ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

Performance analysis of a fully automated green
Effluent Treatment Plant (ETP)

M.Sc Engineering (Mechanical) THESIS

BY

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<u>Table of abbreviations</u>

As	Arsenic
BOD	Biochemical Oxygen Demand
CBO	Community Based Organization
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DWASA	Dhaka Water Supply and Sewage Authority
ha	Hectare
MDG	Millennium Development Goal
TDS	Total dissolved solid
TN	Total Nitrogen
TP	Total Phosphorus
SS	Suspended Solids

VARD	Voluntary Association for Rural Development
VSST	Very Shallow Shrouded Tube well

ABSTRACT:

The major goal of this work is to focus the pollution scenario of our environment due to textile effluent from textile industries and how we can develop and upgrade our system so that the pollution level can be minimized. It is true the rapid industrial development encouraged to form medium to large scale factories and it is now a major source of income of our economy. But the rapid industrialization comes with huge toxic water discharge that is polluting our river water, environment. Therefore, it is high time that we shift our attention to upgrade our existing Effluent treatment Plants with sophisticated systems and machineries.

Since the highest number of factories is of textile category and these types of factories play a major role in polluting the nature, Government's main focus is on the textile mills and industries related to textile. The Government of The People's republic of Bangladesh always encourage the businessmen to establish ETPs with zero discharge, increasing use of green energy .But, for the successful implementation of ETPs, industry owners will have to be socially responsible and at the same time, government should provide the factory owners with logistic supports and re-laxed timeframe to do so.

Chapter 1

Introduction:

Industrial development is the ultimate goal of a developing country to intensify its economic activities. Geographic position, raw materials availability, labour cost, political environment often play vital role to determine in which sector a country will develop strongly. No doubt for Bangladesh, low labour cost played the major role for the rapid and unplanned clustered growth in textile sector. This development paved the way for severe adverse environmental consequences in an alarming way. Water is one of the most important natural resources that is one of the basic requirements in human life. Water is used for a numerous of purposes, but it is used mainly for drinking. Apart from household uses, it is also used for several industrial purposes. Though water is found in abundance in nature, yet most of it is contaminated, and therefore it needs to be treated so that it can be recycled.

To portray water as the motor of life will not constitute an exaggeration. This is because of water in its different shapes, accounts for more than 70 percent of the whole soil surface and all life shapes notwithstanding of their territory depend on this plenteous asset for their continuous presence. In any case, as tremendous as this imperative resource is, as it were a little rate of its natural frame could be promptly utilized for drinking and sanitation purposes by the human. These are normally stored up in provisions and banks such as the aquifers, lakes, waterways and other surface freshwater bodies.

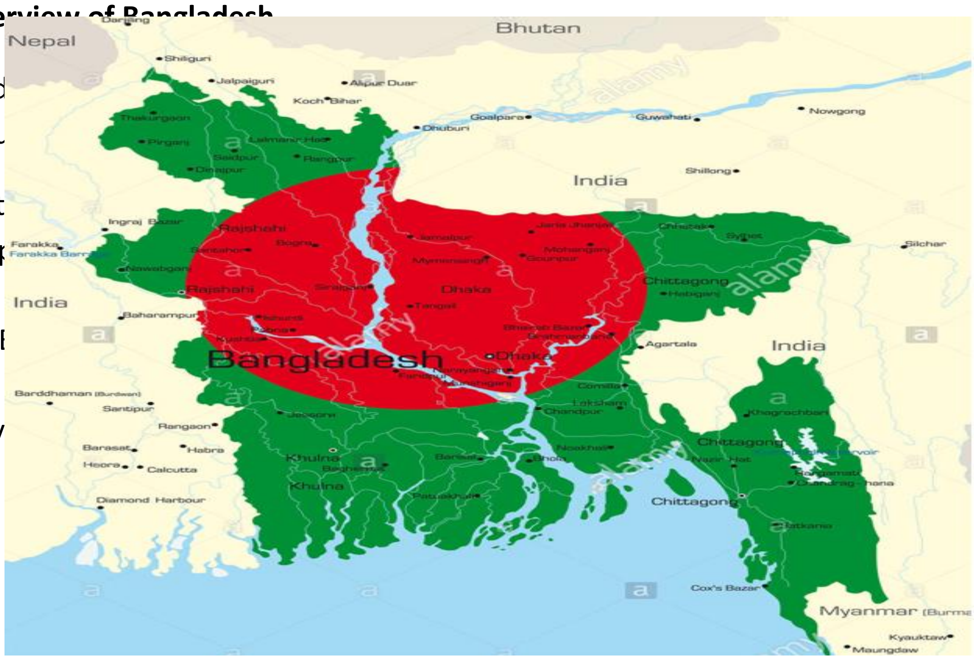
Due to the mounting impact of common events and anthropogenic exercises on these natural water sources, the flawless characteristics displayed by these water sources frequently fade out with time. Nowadays, the understanding of water quality has ended up conceptualized because of the various employments to which diverse sorts of water could be subjected to.

Large quantity of water associated with the production of a number of dyeing and textile industries, releases toxic wastewater rich in dye and chemicals to the environment that result in severe water-body pollution. The untreated industrial effluent mixes with different water bodies like rivers,canals and pollutes water, deteriorate soil, vegetation, water born diseases. Therefore, treatment of waste water is recommended within the factory. Like many other developing countries, less attention is paid in environmental safety, protection and regulation. Better late than never, the government of Bangladesh is very strict to implement environmental laws now and both government and private sector are working together to install new ETPs, upgrading the existing ETPs.

The aim and Importance of ETP

1. To clean industry effluent and recycle it for further use
2. To reduce the usage of fresh water in industries
3. To preserve natural environment against pollution
4. To meet the standards for emission of pollutants set by the Government & avoid heavy penalty
5. To reduce expenditure on water acquisition

1.1 Overview of Bangladesh



Banglad ... southern
part tou ...

Populat ... a growth
rate app ... ately. 70%
land is ... water (Cia,
2016). ... aries from
almost ... lowest in
January ...

Figure 1: Position of Bangladesh (Picture collected from Google map)

Bangladesh came into being independent in 1971, when the two parts of Pakistan split after a bitter war. The country experienced 15 years under military rule and, although democracy was reestablished in 1990 (BBC News, 2016). Dhaka is the capital of Bangladesh with the highest population density of about 13 million. Rapid growing urbanization in the capital is attracting people to the cities. Almost 32% people of Bangladesh live below poverty line (Cia, 2016). Bangladesh is a land of high fertility for agricultural products. The extensive network of large and small rivers contributes a lot to the fertility. Among them, the Ganges-Padma, Brahmaputra, Jamuna, and Meghna are the major rivers. The country is serving rice, wheat, jute and different necessary products for the nation. Most of the rural inhabitants depend on agricultural based work.

The geomorphological condition makes Bangladesh more vulnerable to climate change. Two third territory of the country is less than five meters above sea level. Flooding is a recurrent

And common natural calamity in Bangladesh. Nearly 30% of the country experienced annual flooding during monsoon, where 80% of total annual rainfall occur in monsoon period. Extreme events can be spread up to 70% flooding. Two biggest flood events occurs in 1988 and 1998, where 1,378 people and 1100 people died respectively in these two events (Majumder and Venton, 2013)

Despite the various adverse situations, Bangladesh has developed a lot in education. Also, Bangladesh has improved significantly in the water sector in last few years. According to Central intelligence agency US 2015, around 87% of total population have improved drinking water source. However, about 57% urban and 62% rural population have improved sanitation facility (CIA, 2016).

An "improved" drinking water source is one that protects water against contamination through its construction process. An "improved" sanitation facility is one that separates human excreta from human contact hygienically. It includes different technological options, such as flush toilet, piped sewer network, pour flush latrine, single and twin pit latrine, ventilated improved pit latrine etc. (WHO and UNICEF, 2012).

1.2 Drinking water in Bangladesh

Groundwater is the major source of drinking water, both in urban and rural areas. There are plenty of rivers and canals throughout the country but surface water is not considered as a source for water supply. The availability of water varies throughout the year. During monsoon, almost two third of the annual rainfall evaporates and 15% water percolates into the deep soil which raises the ground water table and makes it easier to collect. In dry season due to less rainfall and high evaporation the water table falls but the regular collection continues throughout the country (Rashid et al., 1994). In average groundwater is the major source of drinking water for more than 98% people of Bangladesh. The underlying sand and gravel aquifer are highly productive. Also sand and clay soil acts as a natural filter. The natural filter reduces bacterial contamination hence groundwater becomes a trusted and cheap source. In rural areas, water is collected by hand tube wells, pumps, and is almost decentralized. But in urban areas water is distributed by the piped system (Bangladesh national drinking water quality survey 2009, 2011).

