Faculty of Engineering

Department of Textile Engineering

STUDY OF BIO-CHEMICAL EFFLUENT TREATMENT PLANT (ETP) IN ANANTA DENIM TECHNOLOGY LTD.

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Advance in Wet Processing Technology

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Sumon Mozumder,** 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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LETTER OF APPROVAL

This project report prepared by **Umme Salma Eti (Id:161-23-4652)** and **Md. Golam Moktadir (Id: 161-23-4574),** is approved in Partial Fulfillment of the Requirement for the Degree of **BACHELOR OF SCIENCE IN TEXTILE ENGINEERING**. The said students have completed their project work under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

14.12.19

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Finally, we would like to express a sense of gratitude to our beloved parents and friends for their mental support, strength and assistance throughout writing the project report.

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DEDICATION

This projects report is dedicated to our Beloved Parents

ABSTRACT

ETP or Effluent Treatment Plant is one of the most crucial parts of wet process. As Global warming is increasing at an alarming rate and we may lack water to use or

consume, ETP is a must for every factory with dyeing/printing/washing department. For this project we studied on biochemical treatment plant. We are working to know more about biochemical treatment plant, what procedures are used in this plant and what tests are done before discharging water. While working for this project we've found how much water is withdrawn every day, how much is used and how much is discharged. We took different tests of the discharged water to see is that was ready for discharge or not. We also studied the chemical consumption and cost. And we studied if the results met the government approved limit or not. The lab was rich with enough instruments and manpower to have an estimated result. All of the tests were done almost every day, only two of them were taken once a week. All the results are documented daily to overview at the end of the month. They had every day and months entry on their doc-book. We took 15 days of data, daily chemical consumption, water consumption for the processes and discharged water. Not all of the tests were taken daily, some of them such as BOD and COD tests were done only once a week. Then the results were compared to the government standard. The results were never out coming as fail, because the industry uses the chemicals in a limit and never let the chemicals exceed their limit. Once in every month audit on behalf of ITS comes to see the condition of discharged water as well as if the full process were being done according to proper measurement or not. We found the most used chemicals are PAC and PAM. And on average more than $2500m^3$ waste water is processed biochemically. And every day on average temperature is found near 29^0c, pH is found 7.44, BOD is found 18, COD 143, TSS 28.27 and TDS 798. These are average amount that are found on discharged water after treatment. To run the biochemical ETP, the industry spends taka 189,000 for electricity, taka 1164971for chemical and for maintenance 120,000After working on this project we've learned what procedures should be followed and what criteria should be used before discharging waste water.

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LIST OF ABBREVIATIONS

ETP- Effluent Treatment Plant

BOD-Biochemical Oxygen Demand

COD-Chemical Oxygen Demand

BSR- Business for Social Responsibility (BSR)

DOE-Department of Environment

DAP-Di Ammonium Phosphate

PAC-Poly-aluminum Chloride

PAM-Polyacrylamide

TDS-Total Dissolved Solids

TSS-Total Suspended Solids

pH-Potential Hydrogen

SS-Suspended Solids

DO-Dissolved oxygen

CHAPTER-1

INTRODUCTION

CHAPTER-1
INTRODUCTION

To expedite disinfection, chemicals are used during wastewater treatment in an array of processes. Chemical reaction included chemical process are called chemical unit process which are used alongside biological and physical cleaning process to achieve various water standards.

Specialized chemicals such as poly aluminum chloride, polyacrylamide, ferrous sulphate, decolor etc. all these are used for different function like coagulation, flocculation, to remove water odor and color etc.

During cleaning, chemical coagulation, chemical precipitation, chemical oxidation, and advanced oxidation, ion exchange, and chemical neutralization and stabilization can be applied to wastewater [1].

1.1 Objectives of the study

The broad objective of the thesis work is to study on bio-chemical effluent treatment plant (ETP) the specific objectives of the work are as follows-

- To learn about bio-chemical treatment plant (ETP).
- To know different chemicals used in bio-chemical plant (ETP).
- To know treatment cost of bio-chemical plant (ETP) and cost of power consumption of ETPs.
- To know average amount of waste water that are processed and average chemicals are used on each day and in a month to run an ETP.

CHAPTER-2

LITERATURE REVIEW

CHAPTER-2
LITERATURE REVIEW

2.1 Effluent Treatment Plant

To protect the environment from the hazardous effect of waste water from textile industry, industries started setting ETP in their areas. So that no waste water can harm no biological creature.

On ETP the treatment of industrial effluents and waste waters is done. ETP plants are used vastly in the industrial sectors.

During the manufacturing process, varied effluents and contaminants are produced. Effluent treatment plants are used in the removal of high amount of organics, debris, dirt, grit, pollution, toxic, non-toxic materials, polymers etc. from waste water .ETP plants use evaporation and drying methods, and other auxiliary techniques such as centrifuging, filtration, incineration for chemical processing and effluent treatment.

Effluents are generated of extremely by textile wet process, variable composition and constitute an environmental risk specially water pollution of major concern. Rapid disposal of untreated water disturbs the ecosystem.1250 m3 of effluent is produced each day by any 10-ton capacity composite factory. which contains chemicals including salts, dyes and bleaches. Under the 1997 rules fabric dyeing and chemical processing “Red industries” are bound to use effluent treatment plant [2].

2.2 Types of ETP

Biological ETP

Biological Growth Equation’s=(λS)/(KS+S) BB1

μ = Specific Growth Rate Coefficient

λ = Max growth rate

S= Concentration of limiting nutrient

Ks= Monod Coefficient

Organic + Bacteria + Nutrients + Oxygen → New Bacteria + CO_2+H_2O+ Residual Organics + Inorganics

The activity of bacteria is affected by several environmental factors. As well as the rate of biochemical reaction. Toxic materials, nutrient concentration, dissolved oxygen, pH, temperature are the most important factors. These all can be controlled by the biological treatment system named bioreactor, to make sure that the growth of microbial is under maintenance of bioenvironmental condition. For biological treatment the optimal temperature ranges from 20-40^0 Celsius. Aeration tank and filters operate at 12-25 degree Celsius. The air temperature rate has an important and outstanding effect on heat loss. High temperature increases the biological activity, which helps to increase the substrate removal rate. But sometime it may cause problem with oxygen limitation [3].

