FABRICATION OF A WATER TREATMENT PLANT

SONARGAON UNIVERSITY

A PROJECT AND THESIS

BY

Md. Abdul Muhit Rubel
Md. Humayun Kabir
Md. Manzur Rahman
Md. Myne Uddin
Md. Abdullah Ebne Munsur

DEPARTMENT OF MECHANICAL ENGINEERING
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BY

Md. Abdul Muhit Rubel
Student Id: BME1601008321

Md. Humayun Kabir
Student Id:BME 1601008316

Md. Manzur Rahman
Student Id: BME 1503007566

Md. Myne Uddin
Student Id: BME1502006355

Md. Abdullah Ebne Munsur
Student Id: BME1503007468

Supervisor: Arup Kumar Haldar

Lecturer

SONARGAON UNIVERSITY
147/1, GREENROAD , DHAKA

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....
Supervisor
Arup Kumar Haldar

....
Head of the Department
Md Mostofa Hossain

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ABSTRACT

The purpose of this thesis is reduction of water drawn from the waste water to secure the coming future, making the premises & surroundings healthier through increased green area. Herewith water management options could be applied to the Bangladesh to maximize sustainability, research opportunities, and the updated treatment technology system, while being environmental friendly, financially & reasonable. The main focus is in five aspects of water management: Rain water harvesting, surface water management, ground water, waste water treatment and sewage water treatment. Securing the sourceable water against undesired contaminations, to make a difference to the overall fresh water consumption in Bangladesh. It is determined that potential exists for the reuse of effluent and sludge in experimental application in agriculture, aquaculture, domestic and industrial settings. Overall, the options considered and evaluated in the thesis indicated that the Sonargaon University of Bangladesh can implement these options to increase sustainability, research opportunities ,and independence from the greater water pollutions while being legally, logistically, and financially practical.

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Chapter -1
Introduction

1.1 Introduction

End-users all over the world suffer from the consequences of poor water quality, whether it is a private household, a factory, a commercial or medical process every one has their own expectations and desires on the requested water quality When the incoming water supply does not meet these expectations, water treatment offers the solution to make your water fit to your demands.[1]

Greater Dhaka currently represents more than 40 percent of Bangladesh's national GDP and its population is growing annually at around 9 percent. Dhaka's population 12 million people is projected to nearly double by the year 2025. Dhaka is surrounded by rivers and inter-connected with cannels which have always formed a life-line for city residents. In last twenty years, a convergence of unregulated industrial expansion, rural-to-city migration, encroachment of the rivers, overloaded infrastructure, confusion about the institutional responsibility for the quality of Dhaka's water bodies, and weak enforcement of environmental regulations have all taken their toll on surface water quality. There is only one sewage treatment plant at Pagla which is currently operating below capacity because of sewerage system failures, and few industries operate Effluent Treatment Plants. Almost all the waste from humans, industry, and millions of farm animals, along with tons of pesticides and fertilizers, make their way into Dhaka's surface water untreated, and a percentage of these wastes infiltrate the ground water.

As a result, pollutant levels in the groundwater are increasing, and many sections of the rivers and canals in the city and surrounding areas, especially the Buriganga and Sitalakhya, are biologically dead during the dry season, spurring wide spread public concern and promoting reaction at the highest political levels.

Industrial pollution accounts for more than 60% of the organic pollution load in the Dhaka catchment area; typically concentrated in dense, informal, unplanned industrial clusters located along the major rivers.

Water is a resource that is becoming increasingly scarce and needs to be sustained, globally and locally. One of the most serious problems faced by billions of people today, is the availability of fresh water.

Governments and organizations all over the world have realized that sustainable water and waste water management is a necessary component of functioning communities. Efforts to find and implement alternative methods can be found from Texas to Thailand to Africa. Alternative practices that are implemented at Bangladesh would provide research opportunities so that effective ideas can be passed on to the people who need it most.

The type and degree of treatment are strongly dependent upon the source and intended use of the water. Water for domestic use must be thoroughly disinfected to eliminate disease-causing microorganisms, but may contain appreciable levels of dissolved calcium and magnesium(hardness).Water to be used in boilers may contain bacteria but must be quite soft to prevent scale formation. Wastewater being discharged into a large river may require less rigorous treatment than water to be reused in an arid region. As world demand for limited water resources grows, more sophisticated and extensive means will have to be employed to treat water.

Most physical and chemical processes used to treat water involve similar phenomena, regardless of their application to the three main categories of water treatment listed above. Therefore, after introductions to water treatment for municipal use, industrial use, and disposal, each major kind of treatment process is discussed as it applies to all of these applications.

The purpose of water treatment is to remove contaminants present in the water or reduce the concentration of such contaminants to make the water fit for its desired end-use. Depending on the incoming water quality and the end-user's expectations different kinds of water treatment can/must be applied.

The alternatives addressed in this thesis provide a foundation for further work. Others can expand upon what we have started, continuing research to develop new and innovative practices.

1.2 Water Filtering Importance of study

Effluent treatment is the process of removing harmful contaminants/pollutants from the water that is used by hotels, restaurants, resorts, hospitals, industries etc. and thereby converting dirty, polluted and unhealthy water into clean, safe and pure water so that it can meet quality standards. Major sources of effluent produced from many hotels are: washing of utensils, sink basins, restrooms and many such units.About70-75% of the hotel waste is biodegradable(like food, vegetable and non- vegwaste)will get mixes with all other type of non-biodegradable waste (such as suspended solids, oils etc.) when disposed at a collection spot.

Fig: 1.1 Water Filtering Plant.

Water Filtering Plant 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 onthe 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 Water Filtering Plant is required. The Water Filtering 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.

1.3 Objective of the study:

- To purify water by the water treatment plant.
- By the Water treatment plant to reduce cost.
- To recycle waste water by the plant.

1.4 Application:

Major applicable environmental legislation in Bangladesh

a. Environment Conservation Act (1995): Which includes environmental guidelines to control and mitigate environmental pollution, conservation and improvement of environment and provisions for Obtaining an Environmental Clearance Certificate (ECC) for development projects.[6]
b. Environment Conservation Rules (1997): Which provides a first set of rules under the Environment Conservation Act giving categories of development projects and requirements for Initial Environmental Examination (IEE), Environmental Impact Assessment (ELA), and preparation of Environmental Management Plan (EMP), and the procedure for obtaining an ECC. Also quality standards for air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhausts are given

Other relevant policies/legislations in Bangladesh

Environment

a. Environment Policy, 1992 and Environment Action Plan,1992
b. National Environment Management Plan,1995
c. Environmental Courts Act,2000

Water Resources

a. National Water Policy,2000
b. National Water Management Plan,2001

Industry, Occupational Health & Safety and Construction

a. Industrial Policy,2005
b. The Bangladesh labour act,2006
c. Bangladesh National Building Code (1993,2006)

Land Acquisition/Requisition

Acquisition/ Requisition of Immovable Property Ordinance (ARIPO, 1982)

Chapter -2
Literature Review

2.1 Distributions:

No portable reclaimed water is often distributed with a dual piping network that keeps reclaimed water pipes completely separate from potable water pipe.

In many cities using reclaimed water, it is now in such demand that consumers are only allowed to use it on assigned days, some cities that previously offered unlimited reclaimed water at a flat rate are now beginning to change citizens by the amount the use.

There are several issues and concerns that need to consider during water supply system in a particular area. Some of the most common and important issues and aspects that are closely related with the water supply system in Bangladesh. The distribution system is a key element of water supply system that is needed to deliver water to individual customers from there servoirs. Water supply networks are part of the master planning of communities' counties and municipalities.[5]

2.1.1 Biological Treatment Plant of Waste Water

1. Biological Aerobic Treatment: Aerobic wastewater treatment is a biological process that takes place in the presence of oxygen. It is the rapid and the most efficient biological waste treatment which remove up to 98% of organic contaminants. This process causes effective breakdown of organic pollutants and yields a cleaner water effluent than anaerobic treatment. Aerobic biological treatment processes include many processes such as activated sludge process, trickling filter, aerated lagoons and oxidation ponds etc. Activated sludge process is the most widely used process for domestic and industrial wastewater. Aerobic biological treatment will remain efficient and stable in all conditions.

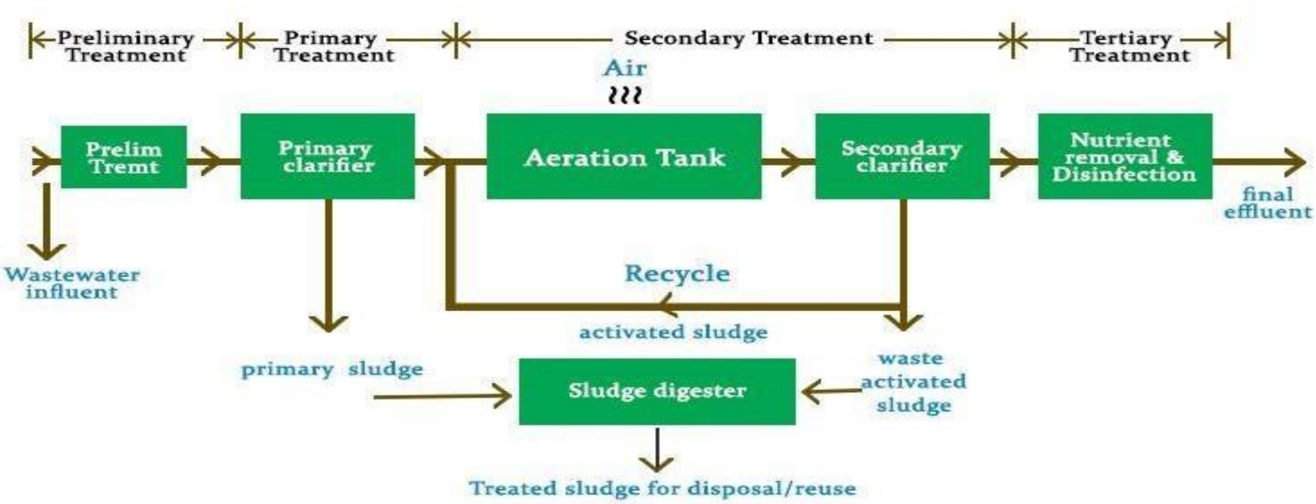

Fig:2.1 Treated sludge for disposal

1. **Activated Sludge Process:** The activated sludge process is the most widely used biological waste treatment in secondary stage of wastewater treatment. An activated sludge process refers to a multi-chamber reactor unit that makes use of highly concentrated microorganisms to degrade organics and remove nutrients from waste water to produce a high-quality effluent. In this method, the sewage containing organic matter with the micro organisms is aerated(by a mechanical aerator) in an aeration tank. This process speeds up waste decomposition. Aeration in an activated sludge process is based on pumping air into a tank, which promotes the microbial growth in the wastewater. The effluent from the aeration tank containing the flocculent microbial mass, known as sludge, is separated in a settling tank, sometimes called a secondary settler or a clarifier. The activated sludge process is a very compact, low-cost and an efficient biological treatment system for-sewage/waste-water-treatment.

