“REPORT ON SITE VISIT TO ANAR CHEMICAL PLANT, GREEN COOPERATIVE SOCIETY, VATVA AND AMUL PLANT, ANAND, GUJARAT”.

Course Name: Industrial Waste Treatment

B.Tech CIVIL
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Under the Guidance of

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ABSTRACT

Today one of the biggest problems that the world is facing is disposal of waste. To study how actual industrial waste is handled, treated, and dispose of with minimal environment hazard, visit to chemical plant and diary industries add great knowledge.

Keywords— Chemical waste, treatment, disposal, test carried out.

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CHAPTER-1. INTRODUCTION

1.1. INDUSTRIAL WASTE WATER

1.1.1 Introduction

Process plants generally try to minimize the amount of wastewater they generate. However, operations invariably result in production of some wastewater. Proper treatment of this wastewater is crucial for both environmental and economic reasons.

Industrial wastewaters usually contain organic and inorganic matter in varying degrees of concentration. They may include toxic and other harmful materials as well as components that are non-biodegradable or that can reduce the efficiency of many wastewater-treatment operations.

Thus, treatment of industrial wastewaters typically is a very difficult task — far more complicated than municipal wastewater treatment —that requires special methods and sophisticated technologies. These options fall into three categories: physical, chemical and biological. Physical treatment methods include sedimentation, flotation, filtering, stripping, ion exchange, adsorption and other processes that remove dissolved and non-dissolved substances without necessarily changing their chemical structures. Chemical methods include chemical precipitation, chemical oxidation or reduction, formation of an insoluble gas followed by stripping, and other chemical reactions that involve exchanging or sharing electrons between atoms. Biological methods rely upon living organisms using organic or, in some instances, inorganic substances for food. Biological treatment is more widely used than any other option where reasonably complete treatment is required. It most often serves as the secondary treatment stage to remove major portions of contamination. Other processes handle primary and tertiary treatment to complete the removal of solids and other pollutants.

1.1.2 The Challenge

Some industrial wastewaters are rich in organics and easily biodegradable while others are nutrient deficient, inhibiting or preventing biodegradability. Total dissolved solids and contamination may exceed by many times the levels found in domestic sewage. Industrial wastewaters often also have pHs well beyond the range of 6–9 and may contain high concentrations of dissolved metal salts. To

further complicate matters, wastewater flows and characteristics within a plant also can vary with time because of campaign manufacturing or slug discharges on top of the usual discharges. In addition, spillages and dumping that occasionally may occur very adversely can impact the performance of the plant's wastewater treatment plant. Consequently, it's always prudent to carefully assess current wastewater and its treatment requirements rather than relying on the past situation. An understanding of the nature of the plant's operations is vital.
One key parameter for wastewater is its biochemical (or biological) oxygen demand (BOD). This is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given wastewater sample at a certain temperature over a specific time period. Therefore, BOD indicates indirectly the amount of organic compounds in wastewater. The BOD most commonly is expressed in milligrams of oxygen consumed per liter of sample during 5 days of incubation at 20°C.

Another key parameter is chemical oxygen demand (COD), which indirectly specifies the amount of organic compounds in the wastewater. It indicates oxygen consumption and also is given in mg/L.

Both BOD and COD measure the amount of organic compounds in wastewater. However, COD is less specific because it measures everything that can be chemically oxidized rather than just levels of biodegradable organic matter. You can estimate the biodegradability of wastewater by considering its COD and corresponding BOD.

CHAPTER-2. ANAR CHEMICAL, VATVA

2.1. INTRODUCTION

Anar Chemicals LLP is a dynamic INDIAN Manufacturer of Specialty Dyes and Intermediates established since 1980. An ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 Certified company having nearly 4 decades of experience in the manufacturing of dyes and dyes intermediates. Concern for health, safety and environment is an integral part of Anar's business policy. All our products are developed in-house in our state of the art R&D facility which comprises of skilled and highly qualified people (Masters and PhDs).

