kg	14	6387.5
Decolorant	230.75 liter	3.85 Liter	350	1347.5
H_2SO_4	27225 kg	453.75 kg	30	13612.5
Total				**46030**

Per Day Total Chemical Cost= **46030 BDT.**

Table 5.6: Total Personnel & Monthly Expenses in BTL.

SL. No.	Personnel	Monthly wages(BDT)
1	Manager-1	25000
2	In charge-2	28000
3	Supervisor-3	22000
4	Assistant-6	48,000
Total	12	123000
Per day wages		**4100**

Per day utility cost = **1800 BDT.**

Per day total operational cost = (46030+4100+1800) BDT. = **51930 BDT.**

Amount of treated textile effluent/day = (150x24) m^3 = (150x1000x24) =**3600000 liter**

- Cost for one liter effluent treatment = **0.014425 BDT.**
- Cost for one m^3 effluent treatment = **14.43 BDT.**

5.4 Calculation of ETP Operational Cost in Raiyan Knit Composite Ltd.:

Table5.7: Calculation of per day ETP Chemical Cost in Raiyan Knit Composite Ltd.

SL. No.	Total used chemical for 60 Days	Per day chemical use(Average)	Cost per unit (BDT.)	Chemical Cost per day (BDT.)
P.A.C	11225 kg	187.0833kg	50	9354.165
Decolorant	14430 Liter	240.5 Liter	150	36075
Polymer	227 kg	3.79 kg	320	1210.67
Total				**46639.835**

Per day total chemical cost = **46639.835 BDT.**

Table 5.8: Total Personnel & Monthly Expenses in RKCL.

Sl. No.	Personnel	Monthly salary(BDT)
1	Operator-3	36000
2	Assistant-2	16000
Total	5	52000
Per day wages		**1733.34**

Per Day Utility Cost = **900 BDT.**

Per Day Total Operational Cost = (46639.835 +1733.34+900) = **49273.18 BDT**.

Amount of treated textile effluent/day = (80x24) m^3 = (80x1000x24) liter=**1920000 liter**

- Cost for one liter effluent = **0.025663BDT.**
- Cost for one m^3 effluent = **25.66 BDT.**

Table 5.9: Overall cost comparison among four industries. In this table, all the data has been taken from Appendix-A, Table-1 to Table 5.8.

Sl. No.	Name of the industry	Per day total effluent (Liter)	Per day total chemical cost (BDT)	Per day total wages (BDT)	Per day utility cost (BDT)	Per day total operational cost(BDT)	Cost for liter effluent treatment (BDT)	Cost for $1m^3$ effluent treatment (BDT)
1	**Divine textile LTD**	2400000	45554.72	2600	1200	49354.72	0.020564	20.55
2	**Divine Fabric LTD**	2400000	42132.2	3100	1350	46582.2	0.019409	19.41
3	**Beximco Textile LTD**	3600000	46030	4100	1800	51930	0.014425	14.43
4	**Raiyan knit Composit LTD**	1920000	46639.835	1733.34	900	49273.18	0.025663	25.66

5.5 Comparison of treated textile effluent/day (Liter):

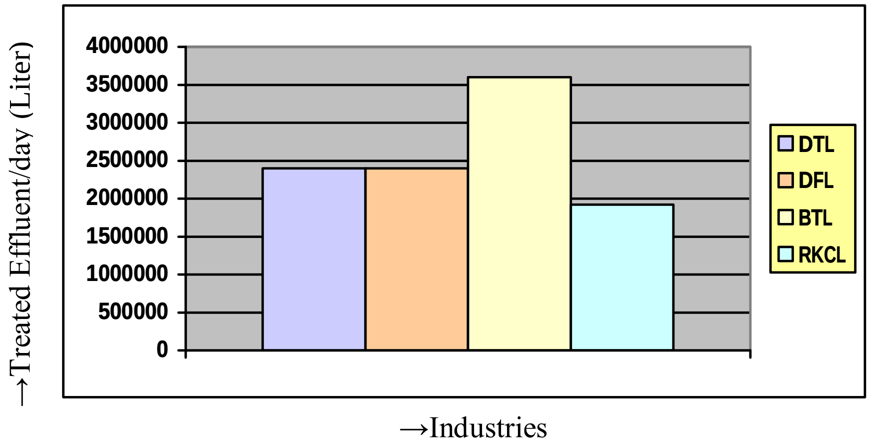


Figure 5.1: Bar diagram represents the comparison of treated textile effluent/day (Liter) for four industries.