   Trickling filters: This is the second commonly using type of aerobic treatment which is also called as percolating or sprinkling filters. These filters are commonly used to remove compounds such as ammonia from the water after primary treatment.

   Aerated Lagoons: It is one of the aerobic biological wastewater or waste treatment process. An aerated lagoon is a treatment pond that is provided with mechanical aeration that introduces oxygen into the pond in order to promote the biological oxidation of the wastewater. The effluent of aerated ponds may be reused or used for recharge, but requires a further treatment.

   Oxidation Pond: The ponds involve an interaction between bacteria, algae and other organisms which feed on the organic matter received from primary effluent. These ponds are also productive, because it generates effluent that can be used for other applications. Overall the process is slow and requires large areas of land. Typically oxidation ponds are used in areas with small populations where land is readily available.

Biological Anaerobic Treatment: This treatment process is effectively utilized to treat high strength waste water and it employs organisms that function in the absence of oxygen and it will typically treat high-strength waste water to a level that will permit discharge to a municipal sewer system. Here, the amount of sludge produced is very small when we compared to aerobic treatment. Anaerobic treatment is a slow process and it occurs in many different stages. Anaerobic digestion is biological process which is used in waste water treatment plants for sludge degradation and stabilization. Once the process is completed, the waste water can undergo many additional treatments. This process is accepted because it is able to stabilize the water with little biomass production.

Biogas is produced as the bacteria feed off the biodegradable material in the anaerobic process. Overall, the process converts about 40% to 60% of the organic solids to methane (CH4) and carbon dioxide (CO2).

Lab Report of Biological Treatment Plant:

Data Table: 1 Lab Report of Biological Treatment Plant

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	12.01.20	B-12	4.84	6.50	300	920	949
outlet of water filtering plant	09.01.20	B-11	7.01	7.60	05	19	501
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

2.1.2 Domestic Waste Water Treatment Plant:

Domestic Waste water

Wastewater derived from human activities in households such as bath, laundry, dish washing, garb- age disposal, toilets etc. is called as Domestic Wastewater which usually contains relatively small amounts even small amount of pollutants can make a big impact on environment. [2]

1. **Primary Stage:**
    - This is the first stage of sewage/wastewater treatment that removes about 40-60% of the suspended solids.
    - It involves screening to remove large objects such as sticks, stones etc which can cause damage to tank inlets.
    - It employs grit chamber which slows down the flow of wastewater to allow grit to fall out naturally to the bottom of the tank where it can be removed.
    - Primary clarifier or settling/sedimentation tank in this stage removes sinking and floating contaminants.
    - The partially treated wastewater from the primary tanks then flows to the secondary treatment system.

2. Secondary Stage:

- This is the stage where the biological (aerobic/anaerobic) treatment of waste water from the primary stage begins and it removes up to 90% of organic matter.
- It uses activated sludge process which use dissolved oxygen to promote growth of biological flow that substantially removes organic matter.
- Bacteria-containing "activated sludge" is continually re-circulated back to the aeration tank to increase the rate of organic decomposition.
- Bacteria attack the dissolved and finely divided suspended solids which are not removed by primary sedimentation.
- The water is then taken to settling tanks where the sludge again settles, leaving the water (90 to 95) % free of pollutants.

3. Tertiary Stage:

- When the effluent from secondary treatment is unacceptable, a third level of treatment called tertiary or advanced treatment, can be employed.
- Its purpose is to provide final treatment stage to raise the effluent quality to the desired level.
- When the wastewater reaches tertiary stage, it still contain suspended matter and fine particles and are removed in this stage.
- The water at this stage is almost free from harmful substances and chemicals and which can be reused, recycled or released back into the environment.
- This stage is also called as disinfection stage and UV is an ideal disinfectant for waste water since it does not alter the water quality.

<u>Lab Report of Domestic Waste Water Treatment Plant:</u>

Data Table: 2 Lab Report of Domestic Waste Water Treatment Plant

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	09.01.20	B-78	4.97	6.30	275	900	949
Outlet Of Water Filtering Plant	09.01.20	B-79	7.58	7.50	4.5	17	501
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

2.1.3 Water Filtering Plant for Hospitals

Hospitals consume large volume of water per day for different purposes and also generate large volumes of wastewater that need to be treated. [2]

There are many units in hospitals which generate wastewater/sewage are listed below:

- Patient wards & administration unit
- Kitchen/canteen and laundry
- Operating rooms and ICUs

Hospital effluent consists:

Hospital effluent may contain large variety of potentially hazardous components including, micro- biological pathogens, radioactive isotopes, disinfectants & sterilizes, drugs and their metabolites, chemical compounds, heavy metals and pharmaceuticals etc., at high concentrations and containing some solids disposed by staff and patients. Wastewater from hospitals categorized into as follows:

- **Backwater:** It is highly polluted wastewater consists of faucal matter, urine, food residues, toxic chemicals etc.
- **Greater:** It is low contaminated wastewater with residues from bathing, washing, laboratory processes.
- **Storm water:** Which consist of rainwater from roofs, grounds and other areas in hospitals.

Water Filtering Plant in Hospitals and its objective

Proper treatment of hospital wastewater is very much essential. Why because, if the effluent from hospitals is not properly treated, then the environment and human health can be negatively impacted. Hence, the selection of suitable treatment technology called Water Filtering Plant for hospitals is very much required. Conventional treatment processes involved effluent treatment is shown in below image.

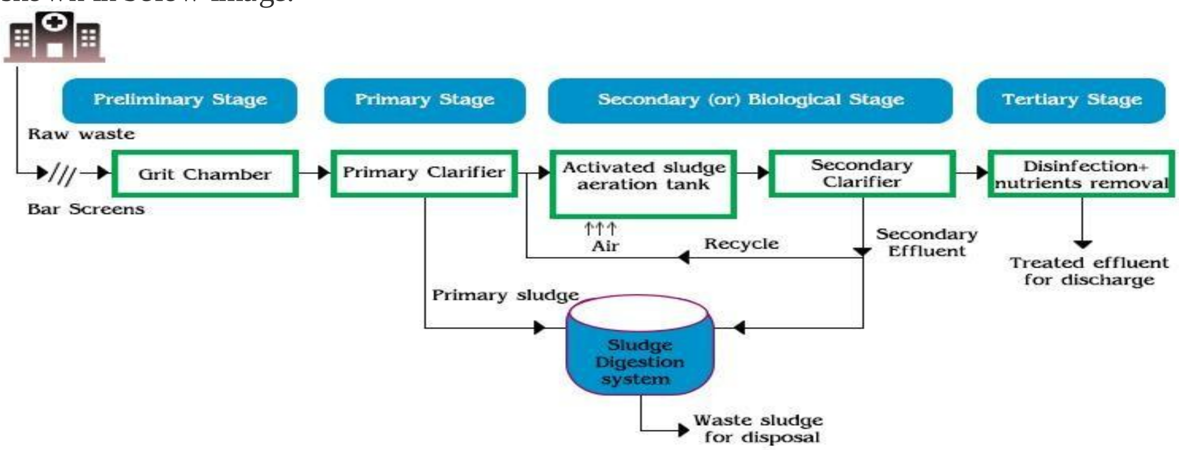

Fig: 2.2 Flow Diagram Water Filtering Plant of Hospital

Preliminary Stage: This stage is also called as pretreatment which is the most essential treatment process in most of the Water Filtering Plant. It involves bar screens which comes in variety of shapes and sizes to remove large sized suspended solids like paper, plastics, metals, debris, rags and many such from incoming raw wastewater/sewage. If these materials are not removed then they may cause serious damage to plant equipment's. When wastewater enters into grit chamber, it slows down the flow of water and thereby removes sand, grit, sand stones and this process is called as sedimentation.

1. **Primary Stage:** It uses physical and chemical methods to improve the quality of the wastewater which was not achieved in previous stage. When wastewater enters to sedimentation tank or primary clarifiers, heavier solid particles settle to the bottom of the tank and lighter particles will float up and will be skimmed off from top of the surface using a process called skimming and thereby removing 60-65% of total suspended solids from liquid wastewater. This stage may use grit chamber to remove grit. The settled solid is known as primary sludge which will to sludge digester for further processing. Now partially clarified stage.
2. **Secondary Stage:** This is the stage which can remove about 80-90% of organic matter by using a process called biological treatment methods. Most of the hospital Water Filtering Plant uses "activated sludge process" in which liquid waste water enters into aeration tank where wastewater mixes with air to encourage the growth of microbes and hence breakdown of organic matter takes place. When aerated water enters into secondary clarifier, floatable matter will be removed and heavier matter settles to bottom which is called as "active sludge" or secondary effluent. Part of the sludge which still contains microbes will be re-circulated back to aeration tank to increase the rate of organic matter decomposition. The left over microorganisms are handled separately.
3. **Tertiary stage:** This is the final stage which is also known as disinfection stage. This stage removes any residual suspended solids and other materials which were not removed in previous stages. The effectiveness depends on the quality of the water being treated. The major objective of disinfection is to reduce number of microorganisms in the waste water to be disposed into the natural environment. Disinfection technologies consist of ozone, chlorine, and Ultraviolet (UV) rays to eliminate toxic chemicals that exist in the wastewater. This stage removes nitrogen, phosphorous and other toxic contaminants.