Anar Chemicals is located at VATVA GIDC, AHMEDABAD in 13500 sq. m land, and possesses excellent infrastructure. Our Main Markets are Europe, USA, Latin America, Far East, Gulf Countries, South East Asia etc

2.2. PRODUCT MANUFACTURE

160 room material required for manufacturing various product like napthols, dyes, intermedariesand phalocynine and its dervatives. All products are organic solvent.

Napthol is used for pigment manufacturing whereas 10 different dyes are prepared for petroleum, textile,etc and used in disel kersone and petrol,etc.

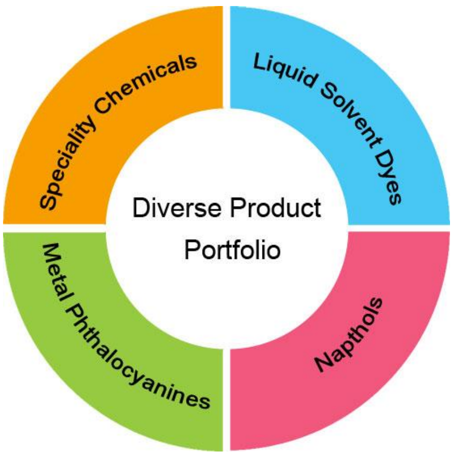

Fig. No. 2.1. Product Manufactured

SOUCRE: http://www.anarchem.com/about-anar.html

2.3. EFFLUENT TREATMENT PLANT

Working of etp is 6 days and its daily flow is 300m3 of water and its capacirtyb is 2.5-3 lakhs m3.