1.3 Water Collection Technology

a) Rural water supply

In rural areas, piped system water supply not introduced and the system is decentralized. Rural water collection technologies include low-cost tube wells such as shallow hand tube wells, Tara hand pump and Very shallow shrouded tube wells (VSST). Usually, one individual household or few households share one tube well.

b) Shallow tube well

Shallow tube wells are quite common techniques in both rural areas and urban slums. Almost 87% of the public wells and 94% of the private wells are shallow tube wells in rural areas. They are very easy to operate and inexpensive. This pump works by creating a vacuum in the suction pipe and can draw water from 7 m below ground level. Moreover, a deep-set hand pump is an advanced technology of shallow tube well and could extract water 30 m deep below ground level (Department of Public Health Engineering Bangladesh, 2016).

c) Dug well

Dug wells generally are seen in hilly areas of the country such as Chittagong and Sylhet. Due to adverse hydrogeological conditions and stony soil condition tube wells are hard to construct in these areas. Dug wells are suitable for shallow depth (Department of Public Health Engineering Bangladesh, 2016).

d) Tara hand pump

In dry season extracting deep ground water with shallow tube wells become much harder and sometimes impossible. To overcome such situations tara hand pump was introduced. It is a force mood pump which operates below static level. The cylinder of the pump is set 18 m below ground level with a PVC hollow pump rod set vertically installed, which operates the piston (Department of Public Health Engineering Bangladesh, 2016).

e) Very Shallow shrouded tube well (VSST)

Usually in coastal areas where salinity is a big issue, VSST used to mitigate the salinity problem. VSST is a special type of tube well, which collect water from very shallow aquifers, formed by displacement of saline water from the continuous flow of accumulated fresh water. The freshwater lenses are usually found beneath the old ponds in coastal areas. An artificial sand packing is placed around the screen of the tube well to prevent fine sand particles from entering on the screen. This packing is called shroud. The depth could be 15 to 20 m depending on the aquifer condition (Department of Public Health Engineering Bangladesh, 2016).

f) Urban water supply

The urban water supply system is mainly centralized and managed by an organization named DWASA for the capital Dhaka city and CWASA for the port city Chittagong. Nevertheless, the water supply systems in slums of the cities are not categories as centralized. Slum dwellers collect water from municipal taps or tube wells, some also collect water from surface water bodies such as canals and rivers, which are not considered as a safe source of water. Dhaka Water Supply and Sewerage Authority (DWASA) have the responsibility of providing water supply and managing storm water and sewage disposal in the metropolitan city of Dhaka. It covers more than 360 sq. km service area with 12.5 million people with a production of almost 2110 million liters per day. DWASA has divided the whole Dhaka city into 11 zones. Among them 10 is inside the city and one is a subzone, Narayanganj. Each zone has an individual office that works for the operation and maintenance of the particular area. According to DWASA the present water demand in Dhaka city is 2.25 million cubic meters per day, where the organization meets 2.11 million cubic meters per day supply at present. About 0.87% of water is collected from 605 deep tube wells and the rest 13% comes from surface water sources (Khan, 2012).

1.4 Quality of drinking water in Bangladesh

According to Bangladesh national drinking water survey 2009, 22 million people are still drinking water that does not meet the standard level for arsenic of 0.05 mg/l and 5.6 million are in high risk of having water with more than 0.2 mg/L arsenic (Bangladesh national drinking water quality survey 2009, 2011). Table 1, shows the standard values of different elements in water according to Department of public health engineering and World Health Organization. Some common elements have been selected in this table. Arsenic was a major concern in Bangladesh in recent years. BOD, COD, Nitrate, Phosphate and chloride are very important elements for drinking water. Excessive amount of these elements can cause health hazard. Drinking water should contain the following elements according to the standard stated in the table.

parameter	**Bangladesh standard for discharge on irrigation land Mg/l**	**Bangladesh standard for drinking water Mg/l**
pH	6-9	6.5-8.5
DO	4.5-8.0	-
COD	400	4
BOD	100	0.2
TDS	2100	1000

Table 1: Water quality parameters (UNICEF, 2011; Department of Public Health Engineering Bangladesh, 2016).

Chapter 2

2.1 Background of Textile Industry in Bangladesh

The textile industry provide the single source of economic growth in Bangladesh's rapidly developing economy. Exports of textiles and garments are the principal source of foreign exchange earnings. The tremendous success of readymade garment exports from Bangladesh over the last two decades has surpassed the most optimistic expectations. The overall impact of the readymade garment exports is certainly one of the most significant social and economic developments in contemporary Bangladesh. With over one and half million women workers employed in semi-skilled and skilled jobs producing clothing for exports, the development of the apparel export industry has had far reaching implications for the society and economy of Bangladesh. It is the largest manufacturing sector, providing jobs for some 50% of the total industrial workforce and con- tributing 9.5% of the country's GDP. Also, it accounts for almost 77% of total exports, making it Bangladesh's leading foreign exchange earner.

In the early 1980s exports were dominated by jute while garment sales were insignificant. But today garment ex-ports are by far the leading export category. In 2001/02 the clothing sector generated as much as US$ 4.58 billion in foreign exchange.

The industry benefits from special access to markets in the EU, Canada, Norway and Japan. Because Bangladesh is a least developed country, its textile and clothing ex- ports enter these countries quota-free and duty-free. This concession, together with low labor costs, provides the garment sector with a strong competitive advantage.

Knitwear sector's contribution was 7.64% of the ready-made garments sector (RMG) sector in 1990-1991. It has shown to 49.43% in 2006-07. Last year knitwear export was over US$ 4.5 billion comprising 37.39% of the total export earning of Bangladesh. The RMG sector earned about 75.6% of the total export earnings in 2006- 2007, a major share of which is from the export of knit-wear.

The data provided above gives a picture how textile sector has established itself an important sub sector of our total economy. Despite this fact, those impose socio-economic deprivation of the people of surrounding communities by polluting the environment. Therefore, industries should take remedy measures to establish public confidence, satisfy foreign buyer's requirement regarding environmental compliance.

2.2 Water Consumption in Textile Industry

The textile dyeing and finishing industry has created a huge pollution problem as it is one of the most chemi cally intensive industries on earth, and the No. 1 polluter of clean water (after agriculture). More than 3600 individual textile dyes are being manufactured by the Industry today. The industry is using more than 8000 chemicals in various processes of textile manufacture including dyeing and printing. Many of these chemicals are poisonous and damaging to human health directly or indirectly. Large quantities of water are required for textile processing, dyeing and printing. The daily water consumption of an average sized textile mill having a production of about 8000 kg of fabric per day is about 1.6 million liters. 16% of this is consumed in dyeing and 8% in printing. Specific water consumption for dyeing varies from 30 - 50 liters per kg of cloth depending on the type of dye used. The overall water consumption of yarn dyeing is about 60 liters per kg of yarn. Dyeing section contributes to 15% - 20% of the total waste water flow. Water is also required for washing the dyed and printed fabric and yarn to achieve washing fastness and bright backgrounds. Washing agents like caustic soda based soaps; enzymes etc. are used for the purpose. This removes the surplus color and paste from the substrate. Water is also needed for cleaning the printing machines to remove loose color paste from printing blankets, printing screens and dyeing vessels. It takes about 500 gallons of water to produce enough fabric to cover one sofa. The World Bank estimates that 17 to 20 percent of industrial water pollution comes from textile dyeing and finishing treatment given to fabric. Some 72 toxic chemicals have been identified in water solely from textile dyeing, 30 of which cannot be removed5. This represents an appalling environmental problem for the clothing and textile m

Fabric	Water consumption (L/kg)
Cotton	250-350
Wool	200-300
Nylon	125-150
Rayon	125-150
Polyester	100-200
Acrylic	100-200

Table 2: Water Consumption in Textile Industry

2.3 Pollution due to industrial effluent and current ETP practice in Bangladesh:

Bangladesh textile industry can be divided into three main categories: public sector, handloom sector, and the organized private sector which is fastest growing sector in Bangladesh. Most of these Industrial units are usually located near waterside in Bangladesh.

Complex mixture of organic and inorganic chemicals are discharged water bodies like rivers often without any treatment. Textile and dyeing industries produce wastewater, or effluent, as a bi-product of their products, which con- tains several pollutants originated from sizing, bleaching, mercerizing, fancy dyeing, screen printing, yarn dyeing and finishing. Chemicals used in these industries include acrylonitrile, chlorinated phenols, salicylanilide, organic mercurial compounds, and copper ammonium carbonate.

Picture: 2 Pollution due to industrial effluent

Organic components degrade water quality during decomposition by depleting dissolved oxygen. The non- biodegradable organic components persist in the water system for a long time and pass into the food chain. In-organic pollutants are mostly metallic salts, and basic and acidic compounds. These inorganic components undergo different chemical and biochemical interactions in the river system, and deteriorate water quality.

In knit dyeing, the local textile dyeing industries higher amount of wastewater which varies from 150 - 330 liter per Kg of fabric, whereas the recommended amount of wastewater that can be discharged from composite textile dyeing industries is 100 liter per Kg fabric as per Environmental Conservation Rules, 1997 [4]. Disposal of these large amounts of wastewater with highly toxic compounds to water body and irrigable land is extensively threatening to the ecosystem and aquatic life and it also enters in our food chains. These lead to diminish the fisheries and agricultural economy day by day. The pollution leads to yield of poor quality of fish with the smell of chemicals. In general, pH of the effluent is found to above 11, which become lethal to all species of fish.