Lab Report of Hospital Waste Water:

Data Table: 3 Lab Report of Hospital Waste Water:

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water Filtering plant	22.01.20	B-42	4.92	6.25	289	880	960
outlet of water filtering plant	22.01.20	B-43	7.98	7.79	4.6	20	517
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

2.1.4 Water Filtering Plant for Textile Industry

If you are into an industrial sector, then you need to pay attention to wastewater management. With the rapid development of industries, more and more harmful pollutants/contaminants are discharged into the environment and lead to serious environment risk specially water pollution of major concern. Textile industry is the most water consuming industry and also generates more waste water too. [2] Hence, it is mandatory to limit hazardous waste water discharging from the textile or garments industry by setting up Water Filtering Plant. Textile or garments sectors generate effluents of extremely variable composition hence wastewater treatment system plays a vital role here. Yes, Water Filtering Plant is the best option for safe environment from textile waste and it results in cost and environment savings with excellent treatment efficiency.

1. Importance of Water Filtering Plant on Textile Industries:
Water Filtering Plant is the most effective and technically advanced treatment system which is designed to treat effluent or waste generated from various establishments like industries etc. The various components of the Water Filtering Plant will depend on the characteristics of the effluent i.e. depending on the type of effluents to be processed. There are different types of Water Filtering Plants are available depending on the quality and quantity of the effluent. Textile industry generates huge volume of wastewater which varies greatly in composition and containing various chemicals used in dyeing, printing, and various other processes. Discharging of untreated effluent from textile industries is highly harmful to the natural environment, causing pollution to nearby water and soil. To get rid of this problem, an Water Filtering Plant plays an important role in textile or garment industries by protecting environment from the harmful effect of waste water.

2. Treatment process sequence involved in Water Filtering Plant for Textile industry:

The untreated textile wastewater from different sections consists of high levels of TSS, dyes, chemicals & auxiliaries, metal toxicants and BOD which must be treated before they are discharged to environment. When waste water passes through the water filtering plant, pollutants are removed and the quality of the water is improved to an acceptance/standard level, allowing for final discharge to the environment without any risk. The mechanisms which often used together in water filtering plant are: physical, chemical and biological generally, water filtering plant consists of four levels of treatment which undergoes in sequence are briefly described below:

3. Preliminary Treatment:

It is also called pretreatment which involves physical mechanism to treat wastewater. It involves screening which uses bar screens to remove large solids like pieces of rags, fabric, yarn, lint's, sticks, etc. that may cause damage to equipment of the plant. Then waste water is subjected to next level called physical treatment.

4. Primary Treatment:

It involves physical & chemical mechanisms for treatment of wastewater. When wastewater enters into primary tank, it stays for lo as a result heavier particles settle to the bottom and lighter particle float on the surface. In this treatment settled and floatable materials are eliminated by flocculation and coagulation process and then it is passed to secondary or biological treatment.

<u>Lab Report of Textile Industry Waste Water:</u>

Data Table: 4Lab Report of Textile Industry Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	07. 01.20	B-23	5.00	6.25	289	921	929
Outlet of Water Filtering Plant	07. 01.20	B-24	8.02	7.63	5.10	20	523
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

2.1.5 Waste Water Treatment Methods

1. What is Wastewater and where does it come from?

Wastewater, also known as sewage can be defined in the following way. Used water that has come into contact with variety of contaminants and concentrations with adversely affected in quality is not fit for human use or environment is called as wastewater. [2]

1. **Homes/Apartments:** Waste water that comes from human and household wastes from kitchen sinks, baths, toilets, showers, laundry etc. is termed as domestic/sanitary waste water.
2. **Industries and Factories:** Waste water which contains toxic chemicals and other wastes from industries, factories, mills etc. is known as industrial waste water.
3. **Schools and Businesses:** A source of waste water which comes from schools, hospitals, offices, hotels, restaurants, airports and many such called as commercial waste water.
4. **Parks, Gardens and Roofs:** Wastewater that flows from areas such as roofs, parks, gardens, roads and gutters into drains, after rain is termed as storm water.

Objectives of Wastewater Treatment:

5. To improve quality of waste water
6. Elimination of pollutants, toxicants and many such
7. Preservation of water quality of natural water resources
8. To make waste water usable for other purposes
9. Prevention of harmful diseases

Methods of Wastewater Treatment:

Wastewater treatment technologies or advanced waste water treatment methods can be broadly classified into three sub divisions and are as follows:

1. **Physical treatment method:** It involves removal of pollutants/contaminants by physical forces.
2. **Chemical treatment method:** Removal of impurities or toxic wastes through chemical reactions.
3. **Biological treatment method:** Ejection of pollutants by biological activities.

1. Screening: Removes heavy solids in wastewater such as rags, paper, plastics, sticks and metals to prevent damage and clogging of downstream equipment.

In organic solids by sedimentation and the removal of materials that will float (scum) by skimming.

It involves physical and /or chemical operations for treatment of wastewater.

1. It involves a more sophisticated tank called sedimentation tank or primary clarifier removes most of the suspended solids that will float or settle.

2. Sedimentation often uses chemicals like flocculants and coagulants.
3. Sludge that settles to the bottom of the clarifier is called as primary sludge and it is collected for further treatment called sludge treatment.
4. In this treatment about 50-70% of suspended solids, 35% of BOD will get reduced and it removes very few toxic chemicals.

2.2 <u>Water supply and Treatments History:</u>

2.2.1 Bangladesh:

Water supply and sanitation in Bangladesh is characterized by a number of achievement and challenges. The share of the population with access to an improved water source and was estimated at 98% in 2004, 2004 a very high level for a low income country. This has been achieved to large extent through the construction of hand pump with the support of external donors. However, in 1993 it was discovered that groundwater, the source of drinking water for 97% of the rural population and a significant share of the urban population, is in many cases naturally contaminated with arsenic.[9]

It gradually emerged that 70 million people drank water which exceeds the who guidelines of 10 microgram of arsenic per liter, and 30 million drank water containing more than the Bangladesh National Standard of 50 micro gram per liter, leading to chronic arsenic poisoning. On the other head, surface water is usually polluted and requires treatment. Taking arsenic contamination into account, it was estimated that in 2004 still 74% of the population head access to arsenic free drinking water. Another challenge is the low level of cost recovery due to low tariffs and poor economic efficiency especially in urban areas where revenues from water sakes do not even cover operating cost. Rural areas, users contribute 34% of investment costs, and at least in piped water schemes supported by the Rural Development Academy recover operating cost.

Sanitation faces its own set of challenges, with only 56% of the population estimated to have head access to adequate sanitation facilities in 2010. A new approach to improved sanitation coverage in rural areas, the community-led total sanitation concept that has been first in traduced in Bangladesh, is credited for having contributed significantly to the increase the sanitation coverage since2000.

The government has adopted a number of policies to remedy the challenges in the sector, including National Policies for Safe Water Supply and Sanitation, both do 1998, a National Policy of 1999, a National Sanitation strategy of 2005. Among others, these policies emphasize decentralization user participation, the role of women, and “appropriate pricing rules”.

The Arsenic Mitigation Policy gives “preference to surface water over groundwater”. At the operational level, there has also been a conceptual shift from single-use of water such as trough hand pumps for drinking water and motorized deep tube wells for irrigation to multiple use of water from deep tube wells since the 1990s.Waste water reuse (planned or unplanned in an ancient practice, which has been applied since the dawn of human history, and is closely and is closely connected to the development of sanitation provision.

2.2.2 United State

In the U.S. the Clean Water act of 1972 man dated elimination of the discharge of untreated waste from municipal land industrial sources to make of safe for fishing and recreation. The US federal government provided billions of dollars in grants of building sewage treatment plants around the country. Modern treatment plants, usually using oxidation and chlorination in addition to primary and secondary treatment, were required to meet certain standards.

Los Angeles County’s sanitation districts started providing treated waste water for landscape irrigation in parks and golf courses in 1929. The first reclaimed water facility in California was built at San Francisco’s Golden Gate Park in 1932. The Water Replenishment District of south California was the first groundwater agency to obtain permitted use of recycled water for groundwater recharge in 1962.

Orange County is located in Southern California, USA, and houses a classic example in indirect potable reuse. A large-scale artificial groundwater recharge scheme exists in the area, providing a much-needed freshwater barrier to intruding seawater. Part of the injected water consists of recycled water, starting as of 1976 with Water factory 21, which used RO and high lime to clean the water

(Production capacity of 19000m^3 per day) .This plant was de-commissioned in 2004 and has since made place for a new project with a higher capacity (265,000m^3 per day with and ultimate capacity of 492,000 m^3 per day), under the name of Groundwater Replenishment System.

2.2.3 European Union:

The health and environmental safety conditions under which wastewater may be reused are not specifically regulated at the European Union level. There are no guidelines or regulations at EU level of water quality for water reuse purposes. In the Water Framework Directive, reuse of water is mentioned as one of the possible measures to achieve and Directive's quality goals, however this remains a relatively vague recommendation rather than requirement rather than a requirement refers to reuse as one of the "supplementary measures which Member states within each river basin district may choose to adopt as part of the programmed of measures required.

Besides that, the Urban Wastewater Treatment Directive concerning the reuse of treated wastewater states that "treated wastewater shall be reused whenever appropriate", is not specific enough to promote water reuse and it leave too much room for interrelation as to what can be considered as an "appropriate" situation to reuse treated wastewater.

Despite the lack of common water reuse criteria at the EU level, several Member States (MS) have issued their own legislative from works, regulations, or guidelines for different water reuse applications (Cyprus, France, Greece, Italy and Spain).