Advantages of biological ETP:

1. In this ETP no toxic chemicals are used
2. Eco-friendly and lower maintenance cost.
3. Sludge can reuse in this ETP
4. High degree of efficiency

Disadvantages of biological ETP:

1. Large amount of space is required
2. Initial investment is higher.
3. Presence of highly toxic heavy metals prevents microorganism growth.

2.3 Biochemical ETP

By adding acid or alkali or by changing temperature or by precipitation as solid, dissolved inorganic compounds are removed usually. Then the precipitate is removed either by sedimentation, flotation or other solid removal process. Coagulation, Flocculation are implemented and recommended for substituting the chemical precipitation process by phytoremediation.

2.4 Neutralization:

Controlling of the pH of wastewater, no matter if its acidic or alkaline. If there is not sufficient alkali an addition of base is required to adjust pH to reach an adjustable range.

CaO, $Ca(OH)_2$, $NaOH$, Na_2CO_3, these are usually used for adjusting the pH. And for the lack of acidity base addition will be of H_2SO_4, H_2CO_3 and other common chemicals [1].

Advantages of biochemical ETP:

1. Less space is required for this ETP
2. Very good treatment efficiency.
3. Initial cost is lower.

Disadvantages of biochemical ETP:

1. Different chemical is used in this ETP which may have adverse effect on environment
2. Maintenance cost is higher.

2.5 Properties Tested

Water Color Test/ Jar test

The Color of discharged water is tested first at a small amount to make sure how much of the chemicals might require for the bulk discharged water.

TDS

Total dissolved solids (TDS) is a measure of dissolved content of all types of inorganic and organic substances that are in a liquid in either molecular, ionized, or micro-granular suspended form.

pH

pH is a scale used to measure how acidic or basic a water-based solution is. Acidic solutions have a pH of 0-7, on the other hand basic solutions have a high pH. At room temperature (25°C), pure water has a pH of 7.

Suspended Solid

Suspended solids are small solid particles which are found in suspension of water as colloid, these can be removed by the sedimentation due to their large size. It is commonly known as one indicator of water quality.

COD

Chemical oxygen demand (COD) is measurement of amount of oxygen that can be consumed by reactions. It is commonly expressed in mass of oxygen consumed over volume of solution in milligrams per liter (mg/L). A COD test can be done to easily measure and quantify the amount of organics in water [3].

BOD

Biochemical oxygen demand (BOD) represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic (oxygen is present) conditions at a specified temperature [4].

2.6 Industrial processes which contributes to wastewater:

Desizing:

Removal of size applied during denim fabric making in warp yarn is known as desizing. In sizing process starch, wax, CMC, and polyvinyl alcohol is used The size is applied to all woven fabrics to strengthen the yarn for weaving.

In many types of sizes there are two major groups:

- Water-soluble carboxy-methyl cellulose
- Water-insoluble starch-based sizes.
- Starch-based sizes are commonly used due to their low prices and availability.

Methods for removing sizes from denim jeans are:

- Garment washing with high alkaline agents
- Garment washing with highly acidic agents
- Garment washing with oxidative chemicals

Stone washing:

One of the most used basic process that can be used alone or combined with other processes to obtain warp specific effects is stone wash. Indigo dyes do not penetrate into the fiber, and the dyed surface fiber is removed by abrasion of the stones on the fibers. The stones and denim are spun together in industrial washing machines to gain an aged and worn out appearance because of abrasion. This process removes the surface reveals the white interior of the yarn, enhances the hand of products and produces a bright appearance. Pumice stones of various sizes create different fades. Variations can be achieved by changing the amount of liquor ratio, garment load, size and shape of stones, number of stones, cycle time, and chemical addition. As a result, the fabric undergoes various cleaning, rinsing, softening and drying processes [5].

Enzyme washing:

Enzyme washing is a new method and has almost replaced stone washing. In denim fabrics, because of an enzymatic abrasion, dyes are released from yarns, giving contrasts in blue color. The fibrillation produced while ageing process is the result of the action of cellules and mechanical action. The pumice stones damage the washing machine and reduce the strength of fabric because of abrasion in the stone washing process. Celluloses prevents damage to the machine and garments, removes the time for removal of used stones, increases the amount of garments in the washing machine and improves the quality of wastewater [5].

Acid washing:

Sodium hypochlorite, potassium permanganate or bleach solutions with the pumice stones and then tumbling similar to stone but washing with small amount of water to obtain lighter colors. Frost, ice or white washed jeans are obtained with these acid wash application techniques. Acid wash too has the tendency of yellowing, so it needs to neutralize as well [5].

Tinting and overdyeing:

Demand for tinted and overdyed looks on garments are one of the most common trends. An additional dyeing process is brought to dye the garment partially or completely. These are usually carried out after the washing processes, to give the final denim a dirty, vintage and worn out look. Jeans are dyed partially by using direct dyestuffs during tinting, Overdyeing is the process of dyeing the whole garment with reactive dyestuffs or metal complex dyestuffs [5].

Spray applications:

Spraying is different method by applying the chemical only to the surface and to the desired parts of the denim garment. Air pressurized hand guns are used to spray the chemical on the surface of garments, which are placed on inflated vertical mannequins. Different chemicals are sprayed for different purposes. Instead of manual spraying, spray robot machines are now widely used in the laundries. The robot sprays chemical in right position and in right amount on all of the jeans in the batch, and therefore same effects will be obtained after the washing procedure. This standardizes the spraying process to ensure standard quality. Potassium permanganate is used to partially create contrast and a variety of effects. It is applied especially on sanded parts of the garment to increase the contrast. After this process, they are neutralized, rinsed, softened and dried.