According to Environment Conservation Rules 1997, the industrial units and projects are classified into four categories (Green, Orange A, Orange B and Red) based on their site and environmental impact. Fabric dyeing and chemical treatment industries fall under the Red category. This clearly means that, when the indus- tries apply for site clearance they must submit ETP plan along with process flow diagram, location, design and time schedule to Department of Environment (DoE). After the approval of ETP design, they make commit- ment in the Environmental Impact Assessment (EIA) approval process to install ETPs. After the ETP has been constructed, these Red category industries can apply for Environmental Clearance Certificate without which they are not allowed to start their production. So, according to the existing laws, all the textile and knit dyeing factories must have ETPs that must be operating throughout the year and all the ETPs (existing and to be constructed) must meet the national water quality standards. Recently, the Government has identified a large number of knit and textile industries that have no effluent treatment plants. Knit processing industry within BK- MEA have about 300 factories of which 100 may have ETP or in the process of installation to cover about 50 percent of the capacity in this sub-sector But, pollu- tion level is still high that require strict measures. Most of the factories were found polluting air and water seriously as they did not have ETPs or other devices to check pollution. The inspection teams also found some factories did have ETPs but they kept those closed most of the time to save electricity. At present, big textile mills are constructed well within the rule of environmental com-pliance. Small and medium factories are the exceptions and most of these were built at least 20 years ago. There is no rule on such compliance and most of the medium and small textile units don't have the financial ability to set up full-capacity ETPs. Few good textile industries are found to have their own ETPs, but hardly run their ETP up to the mark and also the factory authority does not pay due attention to it. Sometimes, ETPs are found under- sized or otherwise non-functional units due to improper maintenance. The main problem associated with mal-functioning of existing ETPs is the lack of technical knowledge of ETP operators about the technology as because ETP concept is not that much familiar in our country. It is to be noted that, under capacity design leads to ineffective ETPs. Another reason behind is the unwillingness of factory owners to operate their ETPs due to operating and maintenance expenses, which is a gross violation of national law. Mills discharge millions of gallons of this effluent as hazardous toxic waste, full of color and organic chemicals from dyeing and finishing salts. Presence of sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, chromium compounds and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the effluent highly toxic. Other harmful chemicals present in the water may be formaldehyde based dye fixing agents, hydro carbon based softeners and non-bio degradable dyeing chemicals. The mill effluent is also often of a high temperature and pH, both of which are extremely damaging. The colloidal matter present along with colors and oily scum increases the turbidity and gives the water a bad appearance and foul smell. It prevents the penetration of sunlight necessary for the process of photosynthesis [5]. This interferes with the Oxygen transfer mechanism at air water interface. Depletion of dissolved Oxygen in water is the most serious effect of textile waste as dissolved oxygen is very essential for marine life. This also hinders with self-purification process of water. In addition when this effluent is allowed to flow in the fields it clogs the pores of the soil resulting in loss of soil productivity. The texture of soil gets hardened and penetration of roots is prevented. The waste water that flows in the drains corrodes and incrassates the sewerage pipes. If allowed to flow in drains and rivers it effects the quality of drinking water in hand pumps making it unfit for human consumption. It also leads to leakage in drains increasing their maintenance cost. Such polluted water can be a breeding ground for bacteria and viruses. Impurities in water affect the textile processing in many ways. In scouring and bleaching they impart a yellow tinge to white fabric.

2.4 Useful Tips to be considered before Setting up an ETP

It is important to have a clear understanding of the ETP before choosing to set up one. Thus, this subsection provides with few useful tips before setting up an ETP and the technology to use in the ETPs.

Some of the useful tips are as follows:

I) selecting the appropriate place- The ETP should not be set up close to the wells or reservoirs of drinking water, wet lands or water discharge zones.

ii) A Design Efficient Treatment plant: Choosing a wasted place or idle place would result in saving land. This could be land which is idle and not being used for any industrial process.

iii) Choosing an appropriate water treatment technology- Studying the effluent type, characteristic and volume can help adopting the ideal technology needing for treatment.

Chapter 3

3.1 What is an ETP?

ETP is one type of waste water treatment method which is particularly designed to purify industrial waste water for its reuse and its aim is to release safe water to environment from the harmful effect caused by the effluent.

Industrial effluents contain various materials, depending on the industry. Some effluents contain oils and grease, and some contain toxic materials (e.g., cyanide). Effluents from food and beverage factories contain degradable organic pollutants. Since industrial waste water contains a diversity of impurities and therefore specific treatment technology called ETP is required.

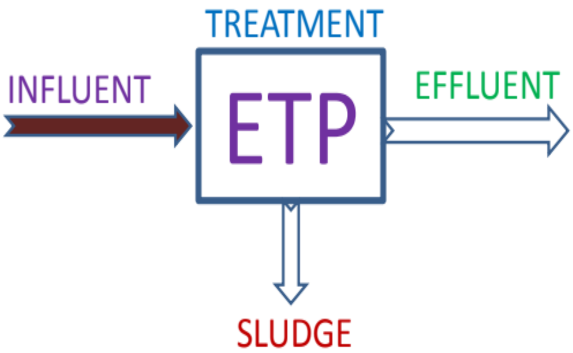
The ETP Plant works at various levels and involves various physical, chemical, biological and membrane processes to treat waste water from different industrial sectors like chemicals, drugs, pharmaceutical, refineries, dairy, ready mix plants & textile etc.

ETP (Effluent Treatment Plant) is a process design for treating the

Industrial waste water for its reuse or safe disposal to the

environment.

- Influent: Untreated industrial waste water.
- Effluent: Treated industrial waste water.
- Sludge: Solid part separated from waste water by ETP.



3.2 Why Wastewater treatment is essential?

Wastewater treatment or sewage treatment is a process to improve the water quality, removing some or all of the contaminants, making it suitable for reuse or discharge back to the environment.

Generally, untreated wastewater contains high levels of organic material, numerous pathogenic microorganisms, as well as nutrients and toxic compounds that can be harmful to human health, environment and waterways, hence effective treatment of wastewater is very much essential.

The major goal of wastewater treatment plants is to eventually produce water that can be reused for various purposes or disposes of in a more ecological and healthy way. Waste water treatment is a major element of water pollution control.

3.3 Criteria Designing of ETP

The design and size of the ETP depends upon:

- Quantity and quality of the industries discharge effluent.

• Land availability.

• Monetary considerations for construction, operation & maintenance.

• Area dimension depends on:

Quality of wastewater to be treated, Flow rate, Type of biological treatment to be used .

• In case of less available land, CETP (Common Effluent Treatment Plant) is preferred over ETP

3.4 Defining the Typical Types of ETP

After learning about few useful tips and technologies before choosing to step up an ETP, this subsection is going to define the typical types of ETP present in the textile and garments industry. There are three types of ETP in general. They are the biological treatment plant, physico-chemical treatment plant, and the combined physic-chemical and biological treatment plant. This section defines these typical types of ETP.

a) Biological Treatment plant:

The design of such a plant typically includes screening, equalization, pH control, aeration, and settling. These can restrict BOD, pH, TSS, oil and grease requirements. But due to toxicity of the industrial effluent to the microorganisms, there is necessity for pretreatment. Especially in the case of dyes which are complex chemicals.

b) Physico-chemical treatment plant:

This typically includes screening, equalization, pH control, chemical storage tanks, mixing unit, flocculation unit, settling unit and sludge dewatering. Through this treatment, it is difficult to reduce BOD and COD, and it is not possible to remove TDS and maintain the national standard. It is effective in removing colour from the processes.

c) Combined physico-chemical and biological treatment plant:

This is the most common treatment found in the textiles. The physico-chemical treatment usually comes before the biological treatment units. The typical components are screening, equalization, pH control, chemical storage, mixing, flocculation, primary settling, aeration and secondary settling. This combination helps to restrict the pollutants according to the national standards.

3.5 The Typical Treatment Steps of the Effluent Treatment

Plant The type and design of ETP depend on the quantity and quality of the effluent. Other factors involve the capital availability for construction, operation and maintenance, and also the space or land available for the setup of the plant. The treatment basically falls under the category of physical, chemical or biological mechanism. The levels of treatment can be described in four steps, which are presented in Figure 3.1 below.

3.6 Treatment Levels & Mechanisms of ETP

• Treatment levels: Preliminary Primary- Secondary- Tertiary (or advanced)

• Treatment mechanisms: Physical, Chemical, Biological.

a) Preliminary Treatment level Purpose:

Physical separation of big sized impurities like cloth, plastics, wood logs, paper, etc.

Common physical unit operations at Preliminary level are:

I. **Screening:** A screen with openings of uniform size is used to remove large solids such as plastics, cloth etc. Generally maximum 10mm is used.

II. **Sedimentation:** Physical water treatment process using gravity to remove suspended solids from water.

III. **Clarification:** Used for separation of solids from fluids.

b) Primary Treatment Level

Purpose: Removal of floating and settleable materials such as suspended solids and organic matter.

• Methods: Both physical and chemical methods are used in this treatment level.

• Chemical unit processes:

Chemical unit processes are always used with physical operations and may also be used with biological treatment processes.

Chemical processes use the addition of chemicals to the wastewater to bring about changes in its quality. Example: pH control, coagulation, chemical precipitation and oxidation.

pH Control: To adjust the pH in the treatment process to make wastewater pH neutral.

For acidic wastes (low pH): $NaOH$, Na_2CO_3, $CaCO_3$or $Ca(OH)_2$. For alkali wastes (high pH): H_2SO_4, HCl.