The above figure shows the comparison of treated textile effluent/day (liter) among four industries. All the data included in these figure has been taken from **Table 5.9**. In figure vertical axis represent the amount of treated textile effluent/day (liter) and horizontal axis represents industries. Here we can see that, the treated effluent for BTL is higher and for RKCL is lower. Because the dyeing capacity of BTL is high.

5.6 Comparison of per day chemical used:

Table 5.10: Per day chemical used (kg).

Sl.	**Name of the industry**	**Total chemical used in 60 days(kg)**	**Per day chemical used(kg)**
1	Divine Textile LTD	29460.1	491
2	Divine Fabric LTD	27497.2	458.2
3	Beximco Textile LTD	137105.75	2285
4	Raiyan Knit Composite LTD	25932	432.2

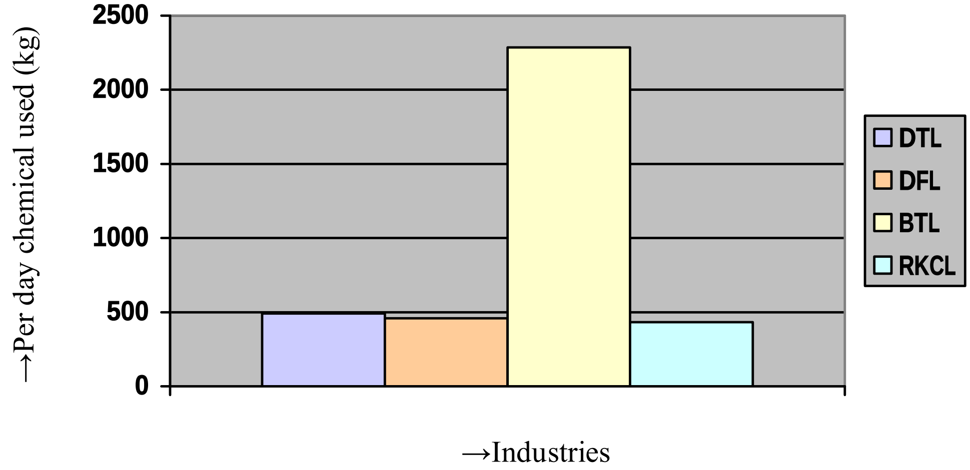


Figure 5.2: Bar diagram represents the comparison of per day chemical used (kg)

The above figure shows the comparison of per day chemical used (kg) among four industries. The data has been taken from **Appendix-A (Table- A1, Table-A2, Table-A3, Table-A4)**. In figure vertical axis represent the amount of per day chemical used (kg). Here we can see that, per day chemical used (kg) for BTL is higher and for RKCL is lower.

5.7 comparison of chemical cost/day (BDT):

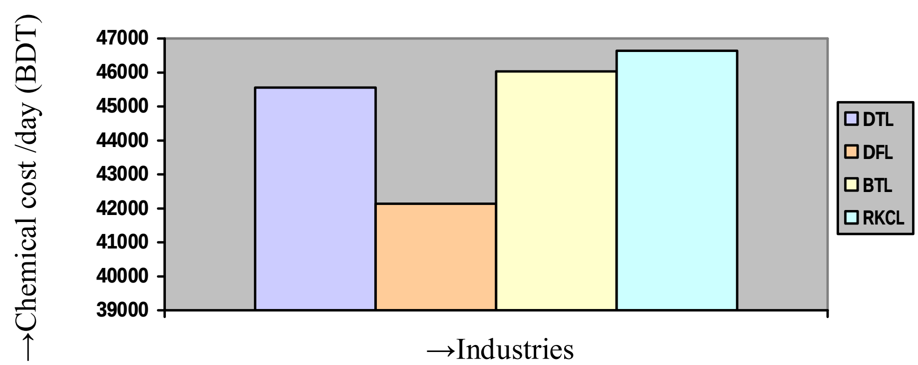


Figure 5.3: Bar diagram represents the comparison of chemical cost/day (BDT)