Polyurethanes are sprayed for coating purposes, to obtain a leather like look and to increase the durability of the garments. Micro-silicones and fatty acids are used as spraying chemicals to obtain an extremely soft handle. In the overdyeing of one color over another, pigments are sprayed to color only the outside of the garment. Resins are also applied by the spraying technique to make the fold's permanent in desired parts of the jeans, to give 3D crease effects, to obtain easy care products, etc. [5].

Bleaching:

Denim garments bleaching means lightening the color of the indigo dyed garment. Sodium hypochlorite, calcium hypochlorite, hydrogen peroxide and potassium permanganate are applied to lighten the garments. Bleaching can be applied instead of stone washing, sometimes together along with stone washing. To stop yellowing effect, neutralization is a must after bleaching. And to prevent any kind of crease mark or yarn damage, garments or fabrics must be stored carefully. The waste water from bleaching as well as neutralization contributes to the ETP waste water inlets [5].

Scouring:

Scouring is an important treatment before fabric dyeing, to remove oil fat and wax from fabric we apply this process, by using caustic soda which is highly alkaline and this water contains oil, grease, fat and wax [5].

Dyeing:

In dyeing different dyes, mordents, reducing agent, acetic acid, alkali, salt is used. This water contains Dissolved solid, highly colored, high COD [5].

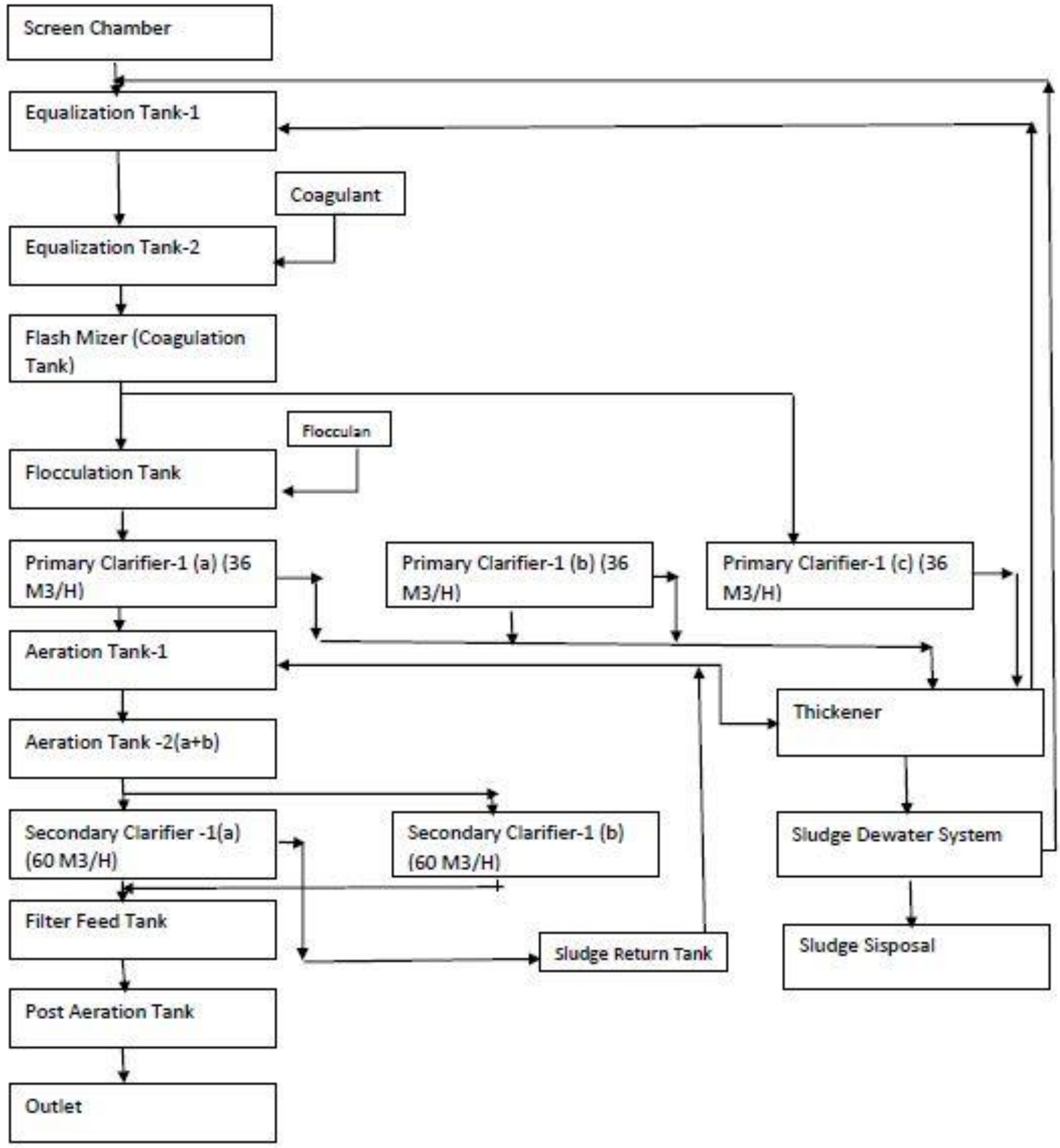
Printing:

In printing process different types of print paste is used and starch, gums, oils, acid and soaps are used. which are highly colored, high COD, oily and contains suspended solid [5].

Finishing:

In textile finishing different types of fabric softener and inorganic salts is used which are highly alkaline and low BOD [5].

2.7 Flowchart



2.8 Process Description:

2.8.1 Greet Removal:

This is used to remove materials like small stones or sand particle from waste water. Large particles get mixed with water and clogs the drainage system. And the particles can create 1.2-2.5 mm holes. This is why greet removal is done [6].

2.8.2 Oil and grease unit:

Though all ETP do not has the oil removal unit, it’s a must for some industries [6].

