WASTE MANAGEMENT AND DRAINAGE WATER PURIFICATION

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Abstract - Most water treatment plants (especially large plants) employ coagulation, sedimentation, and filtration processes for water purification. The major sources of wastes are the sedimentation basins and filter backwashes. Alum coagulation sludges, which are high in gelatinous metal hydroxides, comprise large quantities of small particles. These are among the most difficult sludges to handle because of their low settling rate, low permeability to water, and thixotropic characteristics. Generally, about 5% of the treated water is used for washing filters. Volume reduction of backwashes and recycling of waste water to the plant influent can reduce waste production and cut costs. In the case of treatment plants that remove iron and manganese through aeration or potassium permanganate oxidation, disposal of sludge to receiving waters may cause problems such as water discoloration and destruction of aquatic life. Treatment plants that use an ion exchange softening process have brine wastes (high salts) which become critical disposal problems, especially when the sludge has a high manganese content. The salts cannot readily be recovered or removed from the wastes. Brine wastes are almost impossible to treat. Formerly, wastes from water treatment plants were returned to their original source or discharged to nearby receiving water. Illinois laws and regulations now consider waste discharged directly from water treatment plants to receiving water as a pollutant. All wastes have to be treated to an acceptable level prior to their release into the environment, and water treatment plant wastes are no exception. However, occasionally a site-specific variance for direct discharge may be granted by the pollution 2 control authorities. In these cases, treatment of water plant wastes is not necessary before final disposal. , Many water treatment plants do not have adequate facilities to investigate the quantity of waste produced, its characteristics and treatability, and appropriate waste disposal practices. Methods for assessing waste production have not been well-defined, and the composition of wastes has" scarcely been reported in the literature. Very little research has been conducted on the effects of coagulant and lime sludges applied to farmlands.

Keywords: Drainage system, control valve, electrostatic precipitator, Condenser, PH Sensor, UV plant, Neutralizer, screw conveyor ,Waste Water Tank, Solid Waste Tank, Burner, Electrostatic Precipitator, Settler, Vaporizer Tank, Filter Bed ,Solar Powered Water Heating Coil, phoenix contact: PLC ILC 130 ETH.

Introduction: Now a days the most of the rivers, ponds etc. are become waste water and so much solid waste are dumped into the rivers. The waste water from factories and industries are like chemicals its directly move to the river it will be effect the pure water and the living organism in the river. There are so much of people are use the river water so the waste water is very much effected to them and it cause various disease and many health problems.

In city or town there may not be proper waste management or purification systems. Untreated, the chemical compounds and pathogens in wastewater can harm the health of animals, plants and birds that live in or near the water. It can also contaminate crops and drinking water, affecting human health. Good wastewater treatment allows the maximum amount of water to be reused instead of going to waste.

Drainage water purification and solid waste treatment is the process of removing contaminants from municipal wastewater, from household waste and industrial wastewater. In water purification, remove the chemicals, biological contaminants, solids, and gases from water. The methods used in physical processes such as filtration, sedimentation, and distillation and ultraviolet light. The water purification may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, and fungi. A large portion of wastes from municipal solid waste, household, industrial, and commercial activity.

Model Description: Various components used were:

1. Control Valve or Main Inlet Valve
2. Waste Water Tank

3. Solid Waste Tank
4. Burner
5. Electrostatic Precipitator
6. Settler
7. Vaporizer Tank
8. Filter Bed
9. Solar Powered Water Heating Coil
10. Condenser
11. PH Sensor
12. UV plant
13. Neutralizer

1. **CONTROL VALVE:** control valve is used to control flow of water by varying the size of the flow passage. Control valve enables the direct control of flow rate. The controlling process quantities such as pressure, temperature, and liquid level.

2. **WASTE WATER TANK:** The separated waste water is stored in waste water tank.

3. **SOLID WASTE TANK:** The separated solid waste is stored in solid waste tank.

4. **BURNER:** Heat-producing device (such as a furnace or stove) where flame or heat is produced.

5. **ELECTROSTATIC PRECIPIATOR:** An electrostatic precipitator is a device used to filtration. Its help to removes fine particles, like smoke and dust, etc, from a flowing gas.

6. **SETTLER:** The settler is a calm pool downstream of the mixer where the liquids are allowed to separate by gravity. The water are then removed separately from the mixer.

7. **VAPORIZER TANK:** Filtration or distillation using the process called Solar Water Vaporizer took place in Vaporizer Tank.