The above figure shows the comparison of chemical cost/day (BDT) among four industries. Here, the data has taken from **Table 5.9**. In figure vertical axis represent the chemical cost/day (BDT) and horizontal axis represent the industries. Here we can see that, per day chemical cost for RKCL is higher and for DFL is lower.

5.8 Comparison of wages/day:

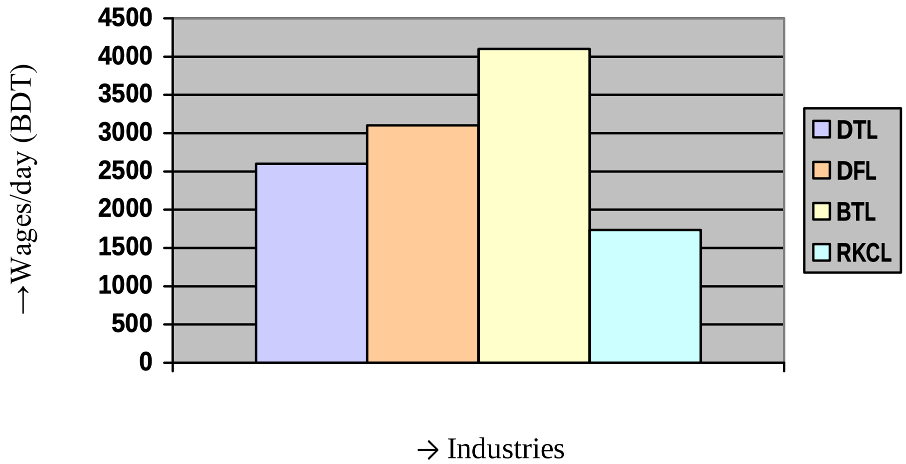


Figure 5.4: Bar diagram represents the comparison of wages/day (BDT)

The above figure shows the comparison of wages per day in BDT among the four industries. Data has been taken from **Table 5.9**. In figure vertical axis represents the amount of wages in BDT and horizontal axis is the industries. In figure we see that the maximum wages is paid by BTL because it has the maximum number of employee and lower amount of wages is paid by RKCL.

5.9 Comparison of total operation cost/day(BDT):

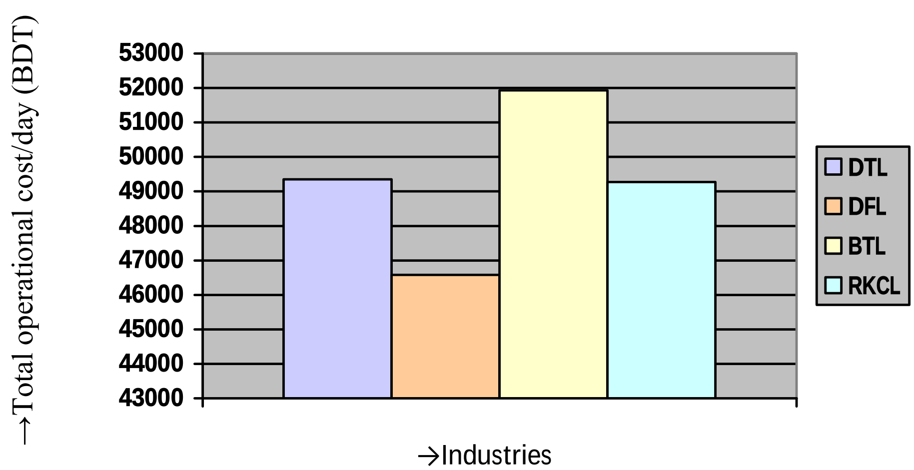


Figure 5.5: Bar diagram represents the comparison of total operational cost/day (BDT)

The above figure shows the comparison of total operational cost/day in BDT among the four industries. The data included here has taken from **Tbale-5.9**. In figure vertical axis represents the amount of operational cost/day in BDT and horizontal axis is the industries. In figure we see that the maximum operational cost/day is for BTL and lowest operational cost for DFL.