However, after an evaluation carried out by the European Commission (EC) on the water reuse standards of several member states it was concluded that they differ in their approach. There are important divergences among the different standards regarding the permitted uses, the parameters to be monitored and limit values allowed. This lack of harmonization among water ruse standards might create some trade barriers for agricultural goods irrigated with reclaimed water. Once on the common market, level of safety in the producing member state may be not considered as sufficient by the importing countries. International standard for best practices in water reuse. The document was developed under a cooperative Research and Development Agreement between the U.S Environmental Protection agency (EPA), the U.S Agency for international Development (USAID) and the global consultancy CDM Smith. The Guidelines provide a framework for state to develop regulation that incorporate the best recites and address local requirements

2.2.4 Australia:

Further information: Water supply and sanitation in Australia. When there are droughts in Australia interest in reclaimed effluent options increases. Brisbane has been seen as a leader in this trend and other cities and towns will review the Western Corridor Recycled Water Project one complete.

While there are currently no full scale direct potable reuse schemes operating in Australia, the Australian Antarctic Division in investigating the option of installing a potable reuse scheme at its davit research base in Antarctica. To enhance the quality of the marine discharge, form the Davis WWTP, a number of different, proven technologies have been selected to be use in the future, such as agonizing, UV disinfection, chlorine, as well as UF, activated carbon filtration and RO.

2.2.5 Namibia:

Further information: water supply and sanitation in a Namibia. An example of direct potable reuse is the case of Windhoek Namibia, New Gringo Water Reclamation Plant (NGWRP), where treated wastewater has been blended with drinking water for more than 40 years. It is based on the multiple treatment barriers concept (pre-assonating, enhanced coagulation/dissolved air flotation/ rapid and improve the water quality. The reclaimed wastewater nowadays represents about 14% of the cities of drinking water.

At the end of 2002 the programmed successfully branded as neater head garnered a 98 percent acceptance rate, with 82% of respondents indicating that they would drink the reused water directly another 16% only when mixed with reservoir water. The produced Neater after stabilization (addition of alkaline chemicals) is in compliance with the WHO requirements and can be piped off to its wide range of application (reuse in discharge to a drinking water reservoir). Neater now makes up around 30% of Singapore’s total use by 2060 Singapore’s National Water Agency plants to triple the current Neater capacity as to meet 50% of Singapore’s future water demand.

2.2.6 South Africa:

In South Africa, the main driver for wastewater reuse is drought conditions. For example, In Beaufort West, South Africa’s direct wastewater reclamation plant (WRP) for the production of drinking water was constructed in the end of 2010, as a result of acute water scarcity (production of 2300m^3 per day) the process configuration based on multi-barrier concept and includes the following treatment process, sand filtration concept and includes the following treatment processes: sand filtration UF, two stage RO, and permeate disinfected by ultraviolet light (UV)

2.3 Bangladesh standard waste water parameters:

This is approved by the environmental department of Bangladesh [11]

Table: 5 Bangladesh standard waste water parameters

SL. No.	Description	Feed	Treated
1	Ph	10-12	<7.5-8.5>
2	TSS	450 PPM	<30 PPM
3	BOD	450 PPM	<30 PPM
4	COD	900 PPM	<200 PPM
5	Temperature	<65ºC	<35ºC

2.4 Water Parameters Descriptions:

Typically contains a wide range of microorganisms and chemicals, some of which could be harmful to public health or to eco systems. Water manager scan choose from a portfolio of treatment options to design a waste-Water treatment system that reduces contaminants to levels that will be acceptable for the intended uses of the reclaimed water. The year under different circumstances, or the "worst case" analysis. For NF and RO units, Table shows recommended inorganic analysis as a minimum.[6]

While scaling is caused by dissolved substance that turn into solids (precipitate) within RO and NF units, fouling causes a loss in performance of a membrane system due primarily to suspended solids. Fouling is typically caused by living or dead particles such as bacteria and algae or non-living particles such as silt, clay and sand. Unfortunately, we don't have soft ware programs that can predict fouling of membrane unit based upon feed water analysis. The presence or absence of certain suspended contaminants doesn't equal to the presence or absence of problems.

There are many factors, including design ones (see below), that affect the fouling Potential of a membrane unit. Fouling potential is quantified most accurately during pilot testing. Total organic carbon (TOC) is important because most micro organisms “eat" pre-existing carbon compounds. TOC is a measurement of the concentration of dissolved organic compounds. Assailable organic carbon (AOC) is better than TOC to determine how much of the dissolved organic carbon can be used (assimilated) by bacteria. Bacteria cannot as similar all organic compounds. It's the assailable organic constituents that promote growth.

SDI test for NF and RO units, there's a test that's a standard in the industry for measuring the fouling potential of a feed water. This is called the Silt Density Index (SDI). Feed water is passed through a 0.45-micron (um) filter pad at 30 pounds per square inch (psi), or 2 bar of pressure for 15 minutes. The time it takes to pass 500 milliliters (ml) of feed water through the filter pad at the beginning and end of 15 minutes are recorded. The longer it takes for the second 500 ml to pass through, the throe fouling particles that are present in the feed water.

An equation converts the time difference into a plugging factor and then an SDI number. The lower the SDI number, the better. For NF or RO feasibility studies, the SDI of the feed water should be measured enough times to accurately categorize the fouling potential.

Table: 6 Minimum analyses performed Parameters

Cationic constituents	Anionic constituents	Other constituents
Calcium, mg/L	Chloride, mgL	Total dissolved solids (IDS) mg/lL
Magnesium, mg/L	Sulfide, mg/L	Conductivity, /cm
Sodium, mgL	Sulfate, mgl	Silica (Sio) mg
Potassium, mg/L	Nitrate, mg/l.	Carbon dioxide (CO.) mgL
Ammonium, mgL	Fluoride, mg/L	pH (at site)
Iron, mg	Bicarbonate, mg/L	Temperature, F (at site)
Manganese, mg/L	Carbonate, mg/L	
Barium, mg/L	Phosphate, mg L	

1. Lead, Copper, Aluminum, Zinc and More

Thecorrosionprocessisanoxidation/reductionreactionthatreturnsrefinedorprocessedmetaltotheir more stable ore state. With respect to the corrosion potential of your drinking water, the primary concerns include the potential presence of Toxic Metals, such as lead and copper, deterioration and damage to the household plumbing, and aesthetic problems such as: stained laundry, biter aster, and greenish- blue stains around basins and drains.

2. Hardness:

Water is a good solvent and picks up impurities easily. Pure water - tasteless, colorless, and odorless - is often called the universal solvent.

Calcium and magnesium dissolved in water are the two most common minerals that make water "hard." The degree of hardness becomes greater as the calcium and magnesium content increases and is related to the concentration of multivalent captions dissolved in the water.

Table: 6 Hardness and Range

Classification	mg/l or ppm
Soft	0-17.1
Slightly hard	17.1-60
Moderately hard	60-120
Hard	120-180
Very Hard	180 & over

3. Iron and Manganese in Water:

A Common Problem Iron and Manganese in Water. Iron and manganese are non-hazardous elements that can be a nuisance in a water supply. Iron and manganese are chemically similar and cause similar problems. Iron is the most frequent of the two contaminants in water supplies; manganese is typically found in iron-bearing water.

4. Taste, and Odors

Besides the parameters described in this report, the color, appearance, taste, smell, and odor of drinking water is the first clue to the home owner that there may be a problem with the water. It is important to note that some chemicals, especially organic compounds and bacterial agents, may be at toxic or at pathogenic (i.e. disease causing) levels, without any observable clues to a problem.

5. TDS:

Dissolved solids" refer to any minerals, salts, metals, captions or anions dissolved in water. Total dissolved solids (TDS) comprise in organic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water.

6. TSS:

Total suspended solids (TSS) is the dry-weight of particles trapped by a filter. It is a water quality parameter used for example to assess the quality of wastewater after treatment in a wastewater treatment plant. It is listed as a conventional pollutant

2.5 Bangladesh Drinking Water Parameters:

2.6

3 Table: 7 Bangladesh Drinking Water Standard Parameters

Water Quality Parameters	Bangladesh Drinking Water Standard
pH Value (pH unit)	6.5-8.5
Alkalinity (mg/L)	100
Iron (mg/L)	500
TDS - Total Dissolved Solids (mg/L)	100
Hardness (mg/L)	250
Calcium (mg/L)	0.2
Magnesium (mg/L)	1.00
Sulphate (mg/L)	0.2
Ammonia (mg/L)	6.5-8.5
Fluoride (mg/L)	100
Aluminium (mg/L)	500

3.3 Advantages:

1. Clean The Industry Effluent And Recycle It For Further Use.
2. Reduce The Usage Of Fresh Water In Industries.
3. Preserve Natural Environment Against Pollution.
4. To Meet The Standards For Emission Of Pollution Set By The Government &Avoid Heavy Penalty.
5. Reduce Expenditure On Water Acquisition.
6. Capable Of Removing 97% Of Suspended Solids.
7. Biological Nitrification without Adding Chemicals.
8. Oxidation And Nitration Achieved.
9. Biological Phosphorous Removal.
10. Solids & Liquids Separation.
11. Removes Organics.
12. Cost Effective.
13. Easily Maintained Mechanical Work.
14. Self-Sustaining System.

Chapter -3
Methodology

3.1 Introduction of Methodology

The methodology is the general research strategy that outlines the way in which research is to be under taken and, among other things, identifies them to be used in it. These methods, described in the methodology, define the mean so modes of data collector, sometimes, how a specific result is to be calculated. Methodology does not define specific methods, even though much attention is given to the nature and kinds of processes to be followed in a particular procedure or to attain an objective.[3]

When proper to a study of methodology, such processes constitute a constructive generic framework, and may therefore be broken down into sub-processes, combined, or their sequence changed.

A paradigm is similar to a methodology in that it is also a constructive frame work. In theoretical work, the development of paradigms satisfies most or all of the criteria for methodology. An algorithm, like a paradigm, is also a type of constructive frame work, meaning that the construction is a logical, rather than a physical, array of connected elements.

Any description of a means of calculation of a specific result is always a description of a method and never a description of a methodology. It is thus important to avoid using methodology as a synonym for method or body of methods. Doing this shifts it away from its true epistemological meaning and reduces it to being the procedure itself, or the set of tools, or the instruments that should have been its outcome. A methodology is the design process for carrying out research or the development of a procedure and is not in itself an instrument, or method, or procedure for doing things.