8. **SOLAR POWERED WATER HEATING COIL:** It is a alternative for vaporizer tank at the time of less availability of solar energy. Electricity is generated using the solar energy and this electricity can be used to heat the Coil and vaporize the water.

9. **FILTER BED:** Filter Bed is another alternative at time of less availability of solar energy. Using sand filters produce high-quality water without the use of chemical. The flocculated water passing through the sand filter and the particle trapped within it, and reduce number of bacteria and remove most of solid wastes,

10. **CONDENSOR:** *Condenser* is a device used to convert a gaseous substance into a liquid state by cooling. The latent heat is produced by the substance and transferred to the surroundings.

11. **PH SENSOR:** A pH meter is used to measures the hydrogen-ion activity in water. Its indicate acidity or alkalinity expressed as pH.

12. **UV TREATMENT:** It is an Environmentally-friendly method with high energy UV radiation. Uses no chemicals, such as chlorine or ozone. Destroy microorganisms including bacteria, viruses and parasites. Help decompose chemicals harmful to health. This treatment which does not affect the smell or taste of the water.

13. **NEUTRILIZER:** A neutralizer is a substance or material used in the neutralization of acidic water. It is a common designation for alkaline materials such as calcite (calcium carbonate) or magnesia (magnesium oxide) used in the neutralization of acid waters. Neutralizers help to prevent acidic well water from creating blue-green stains.

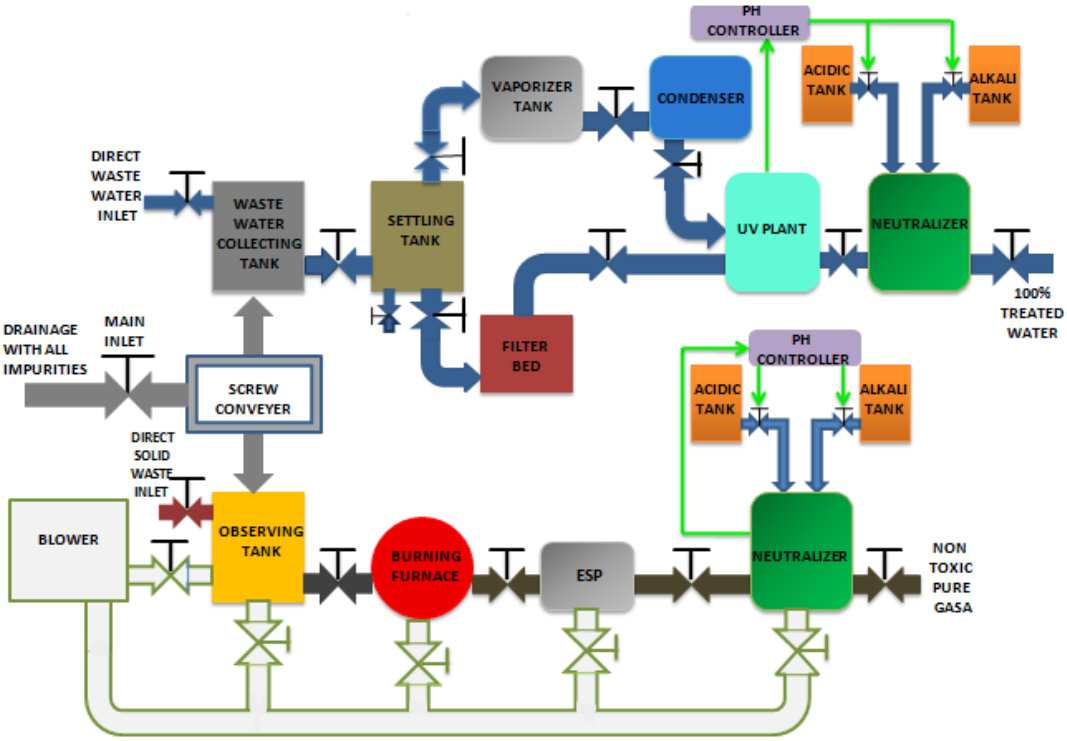

Figure.1.Block diagram of the entire process

Process description:

The water from the drainage system or any other impure sources are fed to the system. This impure drainage is the input of our system contains many types of impurities like Solid wastes (Plastics, Biodegradables, minerals etc.). There are mainly 3 process in this system. Each stages or process receive a signal from the previous stage for starting the process.