2.3.1. PRIMARY TREATMENT

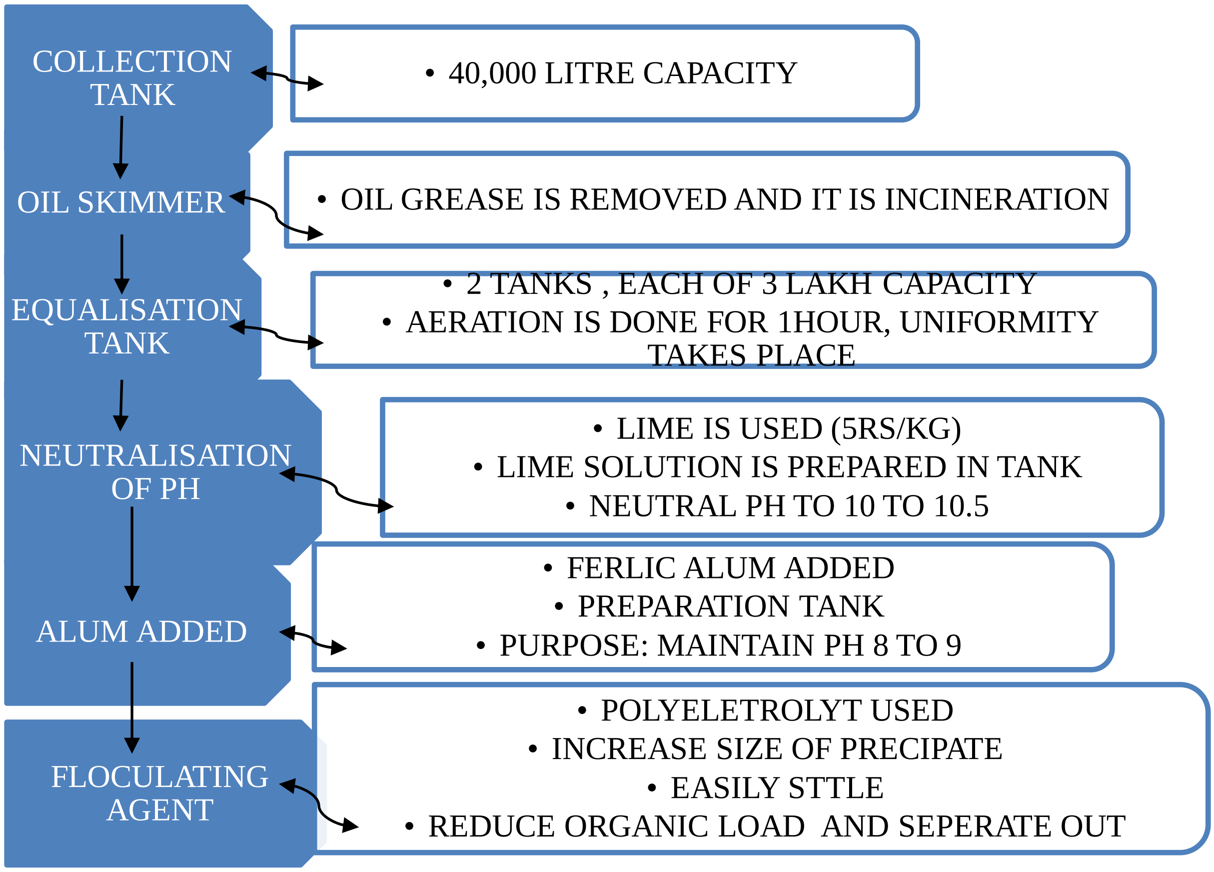

Fig. No. 2.2. PRIMARY TREATMENT

2.3.2. SECONDARY TREATMENT

Sludge is send to Ecocare Company for lanfill

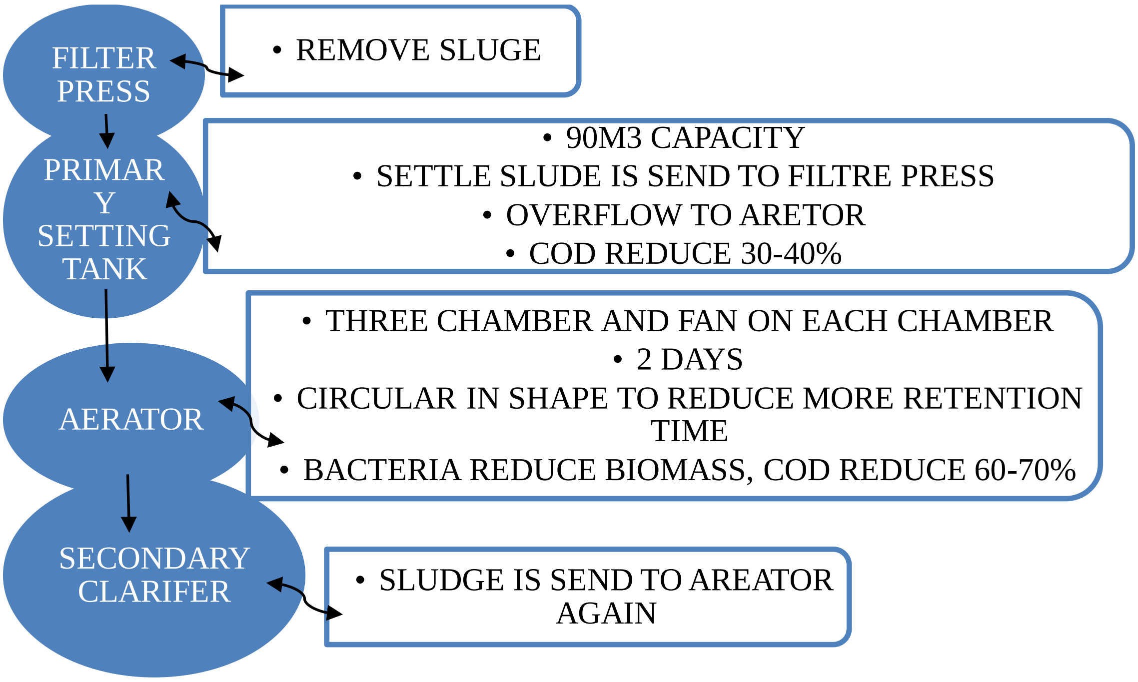

Fig. No. 2.3. SECONDARY TREATMENT

CHAPTER-3. THE ENIVORNMENT SERVICES CO-COPERATIVE SOCIETY LTD. VATVA

3.1. INTRODUCTION

The Vatva Industrial Estate was established by Gujarat Industrial Development Corporation in the year 1960 in the south east direction of Ahmedabad City on Ahmedabad – Mehmadabad state highway to accommodate small and medium scale industrial units.

There are approximately 1800 units in this industrial Estate, out of which approximately 680 generate wastewater and have potential to cause water pollution. These include units manufacturing Pharmaceutical Products, Dyes, Dye-Intermediates, Pigments, Fine Chemicals and other organics. They also include Textile Process Houses, Rolling Mills and other Non Chemical Process Industries.

During the decade of 1990s, many industries started planning compressive treatment. However it was very difficult and techno-economically not viable to arrange for necessary treatment of wastewater by these units individually. There was also constraint of space to install Effluent Treatment Plants by these units in their premises. The most practical and cost effective approach was to establish a Common Effluent Treatment Plant for the treatment of effluent being generated by these units. In fact it was necessary to establish proper infrastructure to take care of the environment related aspects being faced by the individual industrial units in the estate. In order to fulfill these objectives the 'Green Environment Services Co-operative Society Limited' (GESCSL) was formed with the support of Vatva Industries Association and Gujarat Dyestuff Manufacturers' Association. Initially there were 620 industrial units of GIDC Estate, Vatva, Ahmedabad as members. The GESCSL is managed by 15 members including Chairman, Vice Chairman, Hon. Secretary and Hon. Treasure.