Methodology and method are not interchangeable. In recent years, however, there has been at tendency to use methodology as a "pretentious substitute for the word method". Using methodology as a synonym for method or set of methods leads to confusion and misinterpretation and undermines the proper analysis that should go into designing research.

3.2 Description of Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.

Amethodologydoesnotsetouttoprovidesolutions—itistherefore,notthesameasamethod.Instead, a methodology offers the theoretical underpinning for understanding which method, set of methods, or best practices can be applied to a specific case, for example, to calculate a specific result.

It has been defined also as follows:

"The analysis of the principles of methods, rules, and postulates employed by a discipline"

"The systematic study of methods that are, can be, or have been applied within a discipline"

"The study or description of methods ".

3.3 Schematic Diagram

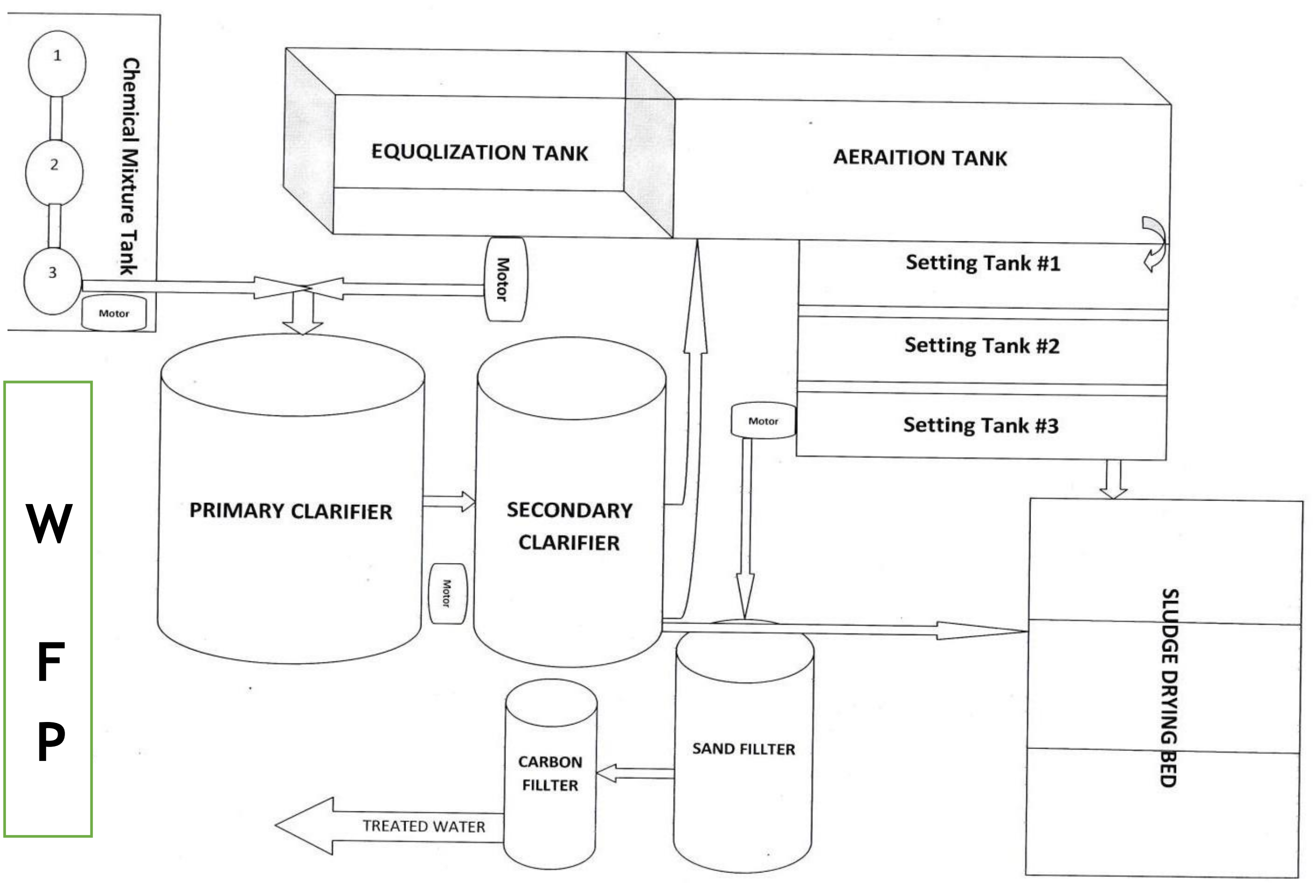

Fig: 3.1 Water Filtering Plant Schematic

3.4 Water Filtering Plant Design/Layout:

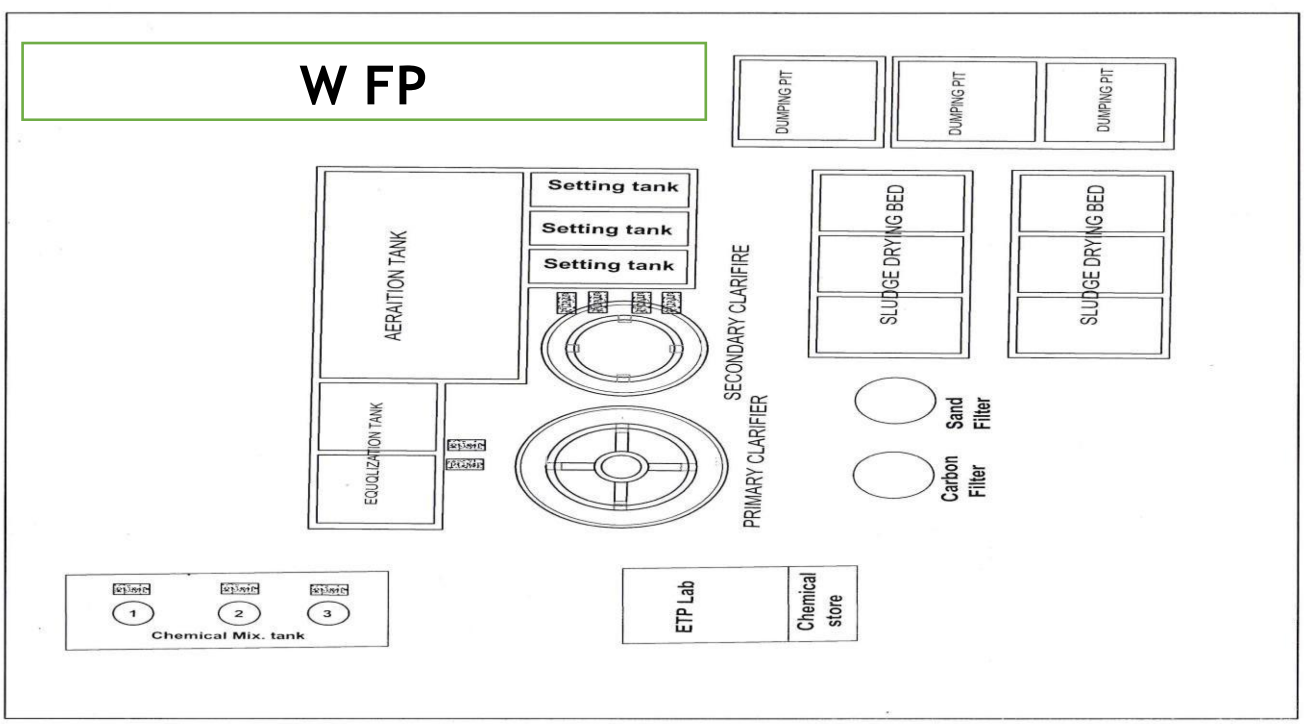

Fig: 3.2 Water Filtering Plant Layout

3.5 Flow Diagram of Water Filtering Plant

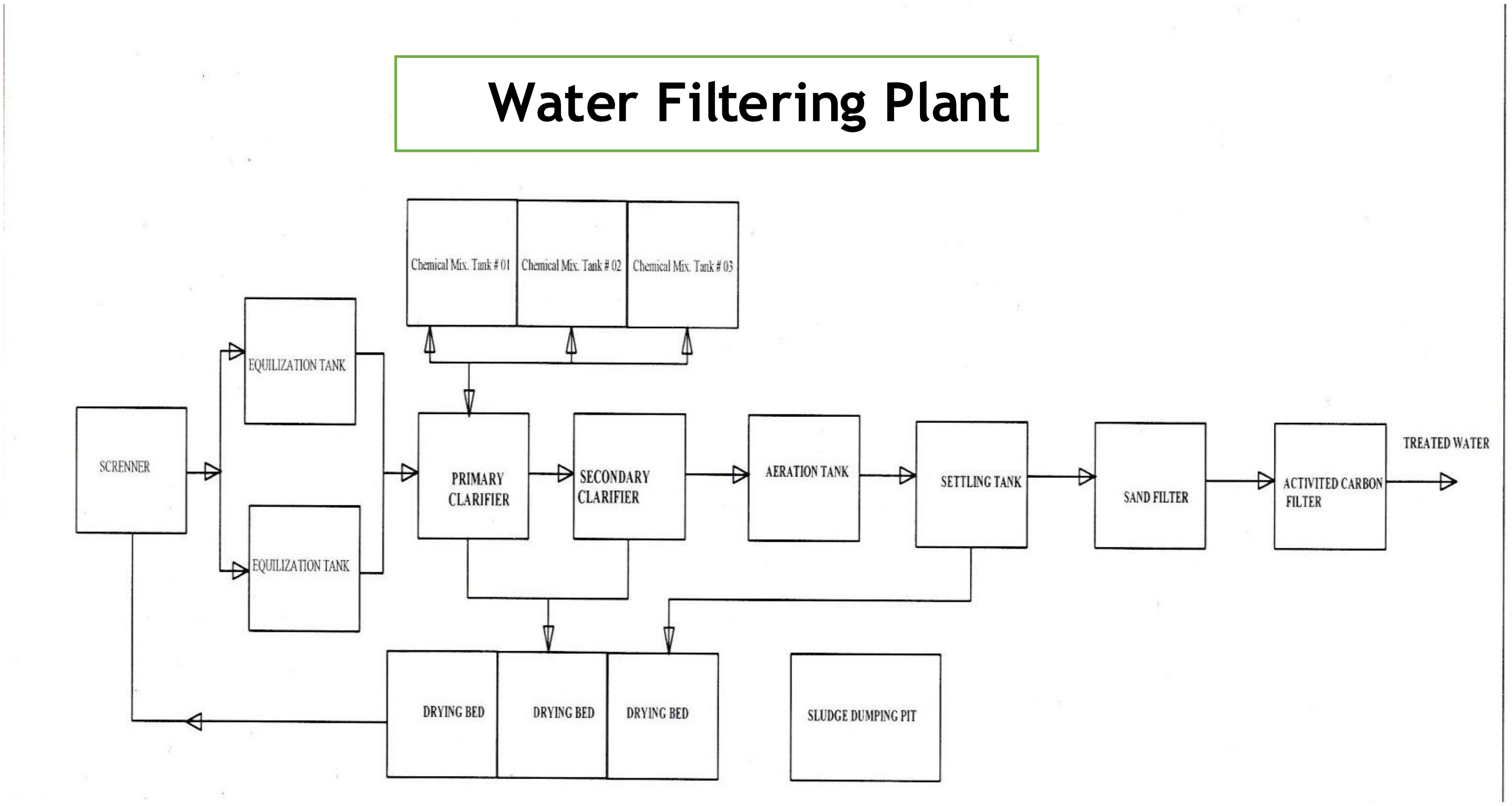

Fig: 3.3 Water Filtering Plant Flow Diagram

3.6 Used Chemical Contents of Water Filtering Plant:

4 Table: 1 Used Chemical Contents of Water Filtering Plant

Chemical Name	Unit	Qty./1000 Ltr.	Remarks
Poly Aluminum Chloride	Kg.	25	
Caustic Soda	Kg.	4	
Polyelectrolyte	Gm.	100	

Fig: 3.4 Poly aluminum chloride

Polyaluminumchloride isapolyvalentpolymericelectrolytecoagulantofinorganicpolymer,which is a intermediate hydrolysis between aluminum dichloride and aluminum hydroxide. Because of the bridging effect of chlorine ions and the polymerization of polyvalent ions, inorganic macromolecule water treatment agents with larger molecular weight and higher charge are formed.[2]

Use: River water, reservoir water, reservoir water, groundwater purification, industrial water supply purification, municipal sewage treatment, sludge treatment, coal washing, papermaking sizing, cosmetics raw materials and catalytic carrier, printing and dyeing, leather, wine, meat processing, mining, refining and heavy metal industry sewage treatment.

Packaging: Solid, polyethylene coated outer bags, double lining, 25 kg/bag.

Storage and transportation:
Liquid: light unloading should be carried out so as to avoid packaging damage and not to transport with harmful drugs. Drying at normal temperature and storage period of liquid products for months. Used in sealed canned vehicles or plastic containers.

Solid: it should be lightly discharged to avoid packing damage and not to carry or store with harmful drugs.

Characteristics: stable chemical properties at normal temperature, in noxious and harmless, high safety of water purification, quick reaction, low dosage, rapid formation of alum flower, fast mass settlement and good filter property, which can improve the utilization of equipment, low cost and low labor intensity. The PH value of the raw water is wide, and it can be condensed in pH 4-12. PH 6-8 is the best. The treated water has strong adaptability and is suitable for various water bodies' treatment, especially for high turbidity water purification. There is no alkaline or other coagulant. It also solves the problem that other agents are not easy to deal with low turbidity water and low temperature water (below 4 degrees) with poor response and slow effect. Good water solubility, excessive dosage, no side effects, easy operation and management, equipment and pipelines.

Usage: according to the different conditions of raw water, the general water supply and purification quantity; solid 3-30PPm, liquid product 10-100ppm. The dosage was added according to the best dosage and adjusted in use. For example, if there is little amount of alum in the sedimentation tank, the amount of dosage will be too small if there is too much turbidity.

Aluminum chlorohydrin rate is a group of specific aluminum salts having the general formula $Al_2Cl(OH)_5$. It is used in cosmetics as an antiperspirant and as a coagulant in water purification.

Formula : $Al_2Cl(OH)_5$
Molar mass : 174.45g/mol
Chem Spider ID: 24771139

Fig: 3.5 Caustic Soda

Caustic Soda

Caustic soda is one of the common names for sodium hydroxide (NaOH).

It is also known as lye, although lye may refer to either potassium hydroxide or sodium hydroxide.

Pure caustic soda is sold for making candles or soap.

Impure caustic soda is found in drain cleaner.

Because lye is used to make illegal drugs, it's harder to buy large quantities than in the past. However, small containers are available in stores and online.

Uses of Caustic Soda or Lye

Lye is used for soap making, candle making, homemade biodiesel, frosting glass, making several foods, and for chemistry experiments.

How to Get Caustic Soda

It's much harder to get hold of lye than it used to be in the past. The main source of caustic soda was Red Devil Lye, but that product is off the market now. Why is it hard to get lye? The reason is because it can be used to control pH during methamphetamine production. There are still a few ways to get the chemical. Make sure the product is 100% sodium hydroxide, lye, or caustic soda. This is especially important if you are making food, since an impure product may contain dangerous contaminants. Sources of lye include:

Drain cleaner (check the label) - e.g., Roebuck Crystal Drain Cleaner, sold as Lowes