1. Separation of Solid Waste and Water
2 Purification of Water
3 Disposal of Solid Waste

1. Separation of Solid Waste and Water

The first process of our plant is the separation of these solid wastes and water into two separate tanks. The separation is done using a machine called Screw conveyer. The start switch turns ON the inlet valve hence the drainage is fed to the screw conveyer therefore the separation starts hence the solid waste and waste are collected in separate tanks in where level switches are placed. When the **Low Level Switch (LLS)** in the **Waste Water Collecting Tank** engage, the main inlet valve opens, outlet valve of waste water collecting tank closes (for the first cycle it will be closed) and the **Screw Conveyer** turns ON hence the separation starts. When **High Level Switch (HLS)** in the Waste Water Collecting Tank engage, the main inlet valve Closes, the screw conveyer turns OFF and the outlet valve of the Waste Water Collecting Tank Opens. There will be LLS and HLS in the Observer tank (Solid waste collecting tank) for the indication of the level of collection of solid waste.

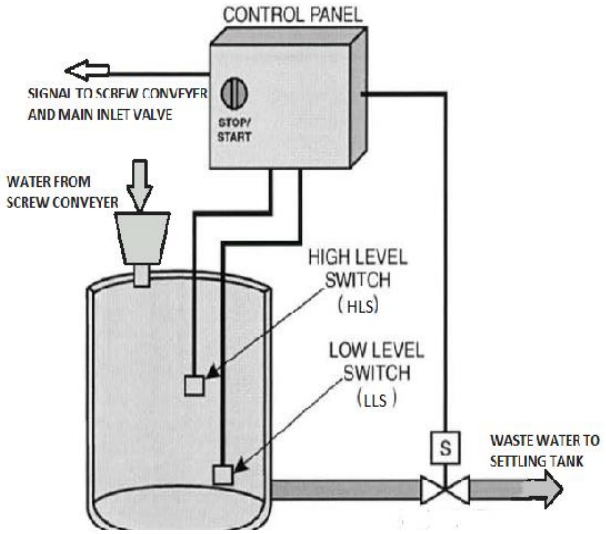

Figure 2.WASTE WATER COLLECTING TANK

A **screw conveyor** or **auger conveyor** is a mechanism that uses a rotating helical screw blade, called a "flighting", usually within a tube, to move liquid or granular materials. They are used in many bulk handling industries. Screw conveyors in modern industry are often used horizontally or at a slight incline as an efficient way to move semi-solid materials, including food waste, wood chips, aggregates, cereal grains, animal feed, boiler ash, meat and bone meal, municipal solid waste, and many others. The first type of screw conveyor was the Archimedes' screw, used since ancient times to pump irrigation water.

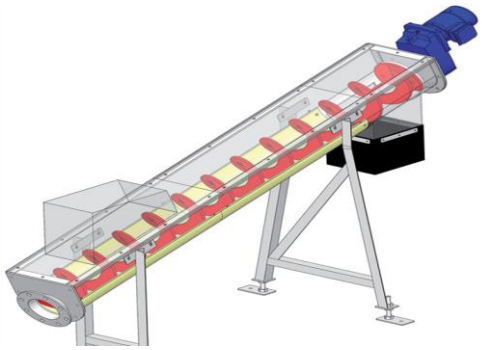

Figure 3. SCREW CONVEYER

Hence the solid waste and water are separated using screw conveyer mechanism and both are collected separate tanks. Solid wastes are collected in a observing tank and the waste water is in another tank in which both of them are having separate inlet for the direct input. The collected solid wastes may contain different types of wastes such as plastics, rubbers, stones, slurry etc. and the collected water may contain different forms of minerals, bacteria, fungus, dusts etc. The aim of our project is to dispose the solid waste without harming the environment and reuse this waste water for irrigation and related purposes.

We make a prototype for the first process of the project that is the separation of solid wastes and waste water using PLC (Phoenix Contact: PLC ILC 130 ETH.).