2.8.3 Equalization tank:

Industrial waste includes the water parameters such as COD, BOD, SS are screened, then they are settled in equalization tank. Here, different liquids from different sectors are mixed, then their concentration is made lower. In an equalization tank, pH can be balanced, color of waste water can be changed into light color. Hydraulic retention of this tank must be minimum 8 to 10 hours. Air bower and diffuser converts all the materials in same concentration for oxidation, the bio organisms start to rot away. As well as the temperature increases a bit. Temperature increases 10% - 20%. The biological process happens in optimum temperature. Pre-aeration accelerates the reduction of ammonia. And as a result nitrification happens on the liquid [6].

2.8.4 Flush mixer:

In this tank, the waste liquid is treated in three steps.

- Chemical mix
- Coagulation
- flocculation

Process: For coagulation and flocculation chemicals are mixed separately. For Hydraulic retention time should be 5 to 10 minutes. Each chemical should be dosed separately. pH limit is 8.5 -9.5. In this tank the color of the waste water changes and suspension of solid waste can be found. These are called flocculants. The size of a good flocculent is 0-0.1 mm [6].

2.8.5 Primary Clarifier:

The flocculants are turned into suspension here. There are two types of clarifier. Bridge clarifier and round clarifier.

Its hydraulic retention time is 3-4 hours. Suspensions are found on the bottom of this tank. The size of the flocculants here are 0.1 to 3 mm. Fiber sheets are used under it, which should be cleaned once a week, and after every 15 days, fiber sheets need to be changed. Sludge's bottom of it are removed after every 1 to 2 hours. Water temperature should be between 30-35^0 Celsius. For the floating waste, a V-notch is used. And water overflow should be maintained. And sludge setting should be maintained here [6].

2.8.5 pH adjustment:

If the pH of waste water is not neutral, or more or less than 7 or 8, pH has to be maintained. If pH is under 7, it'll have to be balanced by alkaline chemicals. And if it's over 7, it needs to be neutralized with acidic solution [6].

2.8.6 Aeration tank:

In this tank, bacteria culture and bacteria waste water treatment is done. This tank is called aeration tank because air is supplied here by a diffuser with the help of a blower. Hydraulic retention of this tank should be between 12-24 hours. Bacteria can be live properly because of proper air supply.DO here should be between 2.5- 4 ppm. In this tank aerobic and facultative bacteria are present. For bacteria activity, nutrition is a must. Such as urea, DAP, Potassium, Calcium. pH limit is 7.5-8. Temperature must be 29-32 degree Celsius [6].

2.8.7 Secondary Clarifier:

From the biological tank, some biogas and floating bacteria are transferred into this clarifier. In this tank activated sledges are gathered. From this tank some sludge are recycled. And some sludge is sent to sludge thickener. Hydraulic retention is 3-4 hours [6].

2.8.9 Sludge thickener:

In this tank, sludge from primary and secondary clarifier are brought. Hydraulic retention time is 45 minutes to 1 hour. Every day sludge dewatering should be done for 2 to 3 times. In this tank aeration filter is used [6].

2.8.10 Multi grade sand and activated carbon filter:

It clears the water, and reduces the amount of suspended solids. Reduces a small amount of TDS. This tank should be backwashed twice a day [6].

2.8.11 Post aeration:

In this tank, DO is increased by aeration. Hydraulic retention time should be 30-40 minutes [6].

CHAPTER-3

METHODOLOGY

CHAPTER-3
METHODOLOGY

3.1 Chemicals used to for the treatment of waste water:

- FeSO4
- Potash
- Lime powder (CaO)
- Poly Aluminum Chloride
- Water decoloring agent
- Poly acrylamide
- Poly electrolyte
- Polymer (Anionic)
- Urea
- DAP
- Sodium Hypochlorite (NaOCl) (15% solution)

3.2 Functions of the chemicals:

$FeSO_4$: Ferrous sulphate can increase the sludge quantity. The water content within the sludge gradually decrease. Then the sludge is added in the coking charge [7].

Potash: Potassium permanganate is used vastly in water treatment. It acts as a regeneration chemical to remove iron and hydrogen sulfide from well water [7].

Lime powder (CaO): Lime water is to remove water hardness from the waste water [7].

Poly Aluminum Chloride: Poly aluminum chloride known simply as PAC, is used as a coagulant in water purification. It is more effective at destabilizing and removal of suspended materials than other aluminum salts. PAC increases the speed of flocs forming and settling makes quicker. Flocs formed are easy to filter from the waste water [11].

Water decoloring agent: Water Decoloring Agent is a type of high efficient decolorizing flocculants which is a color removal chemical and a special product for de-coloring, flocculating. Water decoloring agents can be used both before or after the biochemical treatment. It is suggested to be dosed after the biochemical treatment which can be with low consumption, and low effect to the bacteria [7].

Poly acrylamide: The PAM as a chemical act as flocculating agent to wastewater causes suspended particles in wastewater to aggregate, forming what is known as a floc. And again PAM products react with water and form insoluble hydroxides, trapping small particles into a larger floc. As a result, floc can be filtered or removed more easily [10].

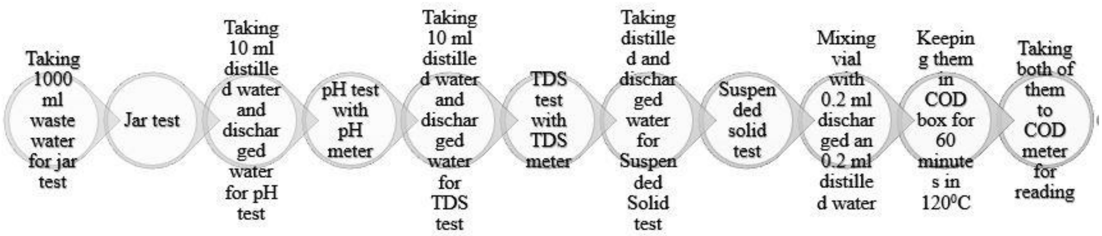
Polymer (Anionic): Polymers are used to coagulate suspended solids and produce large curds of solid materials (floc) [7].