Sodium hydroxide from an online chemical supply store
Soap making store

Candle making
store #Biodiesel
supply store
Be aware, when purchasing caustic soda or lye, you may need to sign a statement that you're not using it for illegal activities. Or, you may not need to sign anything, since a credit card pretty much provides all the details needed to find you if the authorities think you're a rising drug lord.

Fig: 3.6 Poly electro ride

Poly electrolytes are polymers whose repeating units bear an electrolyte group. Placations and polyamines are poly electrolytes. These groups dissociate in aqueous solutions (water), making the polymers charged.

Dosing rate(design) 0. 2 mg/l.

(0.2 mg /l x 720.300 m3/d) / 1000 144 Kg/d.

Solution 0.2 %

Flow rate = 144 / (0.002 x 1.000) = 72 m3/d 3.000 l/h.

Metering pumps (8 + 3).

4.1 Water Filtering Plant Operation

1. Screen chamber: Remove relatively large solids to avoid abrasion of mechanical equipment's and clogging of hydraulic system.

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

3. Equalization tank: The effluents do not have similar concentrations at all the time; the pH will very time to time. Effluents are stored from 8 to 12 hours in the equalization tank result 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.

4. Flash mixer: Coagulants were added to the

effluents: #Lime: (800-1000 ppm) to correct the

pH up to8-9

#Alum: (200-300 ppm) to remove color

#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 micro blogs. Clariflocculator In the clariflocculator 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 flocks, which then settles out in the clarifier zone. The settled solids primary sludge are pumped into sludge drying beds.

Aeration tank: The water is passed like a thin film over the different arrangements like stair case 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 are reduced up to90%.

Clarifier: The clarifier collects the biological sludge. The over flowed 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.

Drying beds: Primary and secondary sludge is dried on the drying beds.

Chapter – 4
Experimental Setup

4. Introduction

The introduction of water vapor in a plasma source may lead to some undesired chemicals reactions and instabilities. However, water vapor can also be elibe rately mixed with the plasma gas to generate radicals of interest such as OH. This approach has already been investigated in different domains: surface treatments, biocompatibility and plasma medicine. In surface treatments, the oxidative functionalization can also be achieved with O2 but promoting the mixture of water vapor with the carrier gas induces a milder treatment.[8]

4.1 Equipment

Fig: 4.1 Chemical Mixture Tank

4.1.1 Equalization Tank

Fig: 4.2 Equalization Tank

Equalization Basins:

Equalization (EQ) Basins are designed to provide consistent influent flow to downstream processes by retaining high flow fluctuations. Due to the additional retention time, aeration and mixing is required in equalization basins to prevent the raw wastewater from becoming septic and to maintain solids in suspension.

Providing consistent flow and loading to a biological process is important to maintain optimal treatment. Equalization (EQ) Basins are designed to provide consistent influent flow to downstream processes by retaining high flow fluctuations. Due to the addition alternation time, aeration and mixing is required in equalization basin stop event the raw waste water from becoming septic and to maintain solids in suspension. Aeration Industries' Aire-O2 Triton® aerator and mixer coupled with a guide rail assembly or swing arm, provides a maintenance friendly alternative to diffused aeration systems. Aeration Industries can include a custom control panel equipped with discreet or analog level indication for operator reference as well. We offer equipment that mixes your EQ Basin to keep suspended solids in solution, add fine bubble aeration to minimize odors, and also ensure predictable and constant flow equalization.

Benefits of Aire-O2 Tritons in your Equalization
Basin: # Efficient aeration and mixing
Simply balance flows during
fluctuations # Mix and aerate or just
mix

Purpose:

Thus, equalization tanks not only function as holding tanks to help equalize flow in waste water treatment applications, but also make excellent holding areas for other liquids, agent sand chemicals introduced to wastewater treatment systems.

How dose tank work:

The activated sludge process is the most common option in secondary treatment. Aeration in an activated sludge process is based on pumping air into a tank, which promotes the microbial grow thin the waste water. The microbes feed on the organic material, forming flocks which can easily settle out.

4.1.2 Primary Clarifier

Fig: 4.3 primary Clarifier

In waste water treatment: Primary treatment. These tanks, also called primary clarifiers, provide about two hours of detention time for gravity settling to take place. As the sewage flows through them slowly, the solids gradually sink to the bottom.

Purpose:

The purpose of a clarifier is to remove solids, produce a cleaner effluent and concentrate solids. Concentration of solids removed from the wastewater reduces the volume of sludge for dewatering and/or disposal.

How dose primary clarifier Work:

Sedimentation tanks have been used to treat waste water for millennia. Primary treatment of sewage is removal of floating and settle able solids through sedimentation. Primary clarifiers reduce the content of suspended solids and pollutants embedded in those suspended solids.