2. Purification Of Water

The water collected in tank is purified and is used for the irrigation and related usage. Hence the water pollution is maintained and the unused unhealthy water is converted to useful healthy water. Waste water from drainage or any other sources are fed to the system through Main valve or Direct inlet valve (if no solid waste are present) to the **Waste Water Collecting Tank**. The collected water is then fed to the **Settler Tank** using a centrifugal pump through a valve. After settling period, scum, slurry, dust etc are removed. The overflow is taken as the output for the next stage. The downwards flow will be the combination of dust, slurry etc. Which is can be treated and used as fertilizers. The next stage is filtration or distillation using **Solar Water Vaporizer** in **Vaporizer Tank** (Distillation Tank).Water distillation is physical process in which filters the solid impurities out of fluid based on the difference in the volatility. At a given temperature and pressure, substances with higher volatility (water in this case) vaporizes more readily than the substances (solid impurities) with lower volatility. The water vapor is then directed to a condenser which condenses the water vapor back to liquid state, leaving all the non-volatile solid impurities such as salts, sediment, pathogenic microorganisms and heavy metals behind. However, the distilled water may not be suitable for drinking since it may still contain some volatile organic compounds. The rate of vaporization is proportional to the vapor pressure, fluid surface area and the fluid temperature.

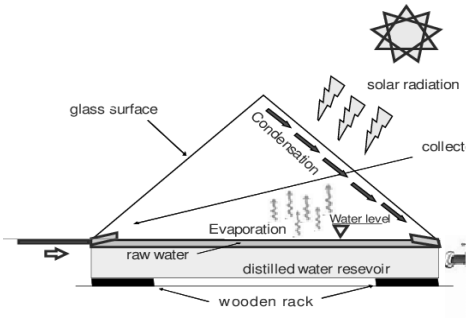

Figure.4.Distillation Tank

But there will be certain situation in which less availability of solar energy which shows a need of alternatives for filtration. Therefore we implement two other alternatives for this situation.

a.Solar Powered Water Heating Coil

Electricity is generated using the solar energy and this electricity can be used to heat the Coil and vaporise the water leaving all the non-volatile solid impurities such as salts, sediment, pathogenic microorganisms and heavy metals behind. The heating coil is placed inside the **Distillation Tank** (Vaporizer Tank) itself.

Figure.5.Solar Powered Water Heating Coil

b. Filter Bed

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 floc and the particles trapped within it, reducing numbers of bacteria and removing most of the solids.A sand bed filter is a kind of depth filter. Broadly, there are two types of filters for separating particulate solids from fluids:

- Surface filters, where particulates are captured on a permeable surface.
- Depth filters, where particulates are captured within a porous body of material.

Smaller sand grains provide more surface area and therefore a higher decontamination of the inlet water, but it also requires more pumping energy to drive the fluid through the bed. A compromise is that most rapid pressure sand bed filters use grains in the range 0.6 to 1.2 mm although for specialist applications other sizes may be specified. Larger feed particles (>100 micrometres) will tend to block the pores of the bed and turn it into a surface filter that blinds rapidly. Larger sand grains can be used to overcome this problem, but if significant amounts of large solids are in the feed they need to be removed upstream of the sand bed filter by a process such as settling.The depth of the sand bed is recommended to be around 0.6–1.8 m (2–6 ft) regardless of the application.Guidance on the design of rapid sand bed filters suggests that they should be operated with a maximum flow rate of 9 $m^3/m^2/hr$ (220 US $gal/ft^2/hr$). Using the required throughput and the maximum flow rate, the required area of the bed can be calculated.

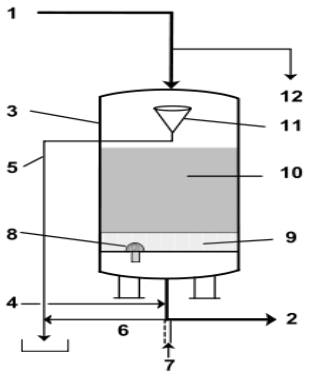

Figure.6.Filter Bed

1raw water 2=filtered water, 3=tank 4=inlet flushing water 5=outlet flushing water 6=retraction line 7=scavenging air 8=injector 9=supporting layer 10=filter sand 11=flushing funnel 12=ventilation

The final key design point is to be sure that the fluid is properly distributed across the bed and that there are no preferred fluid paths where the sand may be washed away and the filter be compromised.