5.10 Comparison of Cost for $1m^3$ effluent treatment (BDT):

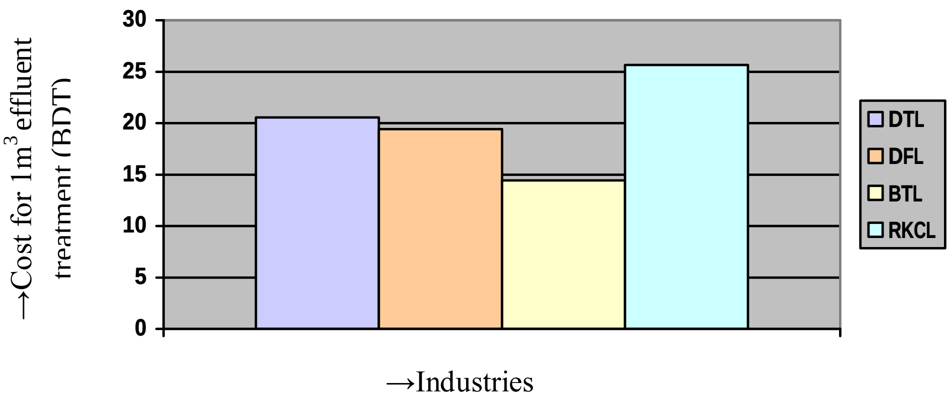


Figure 5.6: Bar diagram represents the comparison of cost for $1m^3$ effluent treatment (BDT)

Above figure shows the comparison of Cost (BDT) for $1m^3$ effluent treatment. Here all the data from **Table 5.9.** Here vertical axis represents the cost in BDT and horizontal axis represents industries. The figure shows that the Cost (BDT) for $1m^3$ effluent treatment for RKCL is higher and for BTL is lower.

CHAPTER 06

CONCLUSION

CHAPTER 06
CONCLUSION

Textile Dye house effluent is the major pollutant in our country. The waste water from dyeing industry destroys the aquatic life and impairs the agricultural growth. The rivers and other natural water sources of our country are now seriously polluted. We are producing vegetables and fishes with heavy metal content and after eating those we are facing several diseases like kidney damage, lever damage, cancer etc. The government of our country has imposed legislation by Gazette notification to control the environmental pollution by the waste water from textile dye house. Even now Effluent Treatment Plant (ETP) is mandatory to set up of any new textile processing industry. Without having proper ETP any new industry will not get gas connection. Government also has given a time frame to set up ETP for the old industries. Every industry is supposed to run their ETP continuously but practically most of the industries are not running their ETP continuously. In the day time when visitors are used to come or when any audit takes places, only that time ETP is kept running. All other time the effluent is directly discharging to the drain.

Generally there are three processes are practiced in our country; 1.Chemical process and 2. Biological process and there is also chemical and biological combined process. The combined process is most effective. In combined process the running cost of ETP is about BDT 15 to BDT 25 for per m^3 of effluent treatment. Though it is little expensive but still we think this is worthy to save our environment for the future generation. Everybody should have to think in this way and the authority should have to take proper action to impose legislation properly. Otherwise everybody has to be suffered due to adverse effect of dye house effluent and the environment will not be sustainable for our future generation.

All the information included in this report was collected authentically. The result we have found on the basis of four industries. If we were got more opportunity and time to collect the information from more industries and sources then we would get more authentic result from this research. However this thesis work will be very much beneficial for our future job life

APPENDIX-A

(Chemicals Consumption of ETP of Different Industries)

Table A.1: Chemicals Consumption in ETP of Divine Textile Ltd.