Clariflocculator:

Clariflocculatorisacombinationofflocculationandclarificationinasingletank.Ithastwoconcentric tanks where inner tank serves as a flocculation basin and the outer tank serves as a clarifier. As heavy particles settle to the bottom, the liquid flows radially upward in the clarifier zone,

4.1.3 Secondary Clarifier

Fig: 4.4 Secondary Clarifier

Secondary Clarifier: A circular basin in which effluent from the activated sludge process is held for a period of time during which the heavier biomass (microorganisms) settle to the bottom as“ activated sludge.”

Secondary treatment removes:

Secondary treatment is a treatment process for wastewater (or sewage) to achieve a certain degree of effluent quality by using a sewage treatment plant with physical phase separation to remove settleable solids and a biological process to remove dissolved and suspended organic compounds.

Secondary Sedimentation Tanks:

Purpose of Secondary Sedimentation Tanks: The secondary sedimentation tanks or settling basins or clarifiers allow the microorganisms and other solids to settle after secondary or biological treatment. This sludge is pumped back into the inlet end of the primary sedimentation tanks and settles with the raw sludge.

4.1.4 Aeration tank

Fig:4.5 Aeration tank

Aeration tank where air (or oxygen) is injected in the mixed liquor. Settling tank (usually referred to as "final clarifier" or "secondary settling tank") to allow the biological flocks (the sludge blanket) to settle, thus separating the biological sludge from the clear treated water.

Purpose of Aeration tank:

The activated sludge process is the most common option in secondary treatment. Aeration in an activated sludge process is based on pumping air into a tank, which promotes the microbial grow thin thewastewater.Themicrobesfeedontheorganicmaterial,formingflockswhichcaneasilysettleout.

Need an Aeration tank:

The pH of the aeration tank should be between 6.5-8.5 to avoid stress on the microbial community and for optimal biological activity. Dissolved oxygen levels in the aeration tank must be maintained at 1- 3 mg/L for effective treatment.

4.1.5 Setting tank

Fig: 4.6 Setting tank

4.1.6 Sand Filter

Fig: 4.7 Sand Filter

Rapid sand filtration is a purely physical drinking water purification method. Rapid sand filters (RSF) provide rapid and efficient removal of relatively large suspended particles. Two types of RSF are typically used: rapid gravity and rapid pressures and filters.

How does sand filter work:

Slow sand filters produce high-quality water without the use of chemical aids. Passing flocculated water through a rapid gravity sand filter strains out the flocculated the particles trapped within it, reducing numbers of bacteria and removing most of the solids.

Pressure Sand filtration for water treatment:

Pressure Sand filtration is frequently used and very robust method to remove suspended solids from water. The filtration media layer consists of a Cylix, Pebbles, Gravels, Mix Sandwich a variety in size and specific gravity. Feed pump is used for generating necessary operating pressure in the pressure sand filter.

4.1.7 Carbon filter

Fig: 4.8 Carbon filter

Carbon filter take out of water:

Active charcoal carbon filters are most effective at removing chlorine, particles such as sediment, volatile organic compounds (VOCs), taste and odor from water. They are not effective at removing minerals, salts, and dissolved inorganic substances.

Carbon filter safe for drinking water:

Carbon filters are good for removing organic compounds that make water taste and smell bad, according to North Carolina State University. The downside to carbon filters is they do not filter out heavy metals, fluoride, bacteria or microorganisms that may be in the water.

Carbon filter remove trihalomethanes:

They remove lead, chlorine and trihalomethanes and many other contaminants at a modest price. If your water is highly polluted and you can afford a more expensive, more comprehensive filtration system, you may want to consider reverse osmosis combined with activated carbon.

4.1.8 WATER FILTERING PLANT:

Fig- 4.9 WATER FILTERING PLANT

Chapter - 5
Data Collection

5.1 Data Collection

Water Analysis Report
Data Table: 1 Water Analysis Report (Gazipur)
Location: Gazipur

Feed Water						Treated Water					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
6.9	240	10	108	46	1.4	7.5	50	Nil	85	50	Nil

Water Quality parameters	Bangladesh drinking water standard
pH value (Ph unit)	6.5-8.5
Iron (mg/L)	0.3
TDS. Total Dissolved Solids (mg/L)	100
Harness (mg/L)	100
Calcium (mg/L)	100
Magnesium (mg/L)	30

Water Analysis Report
Data Table: 2 Water Analysis Report (Dhaka)
Location: Dhaka

Feed Water						Treated Water					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
7.2	140	8	40	45	0.2	7	0	Nil	40	45	Nil

Water Analysis Report
Data Table: 3 Water Analysis Report (Narayangonj)
Location: Narayangonj

Feed Water						Treated Water					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
7.2	140	8	40	45	0.2	7	0	Nil	40	45	Nil

5.1.1 Lab Report of Biological Treatment Plant:

Data Table: 4 Lab Report of Biological Treatment

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	12.01.20	B-12	4.84	6.50	300	920	949
Outlet of water filtering plant	09.01.20	B-11	7.01	7.60	05	19	501
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

5.1.2 Lab Report of Domestic Waste Water Treatment Plant:

Data Table: 5 Lab Report of Domestic Waste Water Treatment

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	09.01.20	B-78	4.97	6.30	275	900	949
outlet of Water Filtering Plant	09.01.20	B-79	7.58	7.50	4.5	17	501
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

Lab Report of Hospital Waste Water:

Data Table: 6 Lab Report of Hospital Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	22.01.20	B-42	4.92	6.25	289	880	960
outlet of Water Filtering Plant	22.01.20	B-43	7.98	7.79	4.6	20	517
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

Lab Report of Textile Industry Waste Water:

Data Table: 7 Lab Report of Textile Industry Waste Water

Sample Location	Date	Lab Code No.	Ph	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	07.01.20	B-23	5.00	6.25	289	921	929
outlet of Water Filtering Plant	07.01.20	B-24	8.02	7.63	5.10	20	523
Bangladesh Standard For Waste Water Form Industrial Units. Discharge To Inland Surface Water As Per ECR 1997.			**6.0-9.0**	**4.5-8.0**	**≤ 50**	**≤ 200**	**≤2100.0**

5.2 Comparison with basic Properties of water

Water is the most abundant and ubiquitous liquid on earth and has played a central role in scientific thought for millennia. Nearly every aspect of life is influenced or controlled by water. No wonder scientists have huge interest in properties of water, among which the hydro phobicity is the one we shall delve into. [7]

We begin by reviewing a few basic facts about water. Water is a small and compact molecule. As the first approximation it can be regarded as a sphere with a radius of 1.4 Å. The H-O-H angle, and the OH bond length is Å. Water has a permanent dipole moment that comes from partial charge transfer from hydrogen to oxygen. Two hydrogen atoms and two lone pairs of electrons are arranged in nearly tetrahedral symmetry around oxygen. It is able to form up to four hydrogen bonds with other water molecules. The formation of hydrogen bonds results in tetrahedral structure in liquid water and ice, which is responsible for its many peculiar properties such as relatively high boiling and melting temperatures. Unusually high dielectric constant in water makes it an excellent solvent for ions comparing with other liquids. Water also has high surface tension compared with the alkanes. The high interfacial tension of the water/oil system leads to low solubility for polar solutes in aqueoussolution. For most materials, the density of the solid phase is higher than that of its liquid form. This is due to the closer congeries in solids. In contrast, liquid water has higher density than ice. Water molecules in ice form regular tetra hedral structure sand are well-ordered by hydrogen bonds with each other. Asice melts, the regular structure is broken, creating larger space in its liquid phase. When ice liquid water is danger.

Lab Report of Textile Industry Waste Water:

Data Table: 8 Lab Report of Textile Industry Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of Water Filtering Plant	07.01.20	B-23	5.00	6.25	289	921	929
outlet of Water Filtering Plant	07.01.20	B-24	8.02	7.63	5.10	20	523

Lab Report of Industry Waste Water:

Data Table: 9 Lab Report of Industry Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water Filtering plant	07.01.20	B-23	5.00	6.25	289	921	929
Outlet of water filtering plant	07.01.20	B-24	8.02	7.63	5.10	20	523

Water Analysis Report
Data Table: 10
Location: Dhaka

Feed Water						Treated Water					
pH	TDS	TSS	TH (Ca)	TH (Mg)	Iron	pH	TDS	TSS	TH (Ca)	TH (Mg)	Iron
7.2	140	8	40	45	0.2	7	0	Nil	40	45	Nil

5.3 Major Experiment Area of our Project Thesis and:

The most industrial effective areas are Dhaka, Gazipur & Narayangonj of our Countries. Water treatments are very essential and first requirement for this area.

Project activities will initially focus on three of the nine major Dhaka water shed pollution hot-spots- located in Narayanganj and Gazipur Pour have as. These clusters typically have over 75 percent of industries in the garment, washing and dyeing sectors and others factories are food, Pharmaceuticals & Chemicals, which increases cluster homogeneity and responsiveness to global supply chain incentives. Based on the alternative site analysis, Gazipur, Dhaka & Narayangonj are primarily identified as the potential sites for water treatments.[12]

Dhaka:

Dhaka is the economic, cultural and political center of Bangladesh. It is a major financial center of South Asia. It is one of the world's most populated cities and within OIC countries, with a population of 17 million people in the Greater Dhaka area it is also the 4th most densely populated city in the world. it lies along the east bank of the Buriganga River in the heart of the Bengal delta.

GAZIPUR:

The Gazipur district has an area of 1,741.53aq.km,and is bounded by Mymensingh and Kishoreganj districts on the north, Dhaka Narayanganj and Narsingdi on the south, Narsingdi on the east, Dhaka and Tangail district on the west. The main rivers are Brahmaputra, Shitalakshya, Turag, Bangshi,Balu and Banar.

NARAYANGONJ:

Area 687.76 sq. km located in between 23°33' and 23°57' north latitudes and in between 90°26' and 90°45 east longitudes. It is bounded by NARSINGDI and Gazipur districts on the north, Munshiganj district on the south, BRAHMANBARIA and Kumilla districts on the east, DHAKA district on the west.