From any of the three methods, the unhealthy water is filtered. If distillation is done without the aid of filter bed then there is a need of **CONDENSER** for condensation of the distilled vapor. After condensation the distilled water is fed to next stage for **UV Treatment** in **UV Treatment Tank.**

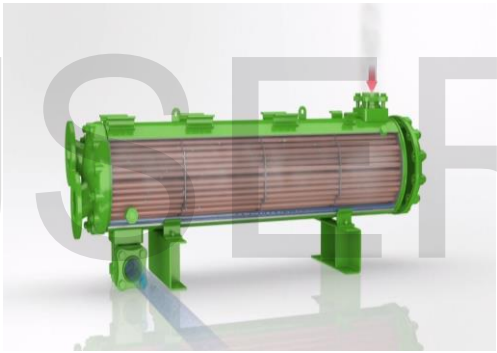

Figure.7. Condenser

The **UV** light kills the nucleus like pathogens, coli-form bacteria, which effectively neutralizes them by preventing them from reproducing. UV Disinfection System is an extremely effective way to combat microbial contamination in water. However, microbes have to be exposed to UV-C light in the proper amount in order to effectively disinfect the water. UV Disinfection Systems are used in many different applications ranging from the purification of drinking water in individual homes to disinfecting water supply of entire townships to industrial wastewater treatment. UV treatment for water is recognized as a safer and more cost-effective way to disinfect water for industrial applications.

Figure.8.UV Plant

The treated water is now pumped to the **Neutralizer Tank** using a pump via a Solenoid Valve. Water is neutralized by mixing proportionate acid or alkali. The proportion is obtained from the **PH Sensor** which measures the PH value from UV Treatment Tank. S per the output of PH Sensor the controller release proportionate acid or base to the water stored in neutralizer which consist of an agitator for agitating. Neutralized water will be having PH value approx 7.

3. Disposal of Solid Waste

Solid Waste collected in the **Observer Tank** is moved to a **Combustion Chamber** using a **Sliding Mechanism, Shutter** and **Blower.** Combustion Chamber is where all of them are burned. Burning is done using the help of a **BURNER. Combustion chambers are** used in a large number of industrial applications. These units **produce gases at different temperatures** starting from the combustion of different fuels such as natural gas, diesel, fuel oil, etc. The internal combustion chambers are covered with refractory to withstand temperatures up to 1500 ºC and have a robust structure and resistant to this type of industrial applications. There are different types of cameras with single or twin shell that makes the heat losses through them quite small.At a basic level, burners are devices used to mix fuel and air (or oxygen) to achieve controlled combustion while producing a specific flame and heat-release pattern. The heat generated is used to control the temperature within a combustion chamber to the process setpoints. An industrial burner is a bit like a tire for a vehicle in that it provides a basic function with a simple concept. All tires are round and provide stability and traction for vehicles on the road. Likewise, most burners are cylindrical and mix a fuel and oxidant to produce a flame and heat. Despite the basic principles, a burner and tire must both be applied appropriately to produce desired results. For example, you would not put racing slicks on your grandmother's station wagon any more than you would put regenerative burners on an air heater.

Figure.9. Combustion Chamber and Burner Management system

Burning of solid waste produces smoke, dust, ash etc. Smoke and dust are moved to **Industrial Electrostatic Precipitator** which removes the dust and smoke from the hot gas.

An **electrostatic precipitator** (**ESP**) is a filtration device that removes fine particles, like dust and smoke, from a flowing gas using the force of an induced electrostatic charge **minimally** impeding the flow of gases through the unit. The most basic precipitator contains a row of thin vertical wires, and followed by a stack of large flat metal plates oriented vertically, with the plates typically spaced about 1 cm to 18 cm apart, depending on the application. The air stream flows horizontally through the spaces between the wires, and then passes through the stack of plates.

Figure.10. Industrial ESP

A negative voltage of several thousand volts is applied between wire and plate. If the applied voltage is high enough, an electric corona discharge ionizes the air around the electrodes, which then ionizes the particles in the air stream. The ionized particles, due to the electrostatic force, are diverted towards the grounded plates. Particles build up on the collection plates and are removed from the air stream. A two-stage design (separate charging section ahead of collecting section) has the benefit of minimizing ozone production,[6] which would adversely affect health of personnel working in enclosed spaces. For shipboard engine rooms where gearboxes generate an oil mist, two-stage ESP's are used to clean the air, improving the operating environment and preventing build-up of flammable oil fog accumulations. Collected oil is returned to the gear lubricating system. In contrast to wet scrubbers, which apply energy directly to the flowing fluid medium, an ESP applies energy only to the particulate matter being collected and therefore is very efficient in its consumption of energy (in the form of electricity).The dust

collected in the plate is removed using **HAMMER Mechanism** and is collected in **Hopper**. The dust collected from the hopper is utilised in environment friendly manner. The smoke free gas is then fed to a neutralizer tank in where the gas is neutralised by spraing proportionate acid or alkali. The proportion is obtained using PH sensor. Now this gas contain many toxic elements such as Dioxins, Furans, Mercury and Polychlorinated Biphenyls, CO ,CO_2 etc. To absorb these gases an **Activated Carbon Bed** is used.