The important aspects of CETP Project are briefly outlined below

Location: The CETP Site is located at Plot Nos.: 244-251, Phase: II, GIDC Estate, Vatva, Ahmedabad.

Land Area: The CETP and associated facilities are set up on the land area admeasuring 24328 sq. m.

Treatment Technology: M/s Advent Corporation, USA gave the process design based on the treatability study carried out by Sudarshan Chemical Industries Ltd., Pune. The detailed engineering was provided by M/s Sudarshan Chemical Industries Ltd., Pune.

The construction of CETP was commenced in March 1996 and was completed in all respects including installation of mechanical and electrical components in May 1998. The CETP was immediately commissioned thereafter.

Project Cost: Initially the common facilities for the collection, treatment (CETP) and conveyance of treated effluent were set up at the cost of Rs. 33.28 crores. The break-up of this cost is as under

Internal Collection Systems Rs. 10.17 crore

Treatment units Rs. 18.00 crore

Conveyance line upto AMC Pirana Plant Sabarmati Rs. 05.11 crore

Total Rs. 33.28 crore

Expenditure towards additional equipment and
installation / modification of new units. Rs. 11.74 crore

Phase: I Up-gradation Rs. 06.70 crore

Phase: II Up-gradation Rs. 06.70 crore

Total Rs. 41.13 crore

Grand Total Rs. 74.41 crore

Thus the total Project Cost became Rs. 74.41 crore

Salient Features of the CETP:

The CETP was designed to treat 16000 m3 of effluent / day making use of new technology known as AIS (Advent Integral System) which consists of Aeration Basin surrounded by Integrated Peripheral Secondary Clarifier. Later during the up-gradation programme this Integral Clarifier was converted into Aeration Zone and two separate Secondary Clarifiers were provided.

The aeration is accomplished with the help of medium bubble aeration grid supplemented by 18 nos. of Triton type aerators supplied by Aeration Industries International Inc., Minneapolis, USA.

Charging Basis: The treatment charges are levied from the member units at the rate of Rs. 20 per kg of TOC in the effluent.