Date	Amount of Polyelectrolyte (in Kg)	Amount of PAC (in Kg)	Amount of Urea (in Kg)	Amount of Decolorants (in liter)
1/9/2014	1.2	200	1.0	300
2/9/2014	1.0	375	1.0	300
3/9/2014	1.2	300	2.0	390
4/9/2014	1.4	225	1.0	330
5/9/2014	1.3	230	1.0	240
6/9/2014	1.7	290	1.0	270
7/9/2014	1.6	240	2.0	300
8/9/2014	1.1	220	3.0	240
9/9/2014	0.1	225	2.0	340
10/9/2014	1.0	190	1.0	220
11/9/2014	1.0	300	1.0	240
12/9/2014	1.2	340	2.0	390
13/9/2014	1.3	390	1.0	330
15/9/2014	0.3	240	1.0	300
16/9/2014	1.0	250	1.0	240
17/9/2014	1.2.	300	2.0	390
18/9/2014	1.4	220	1.0	340
19/9/2014	1.0	340	1.0	300
20/9/2014	1.6	225	1.0	330
21/9/2014	1.0	300	3.0	390
22/9/2014	1.4	250	1.0	339
23/9/2014	1.2	225	1.0	240
24/9/2014	1.2	225	1.0	300
25/9/2014	1.2	200	1.0	240
26/9/2014	1.2	175	2.0	270
27/9/2014	1.2	175	1.0	390
28/9/2014	1.3	180	3.0	180
29/9/2014	1.4	200	1.0	240
30/9/2014	1.2	250	1.0	270
1/10/2014	1.0	225	1.0	270
2/10/2014	0.8	175	1.0	120
3/10/2014	0.4	50	3.0	60
4/10/2014	0.6	300	2.0	210

5/10/2014	1.0	240	1.0	180
6/10/2014	1.0	210	1.0	290
7/10/2014	1.2	190	1.0	390
8/10/2014	1.4	220	1.0	250
9/10/2014	1.3	250	2.0	220
10/10/2014	1.6	340	1.0	210
11/10/2014	1.0	200	1.0	210
12/10/2014	1.2	200	1.0	180
13/10/2014	1.2	275	1.0	210
14/10/2014	1.0	200	1.0	240
15/10/2014	1.2	225	2.0	390
16/10/2014	1.2	175	2.0	120
17/10/2014	1.2	250	1.0	180
18/10/2014	1.2	225	1.0	240
19/10/2014	1.2	225	1.0	180
20/10/2014	1.3	180	1.0	300
21/10/2014	1.4	180	2.0	290
22/10/2014	1.0	200	1.0	210
23/10/2014	1.0	240	2.0	190
24/10/2014	1.2	300	1.0	180
25/10/2014	1.6	220	1.0	320
26/10/2014	1.1	225	2.0	200
27/10/2014	1.0	180	1.0	180
28/10/2014	1.2	175	2.0	390
29/10/2014	1.4	200	2.0	250
30/10/2014	1.3	225	2.0	220
Total	**68.1**	**13780.0**	**83.0**	**15529.0**

Table A.2: Chemicals Consumption in ETP of Divine Fabric Ltd.

Date	Amount of PAC (in Kg)	Amount of Polyelectrolyte (in Kg)	Amount of Decolorants (in liter)
1/9/2014	175	1.2	240
2/9/2014	300	1.1	180
3/9/2014	200	1.1	180
4/9/2014	200	1.0	240
5/9/2014	225	1.3	240
6/9/2014	250	1.2	270
7/9/2014	175	1.4	300
8/9/2014	175	1.3	210
9/9/2014	250	1.3	270