Notes:

This stage of the project (**Disposal of Solid Waste**) is under research. It is recommented in many countries that burning of plastic or its compounds may result in environmental pollution drastically. There will be more gases present in the burning of solid waste. There is no such technology implemented till now to absorb all the gases in a single process. So this part of our project is under research.

Implementation of the whole project: Program is implemented and the prototype is worked using the phoenix contact: PLC ILC 130 ETH.

Figure.11.PLC ILC 130 ETH

The ILC 130 ETH supplements the highly modular range of Inline controllers from Phoenix Contact with a powerful compact controller. This controller further extends the possible area of application of Inline controllers to smaller applications. The compact controller can be adapted to the relevant requirements in a highly modular manner thanks to direct integration in the Inline automation system. Using its integrated Ethernet interface, it can be parameterized and programmed in accordance with IEC 61131 using the PC WORX automation software; it can also exchange data with OPC servers simultaneously and communicate with TCP/IP-compatible devices.
The Inline Controller range of controllers covers a wide performance spectrum. Users can find the right controller for their application, from a starter version up to a high end controller. In the portfolio, users can choose between controllers with different computing capacities, with or without PROFINET controllers and with or without GL approval.

Result

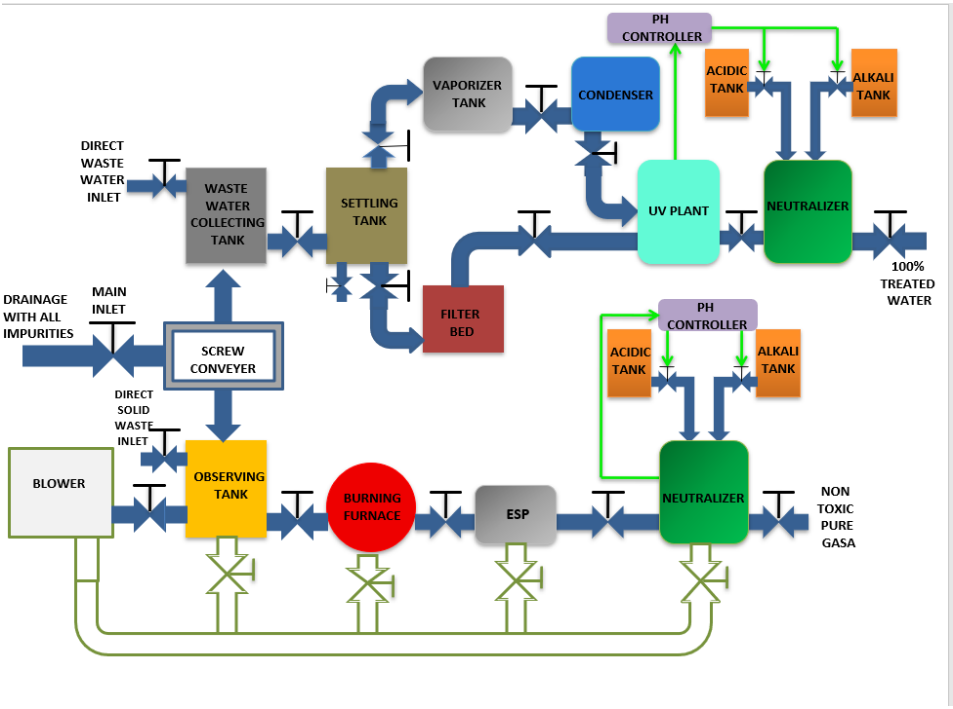

Figure.12. represents that the whole plant is in the off state.