Chapter-6

Result and Discussion

6.1 Result of Experiment

Lab Report of Biological Treatment Plant:

Data Table: 1 Lab Report of Biological Treatment Plant

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	12.01.20	B-12	4.84	6.50	300	920	949
Outlet of water filtering plant	09.01.20	B-11	7.01	7.60	05	19	501

Lab Report of Domestic Waste Water Treatment Plant:

Data Table: 2 Lab Report of Domestic Waste Water Treatment Plant

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	09.01.20	B-78	4.97	6.30	275	900	949
Outlet of water filtering plant	09.01.20	B-79	7.58	7.50	4.5	17	501

Lab Report of Hospital Waste Water:

Data Table: 3 Lab Report of Hospital Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	22.01.20	B-42	4.92	6.25	289	880	960
Outlet of water filtering plant	22.01.20	B-43	7.98	7.79	4.6	20	517

Lab Report of Textile Industry Waste Water:

Data Table: 4 Lab Report of Textile Industry Waste Water

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	07.01.20	B-23	5.00	6.25	289	921	929
Outlet of water filtering plant	07.01.20	B-24	8.02	7.63	5.10	20	523

Water Analysis Report

Data Table: 5

Location: Gazipur

Feed Water						**Treated Water**					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
6.9	240	10	108	46	1.4	7.5	50	Nil	85	50	Nil

Water Analysis Report

Data Table: 6

Location: Dhaka

Feed Water						**Treated Water**					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
7.2	140	8	40	45	0.2	7	0	Nil	40	45	Nil

Water Analysis Report

Data Table: 6

Location: Narayangonj

Feed Water						**Treated Water**					
pH	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**	**pH**	**TDS**	**TSS**	**TH (Ca)**	**TH (Mg)**	**Iron**
7.2	140	8	40	45	0.2	7	0	Nil	40	45	Nil

Discussion:

Water filtering plant process is the most important part of every industry. Because every industry fall down Waste water every time and it is very harmful to our environment. So we can use water filtering plant and save our health & environment. Waste water treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with minimum impact on the environment, or directly reused. The latter is called water reclamation because treated waste water can be used for other purposes. The treatment process takes place in a wastewater treatment plant (WWTP), often referred to as a Water Resource Recovery Facility (WRRF) or a sewage treatment plant. Pollutants in municipal wastewater (households and small industries) are removed or broken down.

The treatment of wastewater is part of the overarching field of sanitation. Sanitation also includes the management of human waste and solid waste as well as storm water (drainage) management.[1] By- products from wastewater treatment plants, such as screenings, grit and sewage sludge may also be treated in a wastewater treatment plant.

Lab Report of Water Filtering Plant Treatment Water:

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	07.01.20	B-211	5.00	6.25	289	921	929
outlet of water filtering plant	07.01.20	B-212	8.02	7.63	5.10	20	523

Lab Report of water filtering plant Treatment Water:

Sample Location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	09.01.20	B-215	4.90	5.92	358	814	897
Outlet of water filtering plant	09.01.20	B-216	7.54	7.10	5.09	28	600

Lab Report of water filtering plant Treatment Water:

Sample location	Date	Lab Code No.	pH	DO mg/L	BOD mg/L	COD mg/L	TDS mg/L
Inlet of water filtering plant	12.01.20	B-213	4.94	6.02	310	850	920
Outlet of water filtering plant	12.01.20	B-214	7.90	7.21	5.49	22	584

Chapter-7

Conclusion and Recommendation

7.1 Conclusion

This Project has encompassed a variety of water management issues as they apply to Sonargaon University, as well as implications of these issues to the Bangladesh& the larger world. We have mined possible Rain Water Collection and Treatment, Surface water management, Ground water treatment, alternatives to the current waste water Management strategy, Sewage water treatment.

A broad overview of these topics is included as well as detailed discussions the applications of these systems to Bangladesh. A comprehensive regarding analysis has been produced that will hopefully lead to the further application of such systems at Bangladesh. In the end, we hope to have demonstrated the values of the proposed changes, and we hope that some (or all) of our proposals will be incorporated into the Bangladesh water system in the future.

It is our opinion that considerable environmental, social, and (in some instances) economic benefits can result from the use of such sustainable practices. It is hoped that our project will not only affect the views of the Sonargaon University community, but also those of the Bangladesh, the nation, and beyond. The proposed Zero discharge, RRR treatment system would realize a number of environmental benefits, including the protection of natural waters from hydro carbon, heavy metal and sediment contamination. This system is shown to be more cost-effective than bio filtration options, and also includes aesthetic benefits. Discussed in this thesis.

The benefits of on-site rainwater harvesting are include the roof-top collection of rainwater for a variety of applications, primarily include n Litigation of SU's lawns and gardens and for general domestic use (not Including drinking needs).

Recollected water can also be stored as an emergency water supply, or for lighting. An extended benefit of rainwater harvesting on campus is the decreased the once on the SU water system and decreased contribution to erosion.

Recommendation

There is no higher priority for the U.S. Environmental Protection Agency than protecting public health and ensuring the safety of our nation's drinking water. Under the Safe Drinking Water Act (SD WA), «State» and other states have the primary responsibility for the implementation and enforcement of drinking water regulations, while the EPA is tasked with oversight of state efforts. Recent events in Flint, Michigan, and other U.S. cities, have led to important discussions about the safety of our nation's drinking water supplies. 1 am writing today to ask you to join in taking action to strengthen our safe drinking water programs, consistent with our shared recognition of the critical importance of safe drinking water for the health of all Americans.

First, with most states having primacy under SDWA, we need to work together to ensure that states are taking action to demonstrate that the Lead and Copper Rule (LCR) is being properly implemented. To this end, the EPA's Office of Water is increasing oversight of state programs to identify and address any deficiencies in current implementation of me Lead and Copper Rule. EPA staff are meeting with every state drinking water program across the country to ensure that states are taking appropriate actions to address lead action level accidences, including optimizing corrosion control, providing effective public health communication and outreach to residents on steps to reduce exposures to lead, and removing lead service lines where required by the LCR. I ask you to join us in giving these efforts the highest priority.

Second, to assure the public of our shared commitment to addressing lead risks, 1 ask for your leadership in taking near-term actions to assure the public that we are doing everything we can to work together to address risks from lead in drinking water. Specifically, I urge you to take near-term action in the following areas:

(1) Confirm that the state's protocols and procedures for implementing the LCR are fully consistent with the LCR and applicable EPA guidance;

(2) Use relevant EPA guidance on LCR sampling protocols and procedures for optimizing corrosion control;

(3) Post on your agency's public website all state LCR sampling protocols and guidance for identification of Tier 1 sites (at which LCR sampling is required to be conducted);

(4) Work with public water systems - with a priority emphasis on large systems - to increase transparency in implementation of the LCR by posting on their public website and/or on your agency's website:

References:

1. Since 2014, WHO has been testing household water treatment products against WHO health-based performance criteria through the WHO International 'Scheme' to Evaluate Household Water Treatment Technologies. The aim of the scheme is to ensure that products protect users from the pathogens that cause diarrheal disease and to strengthen policy, regulatory, and monitoring mechanisms at the national level to support appropriate targeting and consistent and correct use of such products.

2. Biological research division is the largest division in BCSIR laboratories, Dhaka which conducts research and development activities in the field of Biological science in the following sections: Applied Botany, Plant Pathology, Plant Physiology, Zoology, Plant Tissue Culture, Soil and Environment.

3. Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques

- ✓ Irny, S.I. and Rose, A.A. (2005) "Designing a Strategic Information Systems Planning Methodology for Malaysian Institutes of Higher Learning (isp- ipta), Issues in Information System, Volume VI, No. 1, 2005.
- ✓ *Baskerville, R. (1991). "Risk Analysis as a Source of Professional Knowledge". Computers & Security.* ***10*** *(8): 749–764.*
- ✓ ^ Howell, K. E. (2013) Introduction to the Philosophy of Methodology. London: Sage Publications
- ✓ ^*Katsicas, Sokratis K. (2009). "Chapter 35". In Vacca, John (ed.). Computer and Information Security Handbook. Morgan Kaufmann Publications. Elsevier Inc. p. 605. ISBN 978-0-12-374354-1.*
- ✓ ^See, for example, Thomas Kuhn, *The Structure of Scientific Revolutions* (University of Chicago, 1970, 2nd ed.)

***4**.Water Filtration Challenge Activity | NASA/JPL Edu*

https://www.jpl.nasa.gov/edu/teach/activity/water-filtration-challenge/...design process to design and build a water filtration device using commonly available...Speaking in Phases Classroom Activity Water Filtration

5. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Most water is purified and disinfected for human consumption (drinking water), but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination; and the use of electromagnetic radiation such as ultraviolet light.

- ✓ *Combating Waterborne Diseases at the Household Level (PDF). World Health Organization. 2007. Part 1. ISBN 978-92-4-159522-3.*
- ✓ *^ Water for Life: Making it Happen (PDF). World Health Organization and UNICEF. 2005. ISBN 978-92-4-156293-5.*
- ✓ *^ McGuire, Michael J.; McLain, Jennifer Lara; Obolensky, Alexa (2002). Information Collection Rule Data Analysis. Denver: AWWA Research Foundation and American Water Works Association. pp. 376–378. ISBN 9781583212738.*
- ✓ *^ "Aeration and gas stripping" (PDF). Archived from the original (PDF) on July 12, 2014. Retrieved 29 June 2017.*
- ✓ *^ "Water Knowledge". American Water Works Association. Retrieved 29 June 2017.*
- ✓ ^ Jump up to:***a b c d*** Edzwald, James K., ed. (2011). *Water Quality and Treatment*. 6th Edition. New York:McGraw-Hill. ISBN 978-0-07-163011-5
- ✓ ^ Jump up to:***a b c d*** Crittenden, John C., et al., eds. (2005). *Water Treatment: Principles and Design.*2nd Edition. Hoboken, NJ:Wiley. ISBN 0-471-11018-3