Inlet Norms: The CETP inlet norms applicable to the member units in respect of the quality of the effluent are as under…

BOD 1200 mg/l

COD 3000 mg/l

TSS 600 mg/l

The upper limits for the heavy metals and other pollutants have also been specified.

The member units are required to adhere to the inlet norms. The quality of the effluent received at CETP is monitored and extra penal charges are levied from the member units violating these norms.

3.2. Internal Collection System (ICS) and Conveyance Network:

The 680 member units of the estate are spread in an area of 13.5 sq. km. in Vatva industrial estate. The effluent from each member unit is conveyed through ICS to CETP in a systematic manner. Adequate arrangement is made for monitoring quality and quantity of effluent from each unit. The details of the ICS are described briefly below

M/s Dalal Consultants and Engineers Ltd., Ahmedabad provided consultancy services and detailed engineering for the establishment of Internal Collection System and Conveyance Network. The 680 member units which are scattered in different parts of the complex are covered by 92 Sump Rooms from where the wastewater flows by gravity to 6 Pumping Stations. The effluent is pumped from these Pumping Stations into CETP for treatment.

All the member units discharge their effluent from their overhead discharge tank into respective sumps. The butterfly valves and magnetic flow meters are provided in each sump room for measuring flow rate of effluent from each member unit. It is obligatory on the part of every member to install overhead effluent collection tank having enough holding capacity to facilitate gravity flow to the respective sump.

The gravity mains of the ICS have a total pipeline length of approximately 18000 meters; with sizes varying from 250 mm to 600 mm diameter. These pipelines are made of RCC and stoneware. The rising mains are made of HDPE having a total length of approximately 6200 meters with sizes varying from 180 mm to 400 mm diameter.

3.3. Treatment Process

Each member unit is required to arrange for pretreatment of the effluent to meet the CETP inlet norms.

The CETP consists of the following units.

- Equalization Tank
- Flash Mixer
- Flocculator
- Dissolved Air Floatation Unit
- Aeration Tank
- Secondary Clarifiers

The pretreated effluent from the member units is pumped to the Equalization Tank. The Equalization tank is designed to provide residence time of 24 hours under the maximum flow condition. The contents of the Equalization Tank are thoroughly mixed / equalized with the help of coarse bubble diffused aeration supplemented by a Turbo Aerator.

From the Equalization Tank the wastewater flows through flow-control arrangement into Flash Mixer where coagulants and flocculants are added. After complete mixing of the chemicals with the effluent it flows into Flocculator where coagulation and flocculation of suspended solids, colloids and some of the dissolved pollutants take place. The overflow from the Flocculator goes to Dissolved Air Floatation (DAF) Unit. The unit works on the principle of super saturation of the liquid with dissolved air. The super saturation is achieved by mixing pressurized recycled wastewater with compressed air. The saturated recycle flow is released at about atmospheric pressure in the DAF Tank which results in the formation of fine bubbles. These fine bubbles get attached with flocculated particles and are floated to the top of the tank. These particles as well as those settled at the bottom of the tank are removed and collected by the top and bottom scrappers in the form of primary sludge and is collected in the Primary Sludge Holding Tank from where it is sent to Centrifuge Decanter for dewatering. The dewatered sludge is then disposed off into Secured Landfill Site at Vinzol.

In the outlet of DAF the concentration of suspended solids is maintained at less than 100 mg/l. Some reduction in COD content is also observed due to removal of organics in colloidal state. This effluent flows to Aeration Tank by gravity. The total capacity of Aeration Basin is 27800 cu. m. Medium bubble aeration supplemented by 18 nos. Triton type Aerators supply air to maintain the desired DO level and also to maintain the MLSS in suspension. The organic matter is aerobically degraded by the micro-organisms contained in the activated sludge. Nutrients in the form of nitrogen and phosphorous containing compounds are added as per the requirement. The various parameters including MLVSS, MLSS, F/M ratio, DO level and concentration of nutrients are closely monitored and maintained to achieve the maximum degradation of organics.