Urea: Adding urea increases the bacterial growth which is later helpful for coagulation and flocculation [7].

DAP: DAP is also used for the of bacterial colony [7].

Sodium Hypochlorite (NaOCl) (15% solution): It's used for water purification mainly. Any kind of bad odor, bleaching smell, can be removed by using sodium hypochlorite [7].

3.3 Lab tests:



3.3.1 Water color test/ Jar test: At first the waste water of previous day is collected. 1000 ml water is taken, and 5 ml decolor and 12ml PAC is mixed. Then the solution is mixed at 80 r.p.m. for 10 minutes. After 10 minutes the solid particles start to precipitate.

According to this test, the lab manager decides how much PAC and decolor will be needed for bulk waste water.

Fig.3.1: Jar test

3.3.2 Measurement of TDS: TDS is measured with a TDS meter. Here, they use the water that is going to be discharged, not the waste water. After the result they match it with the standard result and take decision of discharging it.

Fig.3.2: TDS and pH meter

3.3.3 Measurement of pH: pH is also measured with a pH meter. The reading is taken from discharged water. The result is compared to the standard.

3.3.4 Measurement of SS: For suspended solid both discharged water and distilled water are needed. On the meter, distilled water is used for calibration. After calibration is done, discharged water is placed in the box and result is compared to the standard.

Fig.3.3: Suspended solid measuring instrument

3.3.5 Measurement of COD: COD is done only once a week. COD test is the costliest of all tests. To test COD there is two instrument.

3.3.6 Test with vial: Vial is a solution of potassium dichromate. For vial test, two tubes of vial are used. One will contain vial with 0.2 ml of distilled water, and other will contain vial with 0.2 ml of discharged water.

After they are mixed, the temperature increases in the tubes immediately. The tubes are then kept inside a compact glass jar. There both tubes are kept for 30 /60/ 120 minutes for 100/120/150^{0}C temperature.

After that, they are kept 60 minutes to be cool. After cooling they are taken to COD meter. Where at first calibration is done with distilled water, and then reading of discharged water is taken. Then compared to the standard.

Fig.3.4: Vial

Fig. 3.5: Vial placement with discharged and distilled water

Fig. 3.6: COD measurement

3.3.7 Measurement of BOD: BOD test is the lengthiest test of all. It almost requires 5 days to give a result. BOD test is done inside a glass bottle. Where 244 ml water is taken. Then Nitrification drop 5ml is added inside the bottle with water, and 5 drops of potassium is added on the cap of the bottle.

Then the bottle is kept inside the BOD machine at a low temperature. After 5 days the result is taken and compared.

Fig.3.7: Glass bottle with distilled water and nitrification

Fig. 3.8: BOD measurement

CHAPTER-4

DISCUSSION OF RESULTS

CHAPTER-4

DISCUSSION OF RESULTS

4.1 Quantity of incoming water to ETP inlet

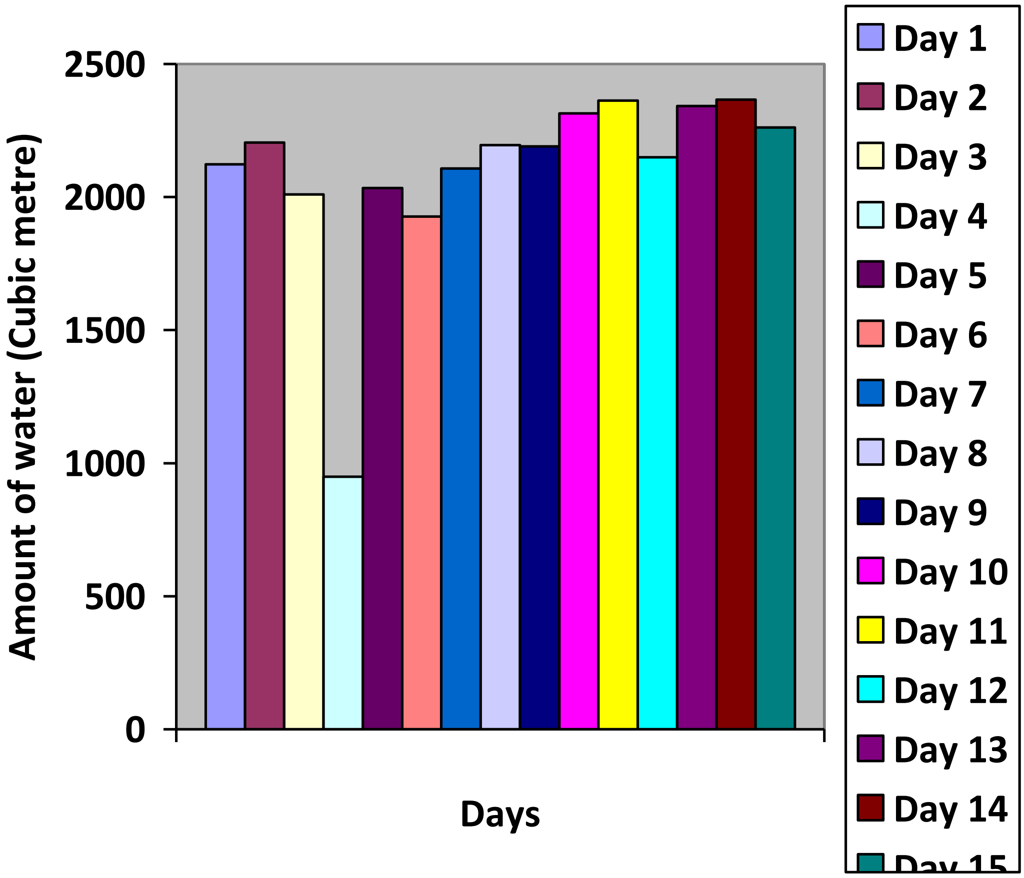


Fig. 4.1: Waste water being processed each day

Figure 4.1 shows a bar graph. This graph shows amount of waste water being processed each day in 15 days.