10/9/2014	250	1.4	330
11/9/2014	175	1.4	180
12/9/2014	175	1.2	330
13/9/2014	200	1.3	300
14/14/2014	175	1.4	330
15/9/2014	225	1.4	490
16/9/2014	225	1.4	330
17/9/2014	200	1.4	300
18/9/2014	200	1.3	240
19/9/2014	175	1.2	180
20/9/2014	175	1.4	180
21/9/2014	225	1.4	240
22/9/2014	175	1.4	240
23/9/2014	300	1.5	270
24/9/2014	200	1.4	300
25/9/2014	200	1.4	210
26/9/2014	225	1.4	270
27/9/2014	250	1.4	330
28/9/2014	175	1.5	270
29/9/2014	175	1.4	210
30/9/2014	250	1.5	210
1/10/2014	250	1.5	210
2/10/2014	175	1.5	210
3/10/2014	125	1.4	150
4/10/2014	225	1.2	270
5/10/2014	175	1.4	225
6/10/2014	250	1.2	170
7/10/2014	275	1.4	200
8/10/2014	200	1.4	225
9/10/2014	175	1.3	170
10/10/2014	225	1.4	210
11/10/2014	100	1.4	120
12/10/2014	225	1.4	300
13/10/2014	300	1.4	270
14/10/2014	250	1.5	180
15/10/2014	225	1.5	270
16/10/2014	350	1.4	300
17/10/2014	275	1.5	180
18/10/2014	300	1.5	210
19/10/2014	300	1.4	210
20/10/2014	300	1.4	210
21/10/2014	300	1.4	150
22/10/2014	250	1.5	120
23/10/2014	175	1.5	300

24/10/2014	175	1.4	270
25/10/2014	125	1.4	180
26/10/2014	225	1.2	225
27/10/2014	200	1.4	200
28/10/2014	275	1.4	200
29/10/2014	200	1.5	225
30/10/2014	250	1.4	210
Total	**13175.0**	**82.2**	**14240.0**

Table A.3: Chemicals Consumption in ETP of Beximco Textile Ltd.

Date	Amount of Ferrous Sulphate (in kg)	Amount of Lime (in kg)	Amount of Polyelectrolyte (in kg)	Amount of Sulphuric Acid (in liter)
02-09-14	1250	400	3.25	400
03-09-14	1275	425	3.25	425
04-09-14	1200	400	3.00	425
05-09-14	1300	425	3.50	425
06-09-14	1275	425	3.25	450
07-09-14	1250	400	3.25	400
08-09-14	1250	400	3.25	400
09-09-14	1300	425	3.50	425
10-09-14	1425	475	4.00	475
11-09-14	1275	425	3.25	400
12-09-14	1325	450	3.50	425
13-09-14	1350	450	3.50	425
14-09-14	1250	400	3.25	400
15-09-14	1175	400	3.00	375
16-09-14	1225	425	3.25	425
17-09-14	1250	425	3.25	425
18-09-14	1250	425	3.25	450
19-09-14	1300	425	3.50	450
20-09-14	1375	475	3.75	475
21-09-14	1400	475	4.00	450
22-09-14	1425	475	4.00	500
23-09-14	1275	400	3.25	425
24-09-14	1300	425	3.50	450
25-09-14	1275	425	3.25	425
26-09-14	1300	425	3.50	425
27-09-14	1275	425	3.25	425
28-09-14	1325	450	3.50	450

29-09-14	1275	425	3.25	425
30-09-14	1425	475	4.00	475
01-10-14	1475	500	4.50	500
02-10-14	1500	500	4.50	500
03-10-14	1475	500	4.50	475
04-10-14	1525	500	4.50	500
05-10-14	1475	500	4.50	475
06-10-14	1425	475	4.25	450
07-10-14	1375	475	4.00	450
08-10-14	1325	450	4.00	450
09-10-14	1350	450	4.00	475
10-10-14	1275	425	3.25	425
11-10-14	1250	425	3.25	400
12-10-14	1375	450	3.75	450
13-10-14	1400	450	4.00	450
14-10-14	1450	500	4.50	475
15-10-14	1375	425	4.00	425
16-10-14	1450	500	4.50	450
17-10-14	1425	450	4.25	500
18-10-14	1350	450	4.00	425
19-10-14	1225	400	3.25	400
20-10-14	1250	425	3.25	425
21-10-14	1300	450	3.50	450
22-10-14	1200	400	3.50	425
23-10-14	1250	425	3.50	425
24-10-14	1375	500	4.50	450
25-10-14	1300	400	4.25	425
26-10-14	1400	450	4.25	450
27-10-14	1325	450	4.25	425
28-10-14	1475	475	4.50	475
29-10-14	1225	400	3.50	400
30-10-14	1200	400	3.50	400
31-10-14	1275	425	3.75	425
01-11-14	1300	425	3.75	450
02-11-14	1325	450	4.00	400
Total	**82275.0**	**27375.0**	**230.75**	**27225.0**