The effluent containing MLSS flows into the two Secondary Clarifiers after passing through the Flow Distribution Chamber. Provision is made for adding coagulant in the Clarifiers depending on the requirement. The suspended solids get settled by gravity and are collected at the bottom of the Clarifiers from where they are taken to the Sludge Sump. This is activated sludge containing biomass along with inert. A portion of this activated sludge is recycled into the Aeration Tank for the maintaining biomass in the form of MLVSS at the desired level. The rest of the sludge is taken into Sludge Holding Tank from where it is pumped to Centrifuge Decanter for dewatering. The dewatered sludge is transported to SLF for final disposal.

The supernatant from the Clarifiers is collected in Holding Tank / Pumping Station from where it is pumped to the Mega Pipeline for ultimate conveyance into river Sabarmati at Pirana after mixing with the treated sewage discharged from Pirana STP of Ahmedabad Municipal Corporation.

3.4. Monitoring and Laboratory Facilities

In order to assess and control the quality of effluent from the member units elaborate monitoring system is practiced. Accordingly sampling of effluent of each member industries is carried out daily during the period of discharge and the quality is determined in terms of pH and TOC of all effluent samples. Additionally depending on the raw materials and products other parameters like ammonical nitrogen, phenolic compounds and heavy metals are also determined. The quantity of the effluent being discharged by the member units is also measured individually with the help of magnetic flow meters. The member units are intimated of the results and are also charged on the basis of the quantity and quality of the effluent.

The performance of CETP is assessed by determining the following parameters…

Primary Treatment Stage: The equalized raw effluent and outlet of DAF unit are analyzed for pH, TOC, BOD, COD, TSS, Oil and Grease, TDS, Ammonical Nitrogen, Phenolic Compounds and Heavy Metals at the frequency of once per shift.

Secondary Treatment Stage: The contents of the Aeration Tank are analyzed to determine pH, DO, DOUR, MLVSS, MLSS, Nutrients and SVI. The overflows of the Clarifiers is analyzed to determine pH, TOC, BOD, COD, TSS, Oil and Grease, TDS, Ammonical Nitrogen, Phenolic Compounds and Heavy Metals to ensure that the standards specified by GPCB are complied with.

Laboratory Facilities:

At CETP Site a well equipped Laboratory and associated facilities have been established. These include the following sections…

Physico-Chemical Lab.
Microbiology Lab.
Instrumental Analysis Lab.
R&D Section.
Sample Preservation and Storage Section.

Fig. No. 3.1. FLOW DIAGRAM

Fig. No. 3.2. AUTOMATIC SAMPLER

Fig. No. 3.3. BAR SCREEN

Fig. No. 3.4. ONLINE DO METER

Fig. No. 3.5. FLOCCUTATOR

CHAPTER-4. AMUL WASTE WATER TREATMENT PLANT

4.1. INTRODUCTION

Amul is an Indian cooperative dairy company, based at Anand in the state of Gujarat. Formed in 1946, it is a cooperative brand managed by a cooperative body, the Gujarat Co-operative Milk Marketing Federation Ltd. (GCMMF), which today is jointly owned by 3.6 million milk producers in Gujarat. Amul spurred India's White Revolution, which made the country the world's largest producer of milk and milk products. Amul was spearheaded by Tribhuvandas Patel under the guidance of Sardar Vallabhbhai Patel. As a result, Kaira District Milk Union Limited was born in 1946. Tribhuvandas became the founding chairman of the organization and led it until his death. He hired Dr. Verghese Kurien in 1949. He convinced Dr. Kurien to stay and help with the mission. Kurien, founder-chairman of the GCMMF for more than 30 years (1973–2006), is credited with the success of Amul's marketing. Amul has ventured into markets overseas.