On day 14 amount of processed water was the most. It almost reaches 2500m^3. Though not every day processed water was this high.

Some days show a very little amount of waste water process, such as day 4. Here the processed water barely reached 1000m^3. Which is less than half of day 14. However, the graph shows how much water was daily processed in 15 days, the amount of water may vary depending on amount of water is being wasted by garment washing processes.

The waste water that come to be processed, cannot be processed fully as the calculation is done in 24 hours' basis, as soon as the 24th hour ends, the amount of water that left on the tank is usually counted as waste water to be processed in a new day, new hour.

Table 4.1: Quantity of incoming water to ETP inlet

Days	Waste water including previous day (m^3)	Waste water for treatment (m^3)	Processed waste water(m^3)	Waste water left to be added next day (m^3)
Day 1	2015	2418	2123	295
Day 2	2137	2432	2205	227
Day 3	1985	2212	2010	202
Day 4	885	1087	949	138
Day 5	2232	2370	2034	336
Day 6	1964	2300	1927	373
Day 7	2035	2408	2107	301
Day 8	2309	2610	2195	415
Day 9	2003	2418	2190	228
Day 10	2193	2421	2315	106
Day 11	2504	2610	2363	247
Day 12	2403	2650	2150	500
Day 13	2060	2560	2342	218
Day 14	2582	2800	2366	434
Day 15	1978	2412	2261	151

Table no 4.1 shows how much waste water is processed per day. It's showing data of 15 days. We can see at day 2, quantity of waste water sent for treatment is 2432 m^3, but water is processed in 24 hours 2205 m^3. Rest 227m^3 will be added with the waste water that'll be sent for being processed at day 3. The amount of water sent for treatment is more than the actual waste water is being treated is because it's calculated as 24 hours. After 24 hours some waste water are still on process, those are added to the next hour. Which actually leads to next day calculation. And the quantity of waste water incoming for processing varies day to day depending on how much waste water is being generated each day.

4.2. In house waste water test result:

These are the weekly test result of waste water. Every test is done according to their test process. After test if we see the result is more than BSR and DOE limit then we have to treat again to follow those limits we can see the reduction of temperature as per BSR and DOE limits [9].

Table no 4.2: Reduction of temperature as per BSR and DOE limits

Test parameter		TEMPERATURE	pH STANDARD	Biological oxygen demand (BOD)	Chemical oxygen demand (COD)	Total suspended solid (TSS) 8am	Total suspended solid (TSS) 6pm	Total dissolve solid (TDS) 8am	Total dissolve solid (TDS) 8am
BSR limit		37 °C	6.0-9.0	30mg/L	200mg/	30mg/L	30mg/L	2100mg /L	2100mg /L
DOE limit		40 °C	6.0-9.0	50mg/L	200mg/	-	-	2100mg /L	2100mg /L
Day 1	in	41 °C	7.54	15 mg/L	139mg/L	30	28	841	878
	out	30 °C							

Day 12		Day 11		Day10		Day9		Day8		Day7		Day6		Day5		Day4		Day3		Day 2	
in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out
40	24	41	30	40	30	34	24	40	24	41	30	40	30	41	32	34	24	40	30	40 °C	30° C
7.45		7.51		7.27		7.38		7.41		7.45		7.58		7.56		7.48		7.51		7.47	
21mg/L																					
148mg/L																					
30		24		28		29		28		26		27		28		30		32		31	
24		27		22		26		27		28		28		26		28		25		27	
767		758		700		825		745		765		725		862		871		900		881	
750		778		711		871		781		772		742		841		892		879		889	

Day 13	in	41	7.52			24	28	754	781
	out	31							
Day 14	in	34	7.46			30	24	811	821
	out	28							
Day 15	in	41	7.42			27	28	773	778
	out	30							

From this table 4.2 we can find the limits of foreign materials that can be found in water after wet process of fabric or garments. We can find different temperature in different days and as well as different amount of martials differ from each day. But none of them crossed the BSR or DOE limit. [9]

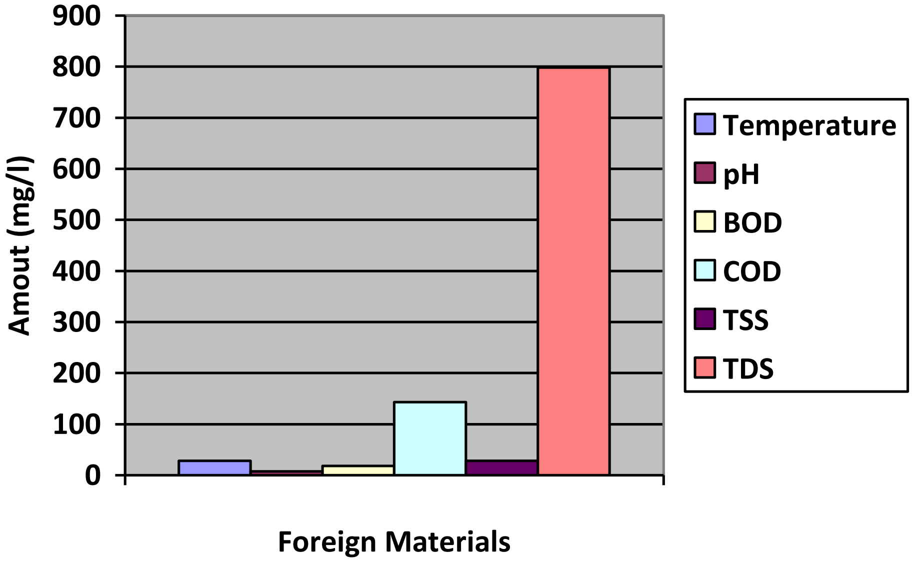


Fig. 4.2: Amount of foreign material found in each day (average)

Fig 4.2 is a bar graph. Here, this graph shows average amount of foreign material found each day in waste water.