Chemical coagulation and Flocculation:

• Coagulation refers to collecting the minute solid particles dispersed in a liquid into a larger mass.

• Chemical coagulants like $Al_2(SO_4)_3$ {also called alum} or $Fe_2(SO_4)_3$ are added to wastewater to improve the attraction among fine particles so that they come together and form larger particles called flocs.

• A chemical flocculent (usually a polyelectrolyte) enhances the flocculation process by bringing together particles to form larger flocs , which settle out more quickly.

• Flocculation is aided by gentle mixing which causes the particles to collide.

c) Secondary Treatment Level

Methods: Biological and chemical processes are involved in this level.

Biological unit process

- To remove, or reduce the concentration of organic and inorganic compounds.
- Biological treatment process can take many forms but all are based around microorganisms, mainly bacteria.

Aerobic Processes.

- Aerobic treatment processes take place in the presence of air (oxygen).
- Utilizes those microorganisms (aerobes), which use molecular/free oxygen to assimilate organic impurities i.e. convert them in to carbon dioxide, water and biomass.

Anaerobic Processes

- The anaerobic treatment processes take place in the absence of air (oxygen).
- Utilizes microorganisms (anaerobes) which do not require air (molecular/free oxygen) to assimilate organic impurities.

The final products are methane and biomass.

d) Tertiary / Advanced Treatment

Purpose: Final cleaning process that improves wastewater quality before it is reused, recycled or discharged to the environment.
Mechanism: Removes remaining inorganic compounds, and substances, such as the nitrogen and phosphorus. Bacteria, viruses and parasites, which are harmful to public health, are also removed at this stage.
Methods:

- Alum: Used to help remove additional phosphorus particles and group the remaining solids together for easy removal in the filters.
- Chlorine contact tank disinfects the tertiary treated wastewater by removing microorganisms in treated wastewater including bacteria, viruses and parasites.
- Remaining chlorine is removed by adding sodium bisulphate just before it's disc

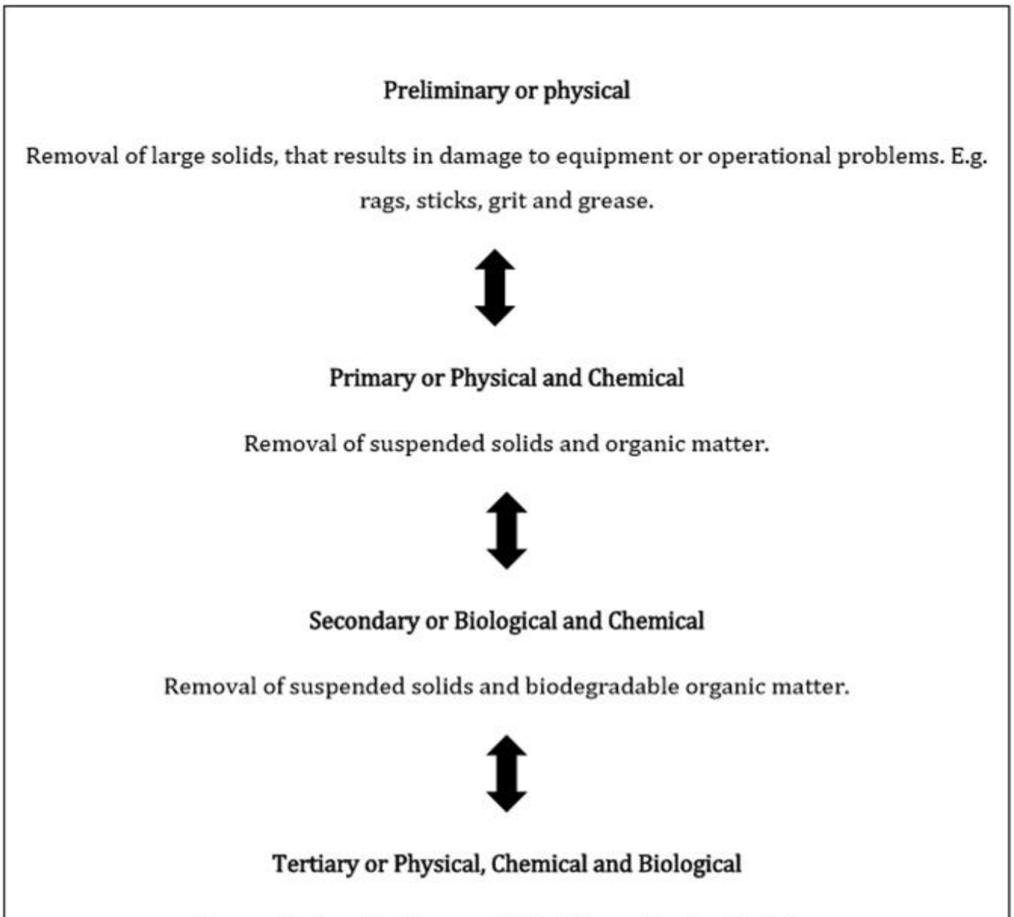


Fig 3.1 the levels of ETP

3.7 Defining the Technical Parameters:

PH: pH is a measure of the concentration of hydrogen ion in the waste water and tells us if the water is acidic or alkaline. It is important because aquatic life, e.g. most fish can only survive in a pH range of 6 to 9. pH value greater or less than this would be threatening for their existence. The national standard for pH is set to be

DO (Dissolved Oxygen): The marine life depends on the oxygen present in water or in other words dissolved oxygen. There are a number of factors on which the DO is dependent, they are: firstly the temperature of the water, the amount of oxygen that goes out of the stream as respiration and decaying of organisms, the amount of oxygen that comes back through photosynthesis (more as a waste product), stream flow and aeration (rapid movement). The temperature plays a vital role for the aquatic life, as in higher temperature there is less dissolving of oxygen. National standard for DO is 0-6 mg/L.

BOD and COD: When the choice is between Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), COD is often chosen as a substitute as it takes only few hours whereas BOD takes about 5 days. The BOD is a measure of how much oxygen the bacteria will consume during the decomposition of organic matter (aerobic conditions). Waste water treatment plants are created in a way through which it would work as a bacteria farm, where bacteria are fed oxygen and organic waste. The process is to remove the excess bacteria grown in the system. This disposable "solid" waste is called sludge and is disposed of on land. COD is the measure of total oxygen required for the oxidation of all organic substances into carbon dioxide and water. Although COD takes less time than BOD, its value is still higher.

TDS and TSS: In defining TDS and TSS we first need to connect the two with TS or total solids. The equation that connects them are, TS = TDS + TSS. Total suspended solid (TSS) can be separated from a given solution by using the process of filtration. The filter holds the residue, where temperature ranges between 103º to 105º and is heated in an oven for an hour or so. The sample is then cooled and weighed. The difference in weight of the residue before and after heating gives us the TSS. The filtrate which is passed to the dish is then dried and the difference gives us the total dissolved solid (TDS). The process is not much expensive and takes couple of hours or so.

Chapter 4

4.1 Description of prepared and installed ETP Model and its working procedure

The ETP Plant works at various levels and involves various physical, chemical, biological and membrane processes to treat waste water from different industrial sectors like chemicals, drugs, pharmaceutical, refineries, dairy, ready mix plants & textile etc.

Emanated treated water from main ETP unit is collected in a sump for further treatment in re-cycle plant for make suitable use in the back process of Dyeing-Finishing unit & other places as requirement. The treated water from ETP sometime contains light colors, suspended solids and other contamination which cannot be used raw water for scouring-bleaching-washing and dyeing process. It may be degraded the final quality of cloths and finally RMG. So, before using in back process it must be make treatment for reusable in textile wet process. From treated water collection sump, it transferred in to the re-cycle unit by pump for further treatment. A typical re-cycle unit plant is shown above. In this unit Cationic poly electrolytes and alum to be dosed for best sedimentation of any Suspended solids and contamination in ETP treated water; Cationic poly electrolytes are used to coagulate and flocculates the contamination flocks. As for the Suspended solids concentration of sludge higher molecular weight Cationic polymers are effective for sludge's with higher concentrations of Suspended solids. Another coagulate Alum is applied to the ETP treated water in mixing and dosing tank of the unit when the alum is added to the treated water, it immediately dissociates, resulting in the release of and aluminum ion surrounding by six water molecules. The aluminum ion - immediately starts reacting with the water, farming large AL.OH.H2O complex. Some have suggested that it forms [Al8 (OH) 20 28H2O-]4+ as the product that actually Coagulates. Regardless of the actual species produced the complex a very large precipitate that removes many of the colloids by enmeshment as it falls through the water & settled at the bottom of settling/ sedimentation tank. If proper treatment operated of the ETP treated water in this unit by proper dosing of poly and Alum, we think about 80-90% recycle water, can be used in textile back processing unit & also other places.

For re-use of ETP treated water it is most important to implement proper design and layout plan, otherwise it is difficult to treat the waste water outlet from Textiles Processing unit and Human waste unit, by chemical dosing and application.

If proper dosing is setting by Jar test result and using blower for 1m3 waste water 1m3/hr. air the treated water will be more/less color less outlet. Treated water TDS will not increase 2000-2100 because after highest saturation the un dissolved salt is dropped at the bottom of dyeing machines.