4.2. TREATMENT PLANT

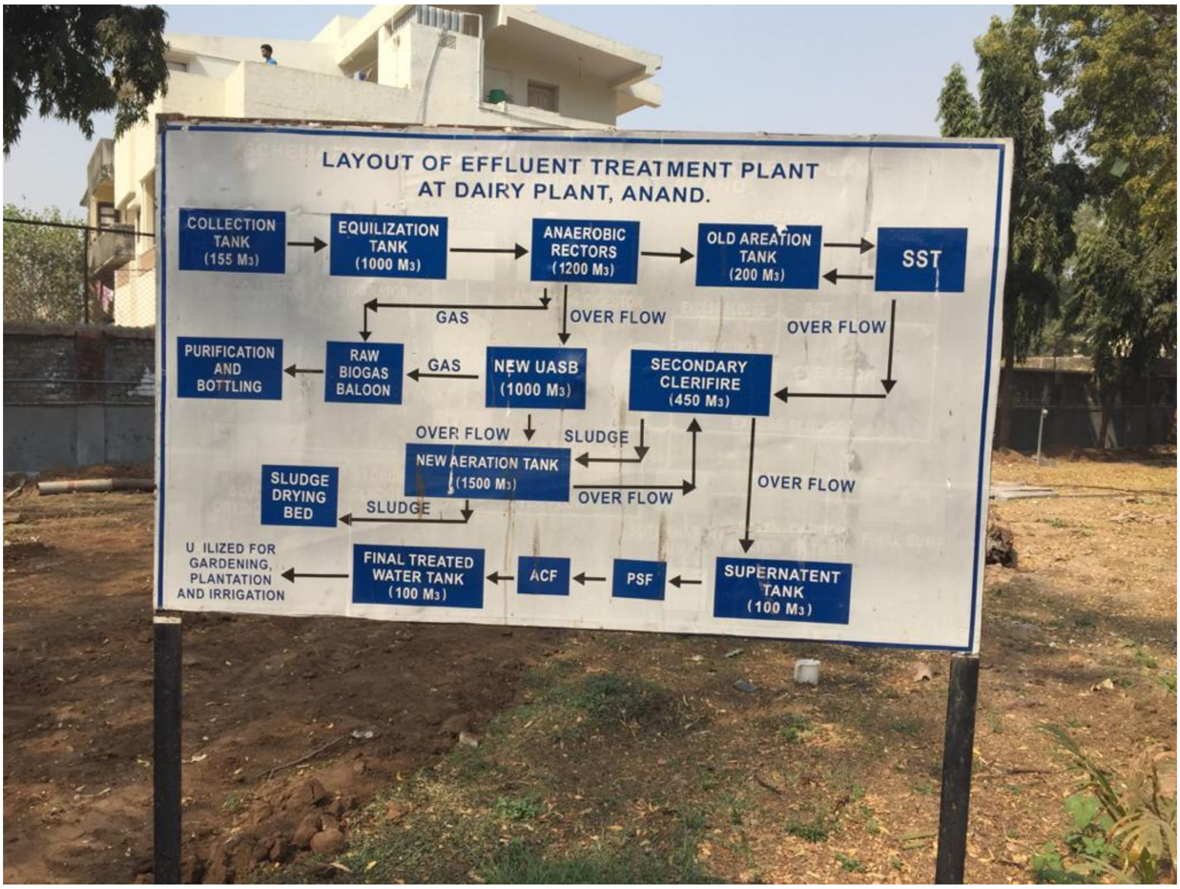

Fig. No. 4.1. FLOW DIAGRAM

Fig. No. 4.2. BIOGAS PLANT

Fig. No. 4.3. WASTE WATER (LEFT) AND TREATED WATER(RIGHT)

Collection tank:

The waste water from the dairy plant from various outlets is collected in one tank and is stored for further processing. This initial storage tank is called collection tank. The capacity of collection tank at amul dairy plant is around 155m*3

Equilization tank:

Equilization tanks are holding tanks that allow for flow to be equalized over a specific period of time. These tanks are provided in order to make the characteristics of waste water uniform and consistent. This is done by proper and thorough mixing pf wastewater collected in equilization tank.