We can see TDS is found more than other factors. It almost reached 800. But as DOE and BSR allows TDS till 2100, this amount of TDS that the graph's showing is safe. The least rise is shown in temperature and pH. Temperature average is about 30-31^{o}C.

And pH varies from 7-8. Comparing to the other factors, rise in pH is less and does not make that much difference. Comparing to the pH BOD is found the second least property in waste water. COD only can be measured 4 or 5 times a month, the result is not alarming but still it's found in waste water.

From the graph we can see almost every foreign material are present from waste water. But none of them cross neither the DOE nor the BSR limit.

4.3 Quantity of Chemical used:

According to the types of water different chemical is used in ETP and their quantity is also varying from each other. we already know that different types of impurities present in industrial waste water, an increase of impurities also increase the amount of chemical required to minimize those from water. Here Table 4.2 shows the chemicals quantity used in monthly basis.

Table no 4.3: Monthly chemical used in ETP

Days	Polyacrylamide (in kg)	Poly aluminum chloride (in kg)	Amount of ferrous sulphate (in kg)	De-foaming (in kg)	Sodium hypochlorite (NaOCl) (in kg)	Decolor(Lime powder) (in kg)
Day 1	10	600	600	6	4	18
Day 2	10	600	600	5	4	20
Day 3	04	600	600	4	4	16
Day 4	10	600	600	4	6	10
Day 5	10	600	600	5	5	12

Day 6	10	600	600	4	5	10
Day 7	10	600	600	6	4	16
Day 8	10	600	600	5	4	18
Day 9	10	600	600	6	4	18
Day 10	10	600	600	5	4	20
Day 11	10	600	600	6	5	20
Day 12	10	300	300	4	6	16
Day 13	10	600	600	5	4	18
Day 14	10	600	600	6	2	20
Day 15	10	600	600	5	2	20
Total amount	154	9000	9000	76	63	252
Average each day chemical consumption	10.26	600	600	5.07	4.2	16.8

Table 4.3 shows how much chemical is daily consumed by ETP. The most consumed chemical is PAC and poly acrylamide. The least used chemical is NaOCl. Which is near the consumption of de-foam.

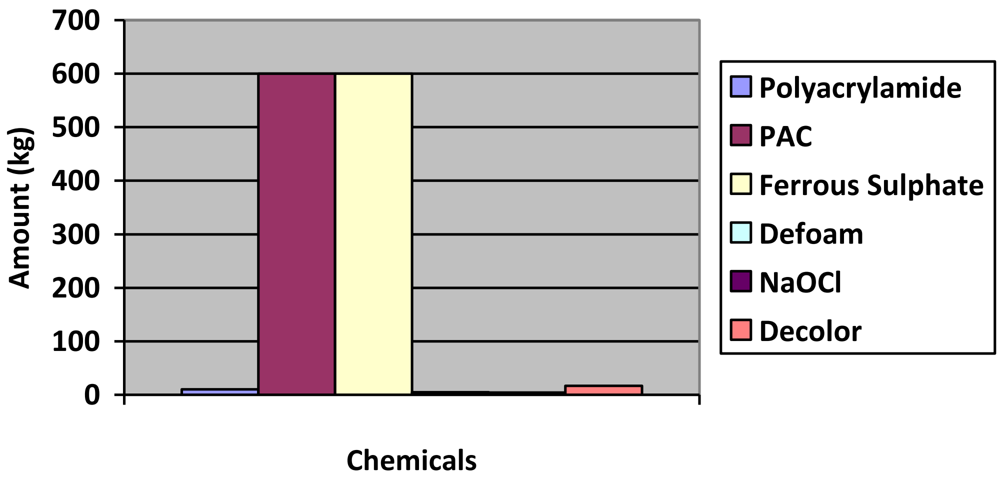


Fig. 4.3: Average chemical used per day (kg)

Figure 4.3 shows a bar graph which represents chemicals used on each day on average (in kg).

The most used chemicals are PAC and Ferrous Sulphate (Salt). Ferrous sulphate can increase the sludge quantity. PAC is used as a coagulant in water purification. It is more effective at destabilizing and removal of suspended materials than other aluminum salts. PAC increases the speed of flocs forming and settling makes quicker. Flocs formed are easy to filter from the waste water. This is why these two are used more than other chemicals.

Both PAC and Ferrous Sulphate are used about 600 kg per day. Whereas least used comparatively less than every other chemical.

Decolor is used more than NaOCl and PAM, it's near 50 kg per day. However, the chemicals are used to run the treatment plant without creating any hazard in the environment. This much chemical per day helps to discharge hazard free water that does not harm the environment.

4.4 Comparison between the amount of chemicals used

Total amount of chemicals used in ETP for one month are given above data table. So we can see the highest used chemical from a pie chart.