Performance characteristics

The major focus point of the new ETP is make it a green project. To do that, the 3R principle was kept in mind that is reduce, recycle and reuse. When we talk about reduce we indicate to the reduction of chemical particles, waste yarn, BOD,COD, microorganisms, heavy particles. The major components where reduction of these take place are discussed beloA detailed understanding of the nature and characteristics of the effluent, gives us an idea in knowing what we are dealing with and in applying correct technology and treatment processes. For example: if the measure is known to mix or separate particular waste streams, it would be easier to treat them. The steps in doing so, is to start monitoring the level of pollutants at certain places, characterizing the effluent, collecting existing information, surveying the effluent stream and implementing a regular monitoring regime.

parameters	**Permissible Limit**
pH	6.5-8.5
Temperature	40 C
TDS	2100 mg/L

Screening Unit:

First of all the influent from the factory comes directly to the screening unit. Remove relatively large solids to avoid abrasion of mechanical equipments and clogging of hydraulic system. We can also call it under the process of preliminary treatment.

To remove coarse materials from the flow, two fine (<2 mm punched hole) drum screen are used at inlet of ETP. One drum screen stays in operation and another as standby. Cleaning of the screening surface is automatic. Baskets are integrated with screen for automatic collection of the debris from screening chamber.

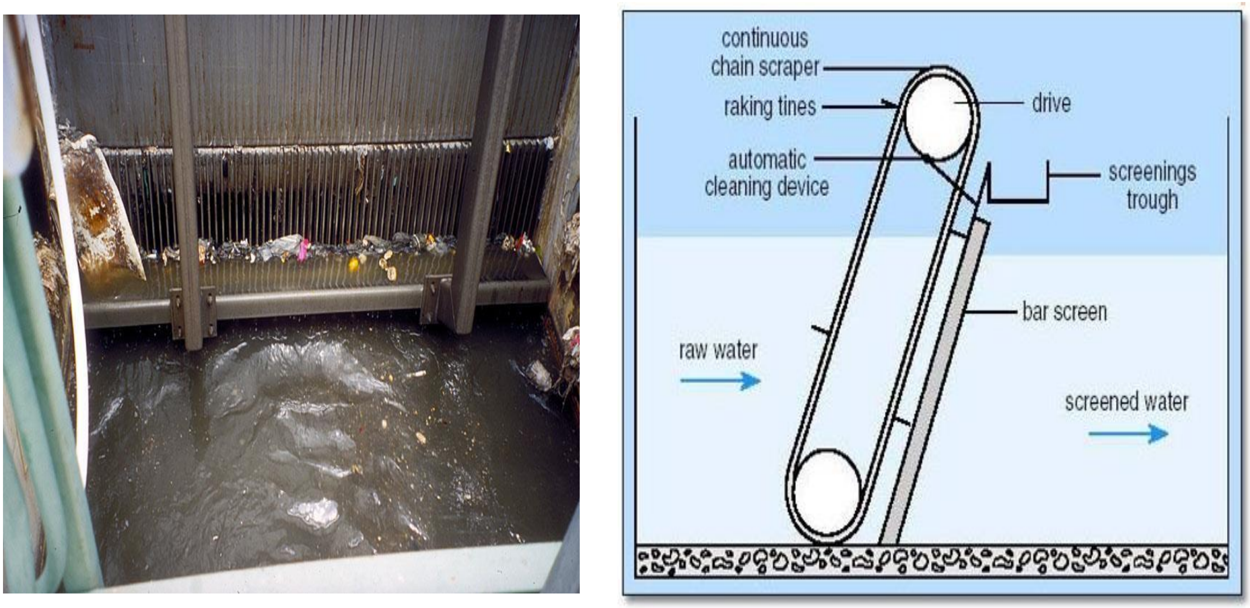


Fig: 4.1 Screening Chamber

The Collection Tank:

The collection tank collects the effluent water from the screening chamber, stores and then pumps it to the equalization tank.

qualization System

The screened wastewater from the screen channel is collected in the equalization tank. The function of the equalization tank is to homogenize the flow and characteristics of the effluent. Variation in the characteristics of the incoming raw effluent in terms of both quantity and quality are equalized in this unit. Apart from this a uniform load of pollution is achieved and the wastewater is made bacteria acclimatized. High-speed bottom fixed aeration device diffuser have been provided in the equalization tank for proper mixing and homogenization of the total effluent. The air grids are provided with coarse disc type diffuser connected to roots air blowers. Generally, this type of device blows air through the wastewater at a rate of about 1m3 of air per 1000 liters of effluent. The rising air tends to coagulate the grease and oils and cause them to accumulate at the surface where they can be removed by a scraper skimmer mechanism. Besides, in order to accomplish a proper equalization of both varying loading and fluctuating pH values, the dissolved air flotation process will also remove a substantial part of the COD. The Equalization Tank-1 volume is almost 3800 cubic meter and Equalization Tank-2 volume is 3800 cubic meter; configure with a divider and retention time is more than 29.2 hours. Coarse bubble aeration is provided in the Equalization Tanks (ET) to achieve a uniform and homogenous mixture of different concentration.

The effluents do not have similar concentrations at all the time; the pH will vary time to time. Effluents are stored from 8 to 12 hours in the equalization tank resulting in a homogenous mixing of effluents and helping in neutralization. It eliminates shock loading on the subsequent treatment system. Continuous mixing also eliminates settling of solids within the equalization tank. Reduces SS, TSS.

Flash mixer: Coagulants were added to the effluents:

1. Lime: (800-1000 ppm) To correct the pH upto 8-9

2. Alum: (200-300 ppm) To remove colour

3. Poly electrolyte: (0.2 ppm) To settle the suspended matters & reduce SS, TSS. The addition of the above chemicals by efficient rapid mixing facilitates homogeneous combination of flocculates to produce microflocs.

4. Clarriflocculator: In the clarriflocculator the water is circulated continuously by the stirrer. Overflowed water is taken out to the aeration tank. The solid particles are settled down, and collected separately and dried; this reduces SS, TSS. Flocculation provides slow mixing that leads to the formation of macro flocs, which then settles out in the clarifier zone. The settled solids i.e. primary sludge is pumped into sludge drying beds. ETP Plant Operation

Aeration System

The biological oxidation is the most important phase of the treatment; here the main activity is the biological oxidation, in order to achieve the degradation of the pollutants that are present in the water flow, which takes place in the following order

The oxygen transfer from the gaseous phase to the liquid phase (water) is a crucial part of the wastewater treatment, especially when it is performed by the activated sludge. Since the solubility of oxygen in water is low, and thus the natural oxygen transfer is low, the oxygen that is necessary for-the biological process oxidation does not enter the water naturally, also because the air-water interface is very limited, thus additional interfaces need to be created in order to carry out the process. Oxygen can be supplied as pure bubbles or as air. The air bubbles are generally chosen instead of the pure oxygen bubbles since the cost is much lower. The air is provided through blowers; once the air supply has been sent through the air piping, it arrives to the air diffusers. The Aeration Tank-1 volume is almost 10230 cubic meter and Aeration Tank-2 volume is 9375 cubic meter; configure with a divider and retention time is more than 75.3 hours.

The water is passed like a thin film over the different arrangements like staircase shape. Dosing of Urea and DAP is done. Water gets direct contact with the air to dissolve the oxygen into water. BOD & COD values of water is reduced up to 90%. Clarifier: The clarifier collects the biological sludge. The overflowed water is called as treated effluent and disposed out. The outlet water quality is checked to be within the accepted limit as delineated in the norms of the Bureau of Indian standards. Through pipelines, the treated water is disposed into the environment river water, barren land, etc.

Sludge thickener: The inlet water consists of 60% water + 40% solids. The effluent is passed through the centrifuge. Due to centrifugal action, the solids and liquids are separated. The sludge thickener reduces the water content in the effluent to 40% water + 60% solids. The effluent is then reprocessed and the sludge collected at the bottom.

Decantation Tank: Decantation is a process for the separation of mixtures, by removing a layer of liquid, generally one from which a precipitate has settled. The purpose may be either to produce a clean decant, or to remove undesired liquid from the precipitate (or other layers). In the decation tank of the new etp,the precipitate from yarn dyeing are removed and the water is transferred for further treatment.

Fig 4.3 Decantation Tank from Dird composite textile Ltd.

Suspended solids (or SS), is the mass of dry solids retained by a filter of a given porosity related to the volume of the water sample. This includes particles of a size not lower than 10 µm. Colloids are particles of a size between 0.001 µm and 1 µm depending on the method of quantification. Because of Brownian motion and electrostatic forces balancing the gravity, they are not likely to settle naturally. The limit sedimentation velocity of a particle is its theoretical descending speed in clear and still water. In settling process theory, a particle will settle only if: In a vertical ascending flow, the ascending water velocity is lower than the limit sedimentation velocity. In a longitudinal flow, the ratio of the length of the tank to the height of the tank is higher than the ratio of the water velocity to the limit sedimentation velocity. Removal of suspended particles by sedimentation depends upon the size and specific gravity of those particles. Suspended solids retained on a filter may remain in suspension if their specific gravity is similar to water while very dense particles passing through the filter may settle. Settle able solids are measured as the visible volume accumulated at the bottom of an Inhofe cone after water has settled for one hour. The settling velocity, defined as the residence time taken for the particles to settle in the tank, enables the calculation of tank volume. Precise design and operation of a sedimentation tank is of high importance in order to keep the amount of sediment entering the diversion system to a minimum threshold by maintaining the transport system and stream stability to remove the sediment diverted from the system. This is achieved by reducing stream velocity as low as possible for the longest period of time possible. This is feasible by widening the approach channel and lowering its floor to reduce flow velocity thus allowing sediment to settle out of suspension due to gravity. The settling behavior of heavier particulates is also affected by the turbulence. The Decantation Tank-1 volume is 900 cubic meter and Decantation Tank-2 volume is 900 cubic meter; configure with a divider and retention time is more than 6.8 hours.