The waste water discharged from various batches has different waste characteristics such as high BOD or COD loading, different pH which can increase the load or decrease efficiency of further treatment units. Hence the wastewater in equalized in order to make it uniform and consistent for further treatment units.

Anaerobic reactors:

Once the waste in equalized, it is transferred to anaerobic reactors where degradation of organic waste present in wastewater takes place anaerobically. The organic matter in wastewater acts as food for the micro-organisms and thus they degrade the organic matter in absence of oxygen. Because of anaerobic reaction, various gases such as CH_4, H_2S are evolved.

Raw biogas balloon& Purification and bottling:

The gases H_2S, CH_4 evolved in anaerobic reactors are then stored in biogas plant balloons and then they are purified and bottled and then can be either sold or used for energy generation purpose.

NewUpflow Anaerobic Sludge blanket(UASB):

The upflow anaerobic sludge blanket reactor (UASB) is a single tank process in an anaerobic centralised or decentralised industrial wastewater or blackwater treatment system achieving high removal of organic pollutants . A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it. Wastewater enters the reactor from the bottom, and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it. Bacteria living in the sludge break down organic matter by anaerobic digestion, transforming it into biogas. Solids are also retained by a filtration effect of the blanket. The upflow regime and the motion of the gas bubbles allow mixing without mechanical assistance. Baffles at the top of the reactor allow gases to escape and prevent an outflow of the sludge blanket. As all aerobic treatments, UASB require a post-treatment to remove pathogens, but due to a low removal of nutrients, the effluent water as well as the stabilised sludge can be used in agriculture.

New Aeration tank:

The tank where raw or settled wastewater is mixed with return sludge and aerated. Also called aeration bay, aerator, or reactor. From primary sedimentation tank or UASB, the waste water flows to the aeration plant and is mixed with the activated sludge. Air is continuously introduced into these tanks either by diffused air aeration (Air Diffusion) or by mechanical aeration or sometimes by combination of both.

Secondary Clarifier:

A secondary clarifier also called as secondary settling tank or humus tank is used for settling the effluents from activated sludge process or from a filter and is provided with recirculation of its filtered settled waste with larger capacities so as to provide adequate settling time with a detention period of 1.5 to 2 hours and overflow rate raging between 40000 to 70000 litres per sq.m.

Sludge drying beds:

The digested sludge from the digestion tank is dewatered or dried up on drying beds. Further disposal of sludge from drying beds is done either by dumping or burning.

Pressurized sand filter (PSF):

These filters are the most popular method for removal of turbidity from water. The Pressure Sand Filter consists of a multiple layer of sand with a variety in size and specific gravity. These Filters are designed to remove turbidity and suspended particles present in the feed water with minimum pressure drop. These Filters are custom designed to suit the process requirement. Waste water flows down wards through the filter bed and as the suspended matter, which is treated by addition of a coagulant like alum or poly electrolyte, is retained on the sand surface and between the sand grains immediately below the surface. There is steady rise in the loss of head over a period of time and the flow reduces once the pressure drop across the filter is excessive.
The filter is then taken out of service and cleaning of the filter media is effected by flow reversal also called as backwash. To assist in cleaning the bed, the backwash operation is sometimes preceded by air scouring by way of agitation through the under-drain system. The air scouring agitates the sand with a scrubbing action, which loosens the intercepted particles. The filter is now ready to be put back into service.

Activated carbon filter (ACF): An activated carbon filter works on the principle of adsorption. The filter medium adsorbs or reacts with the pollutant molecules and hold them in the filter media and then the filtered water is drained out. Because of the nanopores of the activated carbon media, the pollutants remain adsorbed on it thus giving clear water.

Final treated water tank: The treated effluent from the activated carbon filter is then stored in tank from where it can be used for gardening, plantation or irrigation purpose.

WEBSITE

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