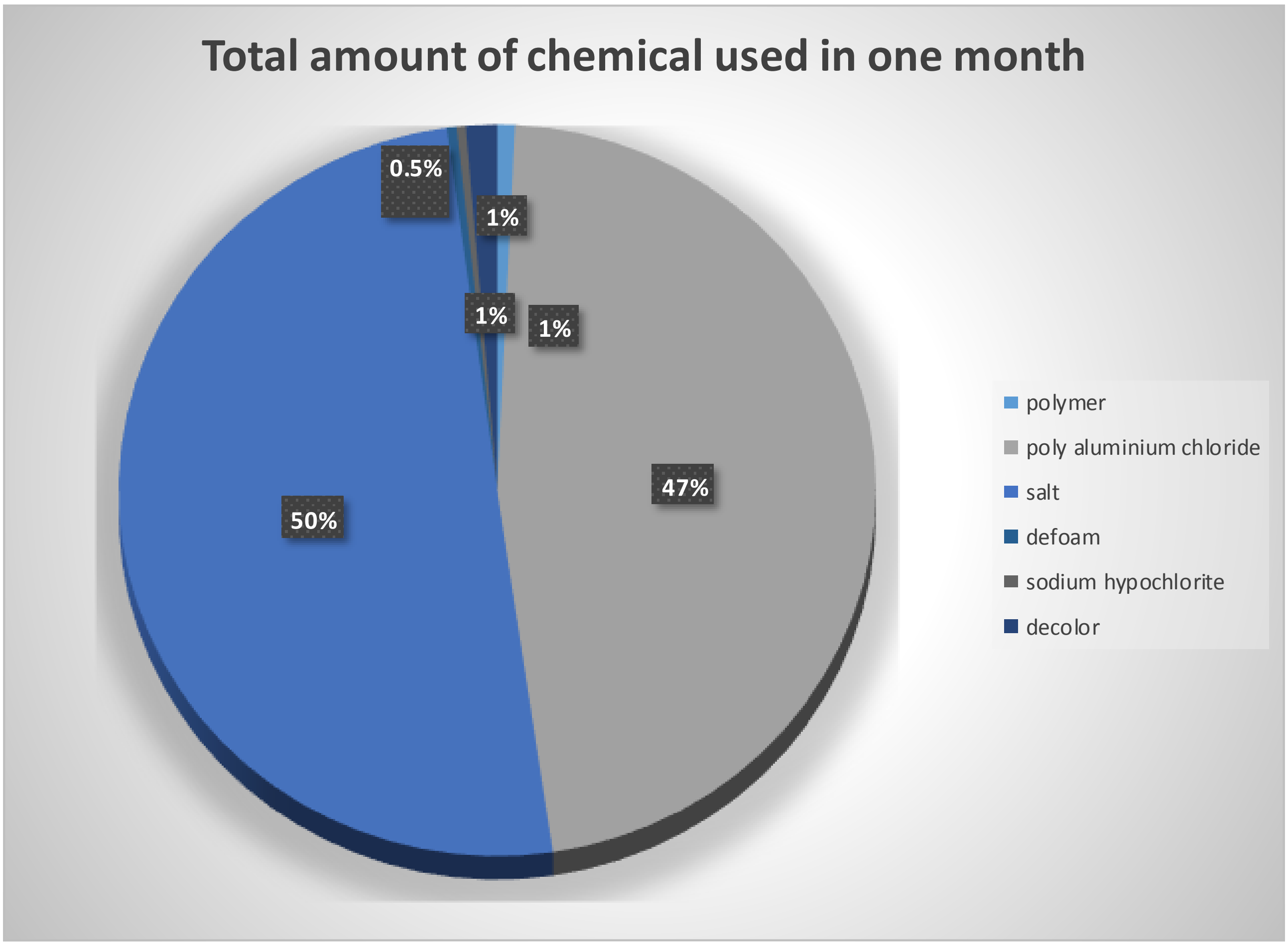


Fig. 4.4: Comparison between the amount of chemicals used

Figure 4.4 is a pie chart, showing percentage of different chemical used in a month.

Here we can see that the highest used chemical is salt 51% and second is poly aluminum chloride is 48%.

In comparison we can see poly aluminum chloride and salt are two most used chemical in large scale. Where sodium hypochlorite is used the least amount following by de-foaming agent. As we saw in our daily chemical consumption chart, the amount of most used chemical was PAC and salt, this pie chart however shows the same percentage as day consumption.

It shows the percentage of chemical that might be used in any biochemical water treatment plant.

4.5 Cost of chemicals and electricity

This study, focused on investigating the best economic effluent treatment plants is about chemicals costing that are used in a Bio-chemical treatment plant [10]. Here we can see that price of lime powder per kilogram is about 30 Taka and then we calculate them for monthly costing, for every chemical we found the costing from their amount that are given in table 4.2. To run a Bio-chemical ETP we also need electricity and maintenance cost.

Table 4.4: Cost of chemicals

Name of the chemicals	Price per kilogram (in Taka)	Price per month for total chemical (in Taka)
FeSO4	30	567000
Lime powder (CaO)	13	126750
Poly Aluminum Chloride	21	370650
Water decoloring agent(Lime powder)	66	33330
Poly acrylamide	94	22936
Poly electrolyte	120	24000
Urea	16	6400
DAP	27	13905
Total chemical cost per month		**11,64,971 BDT**

4.6 Some other cost:

- We found that average electricity cost to run an ETP is Taka 630 per day
- Annual electricity cost is Taka189,000
- Annual maintenance (Repair or instrument) cost Taka 120,000

CHAPTER-5

CONCLUSION

CHAPTER-5

CONCLUSION

After completing this project, we have come to know what factors should be considered while using an ETP, we've learned which parameters are tested of a treatment plant. And which tests are brought to test in the effluent as well as the discharged water. We also learn about the types of chemical used in ETP and their function and costing.

- In the bio-chemical treatment plant of ADTL on average more than 2200m^3 waste water is processed in 24 hours. The ETP runs for 24 hours. If the amount of waste water is about 2400m^3 in 24 hours, not all of them can be processed. About 2000/2100m^3 can be processed in 24 hours. And the rest is added in next hour, which is entered in next day data.
- The amount of waste material that are found, TDS is found the most. Though in both DOE and BSR limit, TDS's limit is 2100mg/l, so 800mg/l is safe. BOD and COD can only be measured once in a week, as they both require time. Yet these also do not cross the BSR and DOE limit which is 30mg/l and 200mg/l respectively. On average we only found BOD 18mg/l and COD 143mg/l, which is eventually on the safe side. And rise in temperature and pH shows no abnormality. There is a very little rise in temperature, and pH is near to the neutral value.
- In case of chemical cost and power consumption, it can be seen that about 11, 64,971 takas are spent in one month for chemical, for maintenance cost about 120,000 takas and for electricity about 189,000 takas are spent in a month. ADTL not just only bear the whole properly cost and do all the tests but also every month ITS visits once to get monthly report about the treatment process and the quantity of materials that are found.

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