Drum filter: Rotary vacuum filter drum consists of a drum rotating in a tub of liquid to be filtered. The technique is well suited to slurries, and liquids with a high solid content, which could clog other forms of filter. The drum is pre-coated with a filter aid, typically of diatomaceous earth (DE) or Perlite. After pre-coat has been applied, the liquid to be filtered is sent to the tub below the drum. The drum rotates through the liquid and the vacuum sucks liquid and solids onto the drum pre-coat surface, the liquid portion is "sucked" by the vacuum

through the filter media to the internal portion of the drum, and the filtrate pumped away. The solids adhere to the outside of the drum, which then passes a knife, cutting off the solids and a small portion of the filter media to reveal a fresh media surface that will enter the liquid as the drum rotates. The knife advances automatically as the surface is removed.

Fig 4.4 Drum filter from Dird composite textile Ltd.

Dewatering unit: In wastewater treatment, dewatering is the part of the process whereby sludges are reduced in volume and converted from a liquid to a solid product. Biosolids dewatering typically occurs when transportation and storage costs for large volumes can be reduced or when the material is destined for landfill. The biosolids dewatering process not only effects the volume but also the nutrient and odour levels of the material.

It is worth mentioning that the raw effluent is transferred from sump tank 1 to sump tank 3 where the actual reduction of different parameters start. The drum filter takes raw effluent from sump tank 1 and after treatment,transfer in tank 2. The strong dye water from yarn dyeing is stored in decantation tank and after the precipitation is formed,the fresh water is transferred in sump tank 2. From there due to overflow,the water is transferred in tsump tank 3 where sulphuric acid is dozed to control the ph.

Floating-Bed Softening Plant

Designed as double-lined floating-bed plant with single valve control with the following specifications for each unit:

Fig: Floating-Bed Softening Plant

Equalization and Aeration Tank: ETPs are usually designed to treat waster water that has more or less constant flow. Equalization tank collects and store waste water to make it a regular quantity. Aeration is required in biological treatment process to provide oxygen to microorganisms that breakdown the organic waste recycle.

Calpus filter: The caplas filter is used to house the activate filter material. Typically crushed glass or sand has surface area of 3000m2 per m3 but activated filter material has surface area 1000000m2 per m3 which is 300 times more arewa for adsorption and catalytic reaction. Hydroxyl group on the surface area on AFM gives strong negative charge known as zeta potential that attracts heavy metals and organic molecules. In the presence of oxygen or oxidizing agent, the catalytic surface generates free redicals that oxidise pollutants and disinfects the surface of AFM.

Fig 4.5 Calpus filter from Dird composite textile Ltd.

Zeta Potential Meter: Zeta potential meter is a static mixture for the injection of products such as APF, ACO and for cavitation of water. They are manufactured in stainless steel for fresh water and in titanium or plastic for marine application. In ZPM the water is made to cavitate and spin at high speed which helps to kill parasite. ZPM also helps to drop zeta potential of water which causes flocculation of solids and increases redox oxidation potential water becomes self sterilizing.

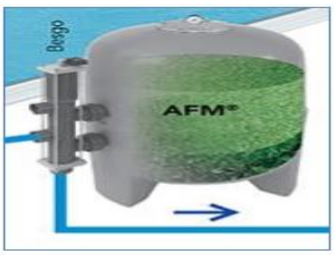
Heat Exchanger: Heat exchanger is a device which is used to transfer heat from hot liqid to cold liquid. The temperature of the dyeing water is around 80 degree Celsius. This hot water is used to heat up the soft water coming from water treatment plant. The cold water is heated up and is stored in hot water storage tank in WTP. The hot water is later used in boiler which minimizes the cost of steam production. The cold dye water is stored in sump tank 3.

Fig 4.6 Heat Exchanger from Dird composite textile Ltd.

U.V. Treatment: ‘Ultraviolet or UV energyis found the electromagnetic spectrum between visible light and x-rays and can be best described as invisible radiation. In oirder to kill microorganisms,the uv must actually strike the cell. UV energy penetrate the outer cell membrane,passes through the cell body and disrupts its DNA preventing reproduction. UV treatment does not alter water chemically,nothing is added except energy. The sterilized microorganisms are not removed from water.UV disinfection does not remove dissolved organics,inorganics or partiles in the water.

Activated Filter Media:

Replaces sand in all filtration applications. AFM® is manufactured from a specific glass type and processed to obtain the optimum particle size and shape. It is then activated to increase the surface area by 300 times over crushed glass or sand. The high surface area is negatively charged (zeta potential) to adsorb organics and small particles. It also has permanent metal oxide catalysts creating a high redox potential to make AFM® self-sterilizing. AFM® is the only activated glass filter media available, and is more efficient and cost-effective than any other filtration media. AFM® is certified under Regulation 31 in the UK and International NSF61.It is also in compliance with European Water Directive (98/83/EC) & (80/778/EEC).



Softener Unit:

Water softeners are used to remove the hardness of water by reducing the salts like magnesium and calcium present in the water. The hardness of water is effectively reduced by exchanging the Sodium ions. The softening process is undertaken to soften the water up to commercially zero ppm.

Sludge Handling System

We installed two centrifuge for sludge dewatering. After dewatering the sludge, it is kept in sludge drying bed to turn this into dry solid by sunlight. Then it transferred to third party or dumped scientifically. The water separated from centrifuge is returned to process.

Reverse Osmosis

Reverse osmosis is a membrane filtration process that is used extensively for the desalination and purification of water. Reverse Osmosis is a process in which dissolved inorganic solids (such as salts) are removed from a solution (such as water). This is accomplished by household water pressure pushing the tap water through a semi permeable membrane. The membrane (which is about as thick as cellophane) allows only the water to pass through, not the impurities or contaminates. These impurities and contaminates are flushed down the drain. A reverse osmosis membrane will remove impurities and particles larger than .001 microns. The process of reverse osmosis is based on the ability of certain specific polymeric membranes, usually cellulose acetate or nylon to pass pure water at fairly high rates and to reject salts. To achieve this, water or waste water stream is passed at high pressures through the membrane. The applied pressures has to be high enough to overcome the osmotic pressure of the stream, and to provide a pressure driving force for water to flow from the reject compartment through the membrane into the clear water compartment.

In a typical reverse osmosis system, the feed water is pumped through a pretreatment section which removes suspended solids and if necessary, ions such as iron and magnesium which may foul the system. RO membranes are susceptible to foul due to organics, colloids and mi-croorganism.

In twenty first century when the ground water level is going downward, environmental safety is prime concern, this etp is definitely going to play a good role to reduce the pollution level and ground water consumption.

The present system is believed to work on the favour of achieving those targets.

4.2 Implementation of ETP plant

Step-01: - Hot water recovery:

Condensed & Flash steam recovery system: Condensed & Flash steam from dye and garments recovered to feed water tank that use to pre heat the boiler again up to 90-92oC

Step - 02: - Energy Saving Practice:

Reduce / Save H_2O	Natural Gas Save	Reduce CO_2 emission
1,25,000 m^3/year	8,00,110 m^3/year	523 Ton CO^2 e/year

Step-03: - Wastewater segregation and installation of plumbing / sanitary work:

Already we have constructed wastewater segregation line. There will be two drain lines, one dye bath water to ETP washing water to new reservoir tank.

Calculation of segregation water:

A) Calculation of concentration water with Knit Fabric Dye Bath:

Dyeing Capacity = 30,000 kg/day. Liquor Ratio = 1:6. Amount of water for 30,000 kg/day dyeing = 30,000 X 90 liter = 2700 m3/day = 112.5 m3/hr.

B) Calculation of Concentration water with Yarn Dye Bath:

Dyeing capacity = 12,500 kg/day. Liquor ratio = 1:6. Amount of water for 12,500 kg/day dyeing = 12,500 X 110 = 1375 m3/day = 57.29 m3/hr.

C) Calculation of concentration water with All Over Printing:

Printing Capacity = 18,000 Kg. Amount of water for 18,000 kg/day printing = 18,000 X 55 liter = 990 m3/day = 41.25 m3/hr.

D) Calculation of concentration water with Screen Print Wash:

Wash Capacity = 50,000 pcs. Amount of water for 50,000 pcs/day = 50,000 X 0.75 liter = 37.5 m3/day = 1.56 m3/hr.

E) Calculation of Concentration water with Human Waste:

Total Manpower = 9000 persons. Water Required 50liter/person. Total Water Generation: - 9000 X 50 = 450,000liter = 450 m3/day. = 18.75 m3/hr.