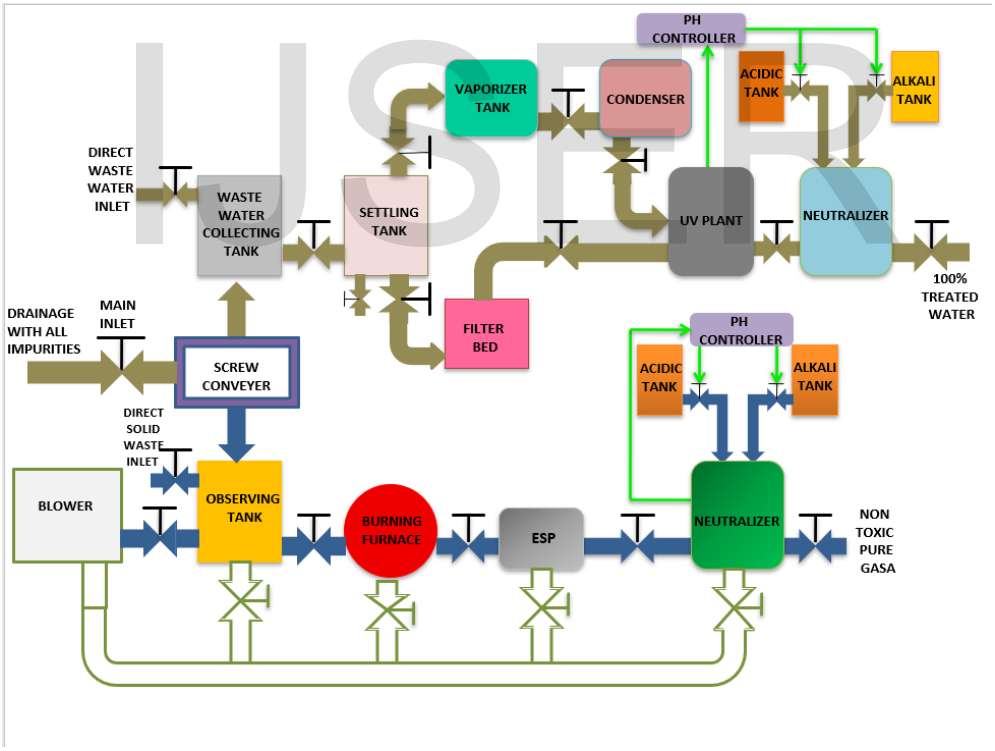

Figure.13. represents that the water coming out to the drainage will be having various types of impurities. It is first separated by means of a screw conveyor. The solid waste goes to the observing tank and the waste water will goes to the collecting tank. The impure water will settles in the settler. The settled scum will goes to the filter bed, where a sand filter is used for the filtration process. The filtered water goes to the UV plant ,meanwhile the water which is condensed also goes to the UV plant. In the UV plant it is purified and the PH is controlled . If the PH of the water is greater than 7 alkali is added and if it is less than 7 acid is added.