Table A.4: Chemicals Consumption in ETP of Raiyan Knit Composite Ltd.

Date	Amount of PAC (in kg)	Amount of Decolorant (in liter)	Amount of Polyelectrolyte (in kg)
2.9.14	125	210	2
3.9.14	125	120	2
4.9.14	150	120	3
5.9.14	150	180	1
6.9.14	125	180	1
7.9.14	25	70	1
8.9.14	100	190	1
9.9.14	150	180	2
10.9.14	75	170	4
11.9.14	200	180	3
12.9.14	200	330	2
13.9.14	125	210	2
14.9.14	125	120	2
15.9.14	150	120	3
16.9.14	150	180	4
17.9.14	125	180	4
18.9.14	150	270	4
19.9.14	150	150	4
20.9.14	150	180	5
21.9.14	150	180	6
22.9.14	200	270	6
23.9.14	175	180	6
24.9.14	200	300	5
25.9.14	200	270	5
26.9.14	150	180	5
27.9.14	125	210	6
28.9.14	175	180	5
29.9.14	125	210	6
30.9.14	225	180	6
01.10.14	175	150	6
02.10.14	150	240	6
3.10.14	300	240	6
4.10.14	250	330	6
5.10.14	200	300	6
6.10.14	175	270	11
7.10.14	150	210	6
8.10.14	200	240	3
9.10.14	350	440	4

10.10.14	225	240	3
11.10.14	250	270	5
12.10.14	225	270	5
13.10.14	225	240	6
14.10.14	200	330	6
15.10.14	225	270	6
16.10.14	175	240	4
17.10.14	150	440	3
18.10.14	300	240	5
19.10.14	175	270	6
20.10.14	150	210	6
21.10.14	200	240	6
22.10.14	350	440	11
23.10.14	225	240	6
24.10.14	250	270	3
25.10.14	225	330	4
26.10.14	225	240	3
27.10.14	200	270	5
28.10.14	225	270	6
29.10.14	175	240	4
30.10.14	150	440	3
31.10.14	300	240	5
01.11.14	175	270	6
Total	**11225.0**	**14430.0**	**277.0**

REFERENCES

[1] P.K. Goel, Water pollution- causes, Effect and Control, NEW AGE INTERNATIONAL PUBLISHERS, 2006

[2] Keith Slater, Environmental impact of textiles (production, process and protection), WOODHEAD PUBLISHING LTD, 2003

[3] M. Akhtaruzzaman, Alexandra Clemett, Jerry Knapp, Mahbubul A. Mahmood, Samiya Ahmed- "Choosing an effluent treatment plant"

[4] textilelearner.blogspot.comhttp://textilelearner.blogspot.com/2013/03/required-chemicals-and-their-functions.html(Retrieved date: 8th September 2014, Retrieved time: 8.41 PM)

[5] http://www.radheenterprise.in/poly-aluminium-chloride-1047578.html (Retrieved date: 10th September 2014, Retrieved time: 6.57 PM)

[6] http://water.me.vccs.edu/courses/ENV149/preliminary.htm (Retrieved date: 10th August 2014, Retrieved time: 10 pm)

[7] http://textilelearner.blogspot.com/2012/07/process-flow-chart-of-effluent.html (Retrieved date: 10th August 2014, Retrieved time: 11 pm)