F) Wash water calculation

F.1 Water calculation for toilet flushing:

Total no of people worker with management = 4500 persons. Water require = 50 liters per capita per day. Amount of water = 50 X 4500 = 225,000 lit = 225 m3/day.

F.2 Water calculation for car washing:

Total no of car = 20 no's. Water require = 200 liters per car. Amount of water = 20 X 200 = 4,000 lit = 4 m3/day.

F.3 Water calculation for floor flushing:

Total floor area: - (Dyeing + Washing) Total Area = 83098.08 Sft Water require = 0.20 liters per sft Amount of water = 83098.08 X 0.20 = 16,619.62 lit = 16.62 m3/day.

F.4 Chemical Drum Washing:

= 20 m3/day.

F.5 Firefighting (On Demand):

= 6 m3/day.

F.6 Water calculation for road watering:

= 5 m3/day.

F.7 Water calculation for Cooling Pad:

= 15 m3/day.

Step - 04: - WTP new reserve tank for backwash water storage:

WTP (Capacity – 300 m^3/hr.)
Back Wash (Multigrade Filter & Activated Carbon Filter) 200 m^3/day. (Go to ETP) Back wash (Softener unit) 65m^3/day. (Go to ETP) Salt regeneration 70 m^3/day. (Go to ETP) Rewash 70m^3/day. (Go to WTP raw tank) Drain wash 180 m^3/day. (Go to reserve tank for regeneration)
Reuse volume 250 m^3/day (Rewash + Drain wash volume)

Step-05: - Magneto Hydro Dynamics:

Uses are in Boiler and Generator.

Benefits:

Reduce Natural Grid Gas Consumption 15% from present use in boiler and generator.

Step - 6: - Water Flow Meter Installation:

I. Continuous process
II. At present, we have some water flow meters.

Waste water recycling is the only holistic solution to the water scarcity and can meet the growing demand for good quality water even as water scarcity and pollution increases

Chapter 5

5.1 Combersion between old and advanced ETP

Sl No	Difference Criteria	Old ETP	Advanced ETP

1.	Methodology	Only one type of raw effluent can be treated mostly, Low contaminated effluent.	Three types of ray effluent can be treated including Solid,Low Contaminated & High Contaminated raw effluent which is shown at the flowchart above.
2.	Screening Chamber	Manual Screening Chamber	Automated Screening Chamber
3.	Hot water Recovery	No recovery for hot water is possible at this kind of ETP	30% to 40% of hot water can be recovered by the parallel flow heat exchanger of this ETP
4.	Uses of AFM (Activated filter media)	No uses of AFM at any filtration process	Used AFM at every filtration process for recycling purpose 
5.	Softener Unit	No Uses of softener Unit as a result the hardness of the water is more.	Used Softener unit to reduce the hardness of the water by reducing the salts such as calcium & magnesium in water for using it Commercially.
6.	Reverse Osmosis	This process is not included in the Old ETP	This process is included in the new one for desalination and total purification of the water for reusing purpose.
7.	Floating Softening Unit for pH monitoring	No Floating Softening Unit is used in this ETP	A fully automated floating softening Unit is included in this ETP for pH monitoring purpose

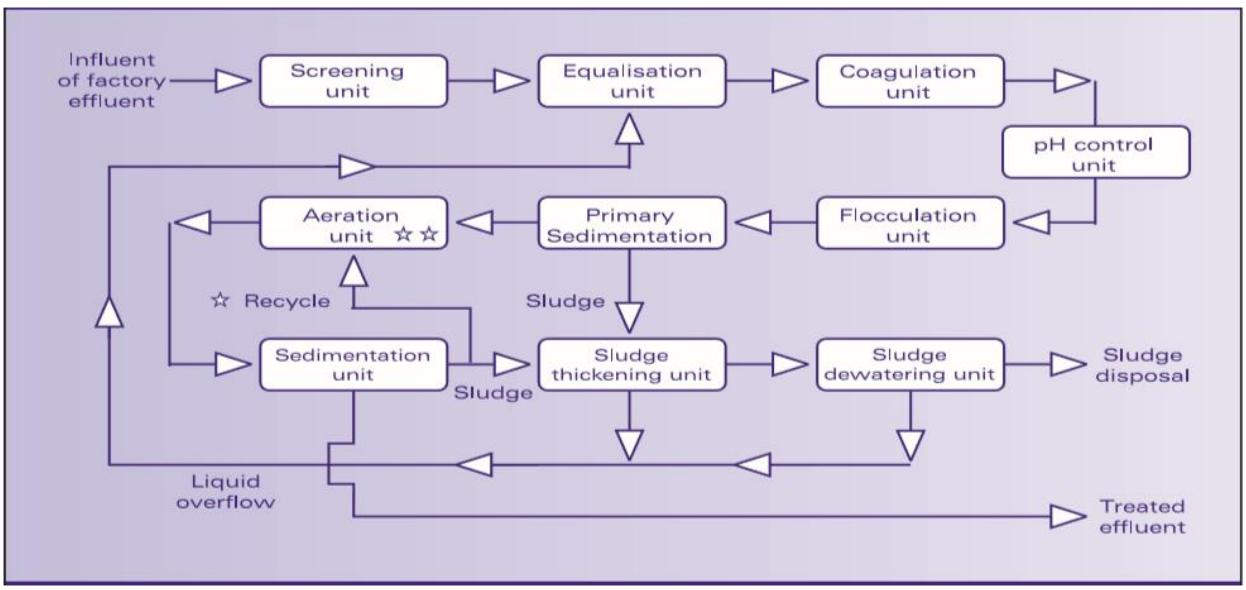
			
8.	UV Treatment Unit	No UV treatment unit is used	UV Treatment unit is used for the removal of hazardous micro-organisms for the treatment of water.
9.	Decantation Tank	Only one conventional decantation tank is used in this ETP	Two types of Decantation tank is used as shown above which can handle solid particles Not less than 10 µm
10.	Uses of Advanced Chemical	No uses of Advanced chemical such as APF and Nanofloc	Uses of APF (All poly floc) and Nanofloc for the coagulation and flocculation purpose. 
11.	Parameters	Poor improvements at the parameters as shown above as a chart such as pH, TDS, after the total treatment process	A huge improvements at the parameters as shown above at the charts such as pH, TDS & Hardness after the total treatment process.
12.	Drum Filters	No drum filters are used for Low Contaminated effluent	Drum filters are used for Low Contaminated Effluent in the advanced ETP pictures are given above.
13.	Screw Filters	No Screw filters are used for Hard or solid effluent	Screw filters are used for Hard or solid effluent such as Human waste.

14.	Backwash Process	There is no backwash process included in the old ETP	Backwash process is included into the advanced ETP for cleaning and washing the wastage from the machineries.
15.	Aeration tank air diffusers	Old models of Air diffuser is used where oxygens are not mixed as bubles & properly with the water 	New models of Air diffusers are used where oxygens are diffused as air bubbles so that it can get easily mixed up with the water as a result the bacteria can survive easily. 
16.	Zelta Potentiometer	No Zelta potentiometer is being used for flocculation purpose	Zelta potentiometer is being used for the help of flocculation purpose. 
17.	Heat Exchanger Unit	No heat exchanger unit is used as there is no hot water recovery possible	Parallel flow Heat exchanger is used for the hot water recovery and reuse of this water to the dyeing floor.

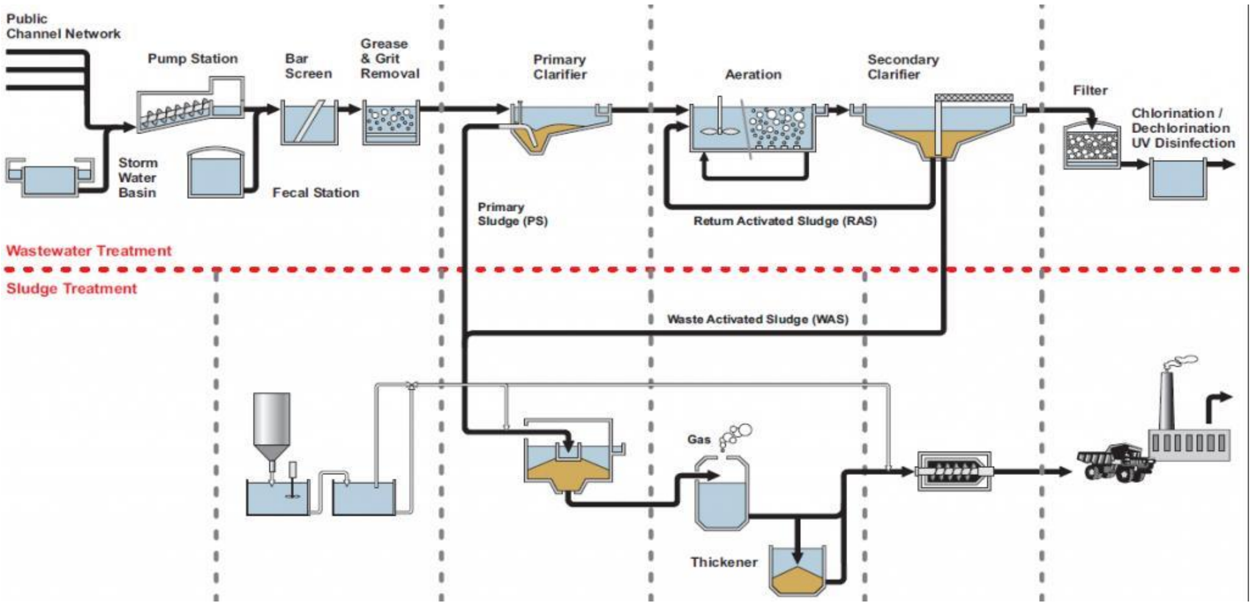
			
18.	Sludge Transfer pumps	No Sludge transferring pump is used as only gravitational flow is used in this ETP	For sludge transfer high efficient pumps are being used specifications are given above. 