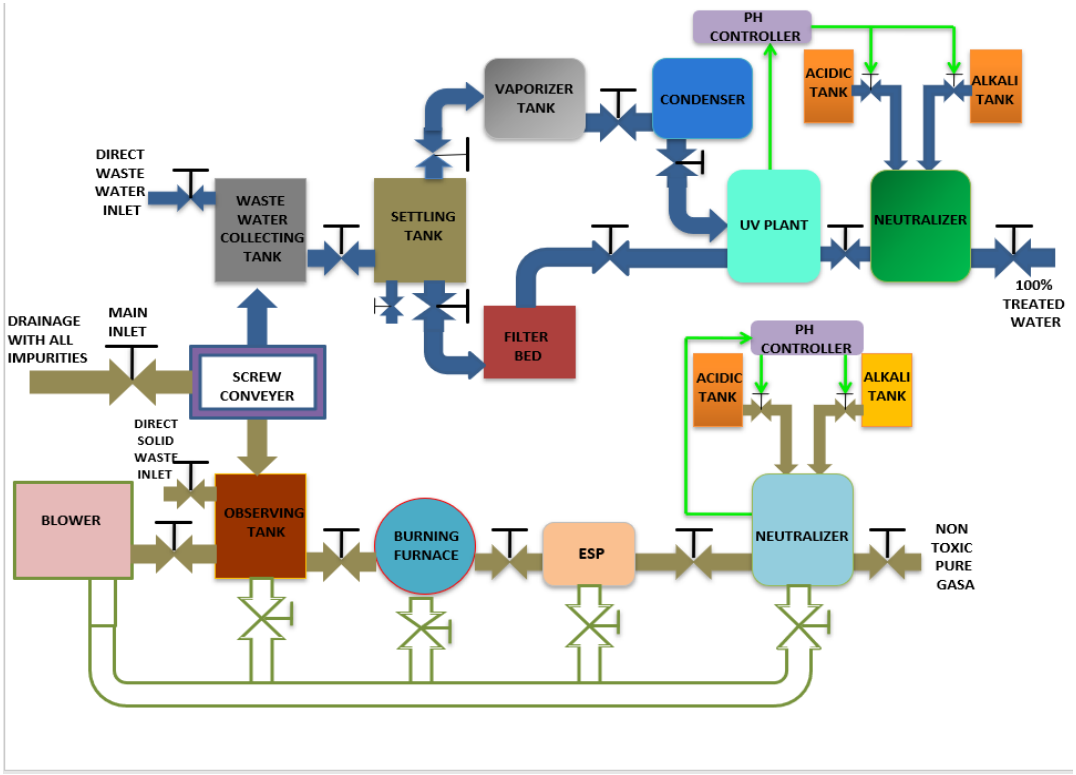

Figure.14. represents the solid separation. The solid waste after separated from the screw conveyor is stored in the observing tank. From there it is moved to the furnace and it is burned. The developed smoke will be having various impurities . Its is purified by using an electrostatic precipitator. The PH of the air is purified using a PH controller by adding alkaline or acid respectively. Then the controlled smoke is given to the neutralizer, which neutralizes the gas.

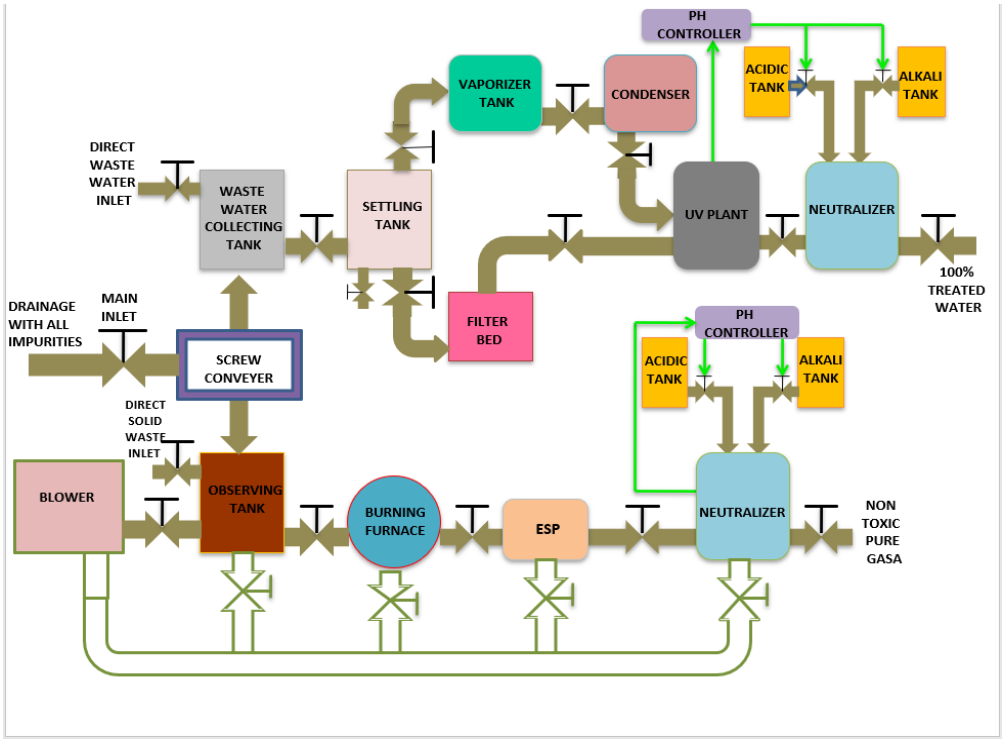

Figure.15. represents when both the process operates on same time.

Conclusion

Drainage ensures that the soil is properly aerated. If you have excess or standing **water** it can choke your crops. Drainage reduces soil and nutrient loss from runoff and can help avoid soil erosion. Drainage on hill slopes helps to reduce the risk of soil slippage.**Poor drainage** can lead to flooding, resulting in property loss, and people may even be forced to move to escape floodwaters. Flooding may also damage water supply infrastructure and con- taminate domestic water sources. **Drainage** infrastructure facilitates rapid surface flows that **can** result in damage to fish and habitat and to increased flooding downstream. Reduced Summer Flows - Historically, winter stormwater was stored in wetlands and in the soil, becoming available at a later time to supplement low summer flows.

Acknowledgment

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