5.2 Comparison of flow charts of old ETP with the new

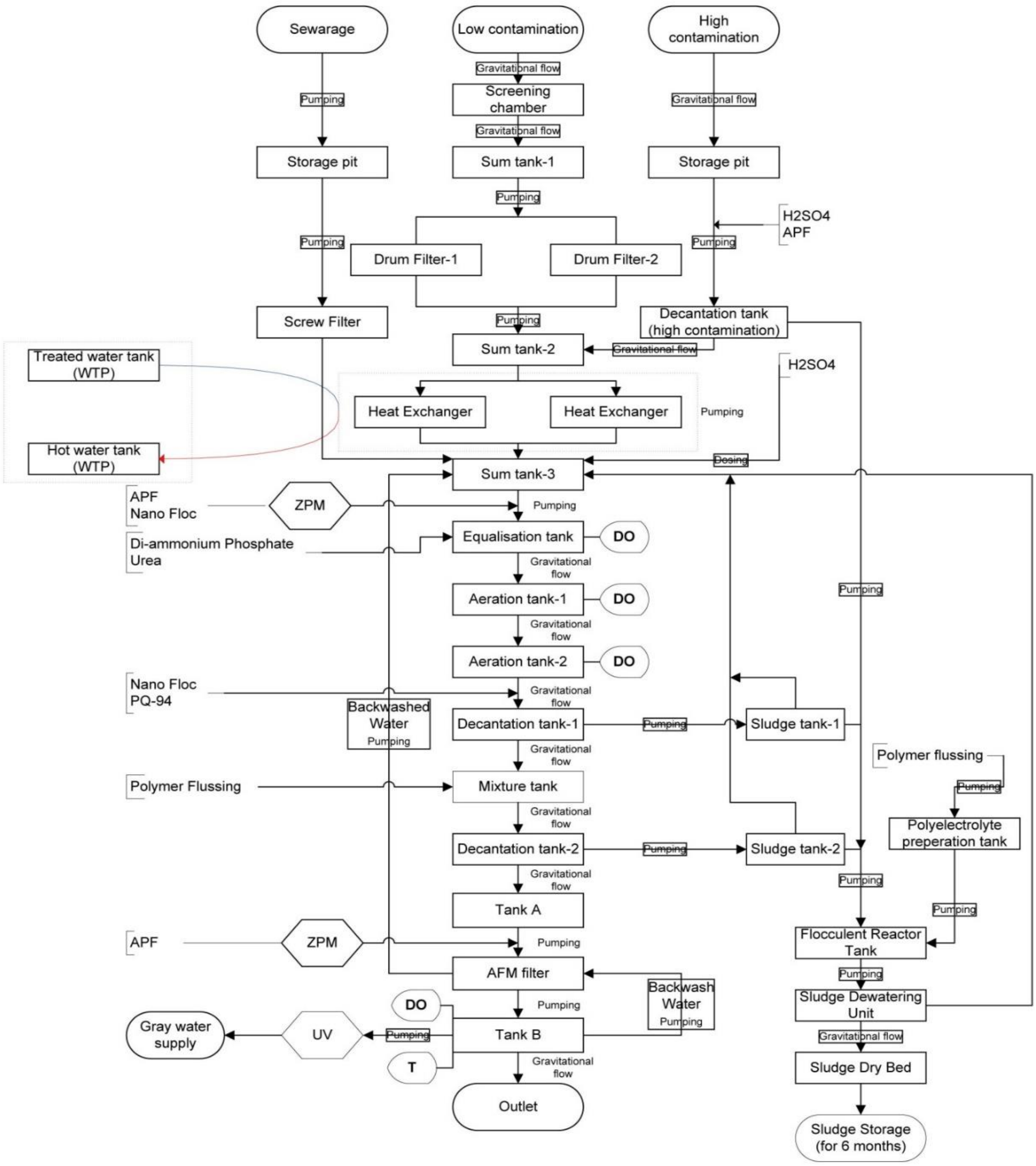
Flow chat of old ETP



Overview process of advanced ETP



Flow chart of the Advanced effluent treatment plant(ETP) :



5.3 Comparison table of parameter chart for old and new ETP

Parameters Chart for an Old ETP:

	Water processed

Time	PH	Temp. c	TDS ppm
04.00pm	8.9	38	2600
05.00 pm	8.2	40	2580
06.00 pm	8.4	38	2580
07.00pm	8.8	41	2610
08.00pm	8.7	40	2570
09.00 pm	8.6	41	2620
10.00pm	8.8	39	2560
11.00pm	8.7	38	2540
12.00am	8.9	36	2570
01.00 am	8.8	37	2530

Parameters Chart for a New ETP:

Dird Composite Textile Ltd

Unit -02

Present status of ETP Effluent

Date: 24/12/18 -25/12/18

Time	Raw Effluent ppm				After Equalization tank ppm			
	p^H	Temp.^{0C}	TDS	DO	p^H	Temp.^{0C}	TDS	DO
04.00 pm	9.9	46	990	0	7.9	35	1900	0.2
05.00 pm	10.1	47	2900	0	8	36	1890	0.2
06.00 pm	10	47	3100	0	8	36	1890	0.3
07.00 pm	10	46	3010	0	8	36	1910	0.2
08.00 pm	9.8	46	2100	0	7.9	37	1910	0.2
09.00 pm	10	47	2500	0	7.9	36	1930	0.2
10.00 pm	10.1	47	3100	0	8	36	1900	0.2
11.00 pm	9.5	42	2810	0	8	36	1910	0.2
12.00 am	10.2	48	3080	0	8.1	37	1880	0.3
01.00 am	10	45	3150	0	8.1	37	1920	0.2
02.00 am	10.5	47	2840	0	8	36	1900	0.2
03.00 am	10.2	45	2150	0	8	36	1910	0.3
04.00 am	9.8	40	3080	0	8.2	37	1890	0.3
05.00 am	10	43	2610	0	8.1	36	1890	0.4
06.00 am	9.6	42	2980	0	8.1	36	1910	0.2
07.00 am	10.2	44	2340	0	8	36	1920	0.3
08.00 am	10	41	1650	0	8.1	36	1900	0.2
09.00 am	9.8	44	750	0	7.9	35	1890	0.2

Dird Composite Textile Ltd

Unit -02

Present status of ETP Effluent

Date: 24/12/18 -25/12/18

After Aeration tank-1 ppm				After Aeration tank-2 ppm				Outlet water ppm			
p^H	Temp.^{0} c	TDS	DO	p^H	Temp.^{0C}	TDS	DO	p^H	Temp.^{0C}	TDS	DO
7.5	34	1850	2.8	7..5	33	1870	3.4	7.7	33	1760	4.7
7.5	34	1850	2.9	7.6	33	1840	3.5	7.6	32	1760	4.8
7.5	35	1860	2.9	7.6	34	1840	2.1	7.7	32	1750	4.8
7.6	35	1840	3	7.6	34	1850	3.6	7.6	31	1760	4.7
7.5	36	1850	3	7.6	35	1800	3.7	7.6	33	1750	4.4
7.6	35	1850	2.8	7.6	34	1840	3.6	7.5	33	1750	4.8

5.4 Environmental Benefits of installation of new ETP

I. Less contaminated sediment & sludge build-up.
II. Decrease in pathogens.
III. Less Biological Oxygen Demand (BOD).
IV. Regulated water temperature.
V. Lower Nutrient loading
VI. Enhance marine habitat. Return of native marine life.
VII. Maintenance and /or enhancement of current marine life.
VIII. Reduce chance of nuisance and toxic algal blooms.

5.5 Economic Benefits of installation of new ETP

I. Increase recreational opportunities.
II. Increase property values.
III. Reduce human health risks.
IV. Enhances attractiveness.
V. Increase in commercial fisheries

Conclusion:

In this thesis we have showed how the parameters of an fully automated Green ETP varies from an Old or conventional type ETP's by using advanced technologies and machineries through performance analysis So the recent awareness on the ETP requirement should be directed in a constructive way.

So factories must come forward to fulfill their responsibilities towards our environment and society. The Government must come forward to facilitate ETP installation with technical guidance and also with financing. Government's recent stringent role against industry owner may pressurize them to come up with compliance meas- ure regarding ETP installation, but in the long run, a good result from the concept of ETP installation can only be ensured by proper monitoring and environmental audit by Government afterward.

The readings came directly from the ETP plants which is situated at Rajendrapur Sreepur, Gazipur paragraph 5.3

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