CP301 FINAL PRESENTATION

Wastewater Treatment Plant in a village

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Introduction

- The water we use for showers, laundry, and sanitation doesn't simply disappear down the drain. Instead, it undergoes a multi-stage process to remove contaminants and transform it into a safe and reusable resource.
- This project delves into the critical world of wastewater treatment. We will explore the methods of treating wastewater, from the removal of large solids to the breakdown of harmful bacteria. We will do energy balance of all system, material balance and equipment design. Additionally, we will investigate emerging technologies that are revolutionizing the way we treat wastewater.
- Through the application of fundamental principles such as material balances, energy balances, and equipment design, we aim to develop an innovative and efficient treatment model tailored to our village's specific requirements.

OBJECTIVES

- Process and Equipments description
- Material balances
- Energy balances
- Equipment design

Process description

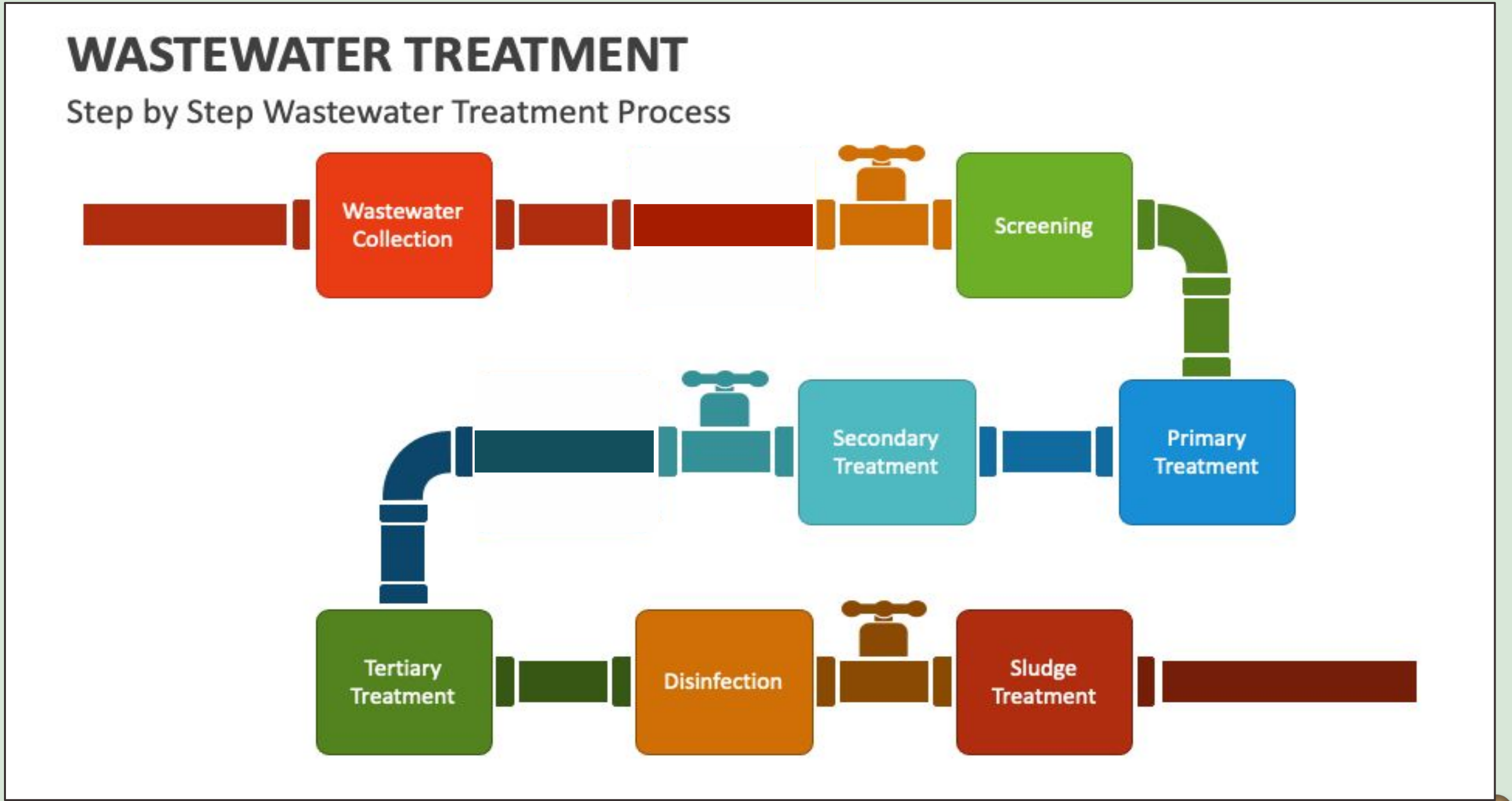


Fig .1 : WWTP Block Diagram

Chalaila, A Village in Patiala

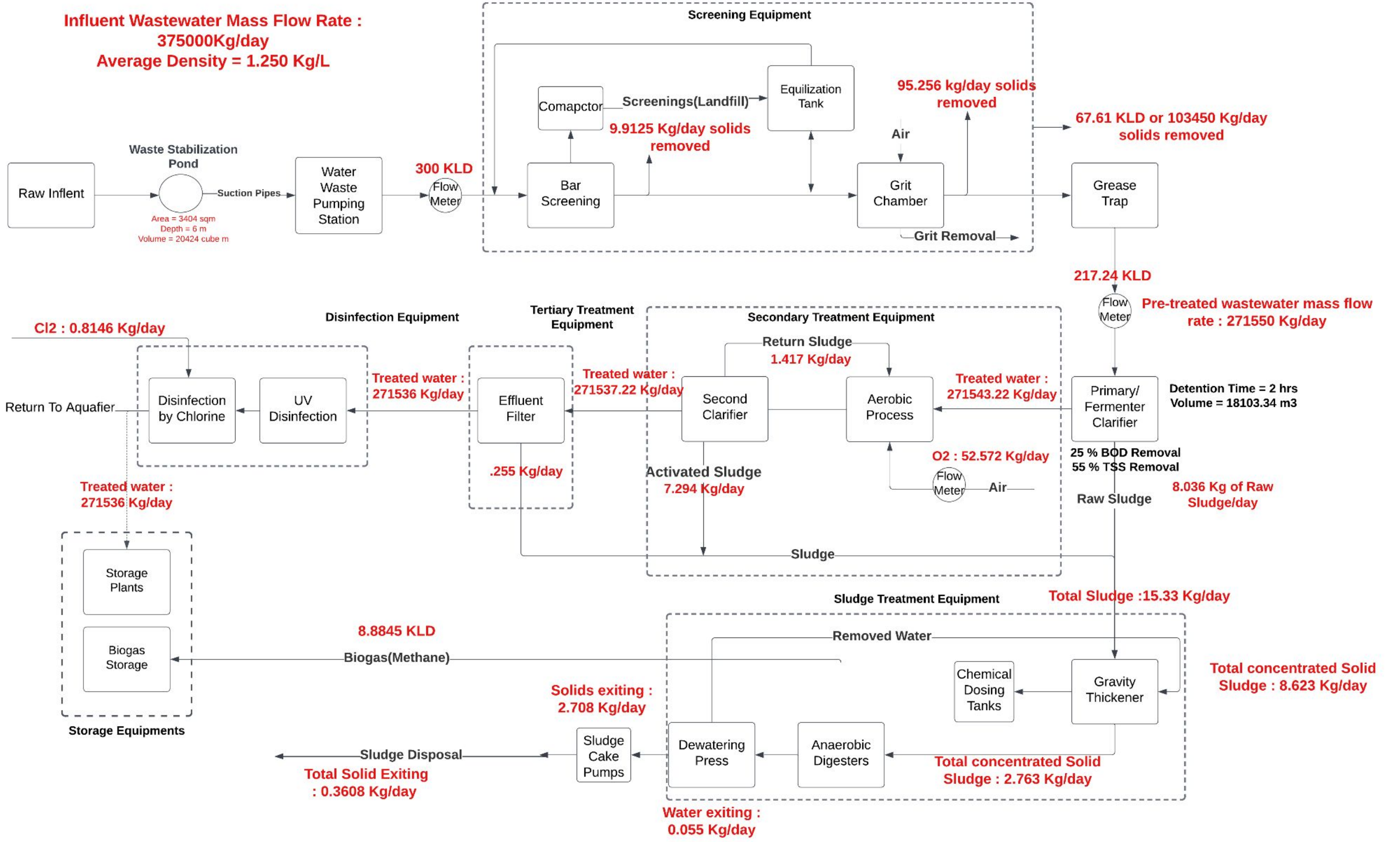
Total population = **2835 people**

Waste water feed (Qin) = 284 kL/day ~ **300 kL/day**

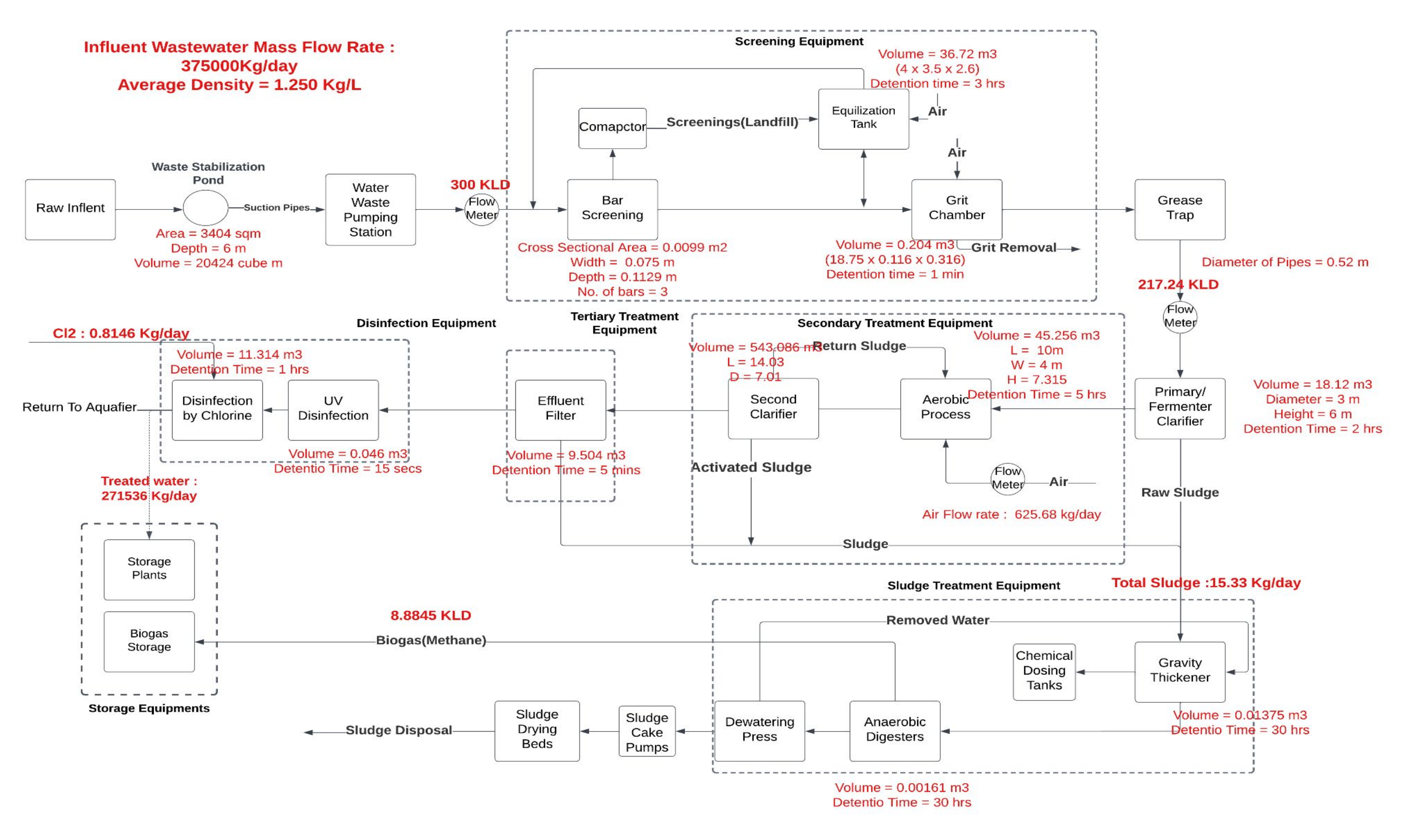
Inlet:

Tss = 74 mg/liter
BOD = 102 mg/liter
COD = 242 mg/liter
pH = 7.56

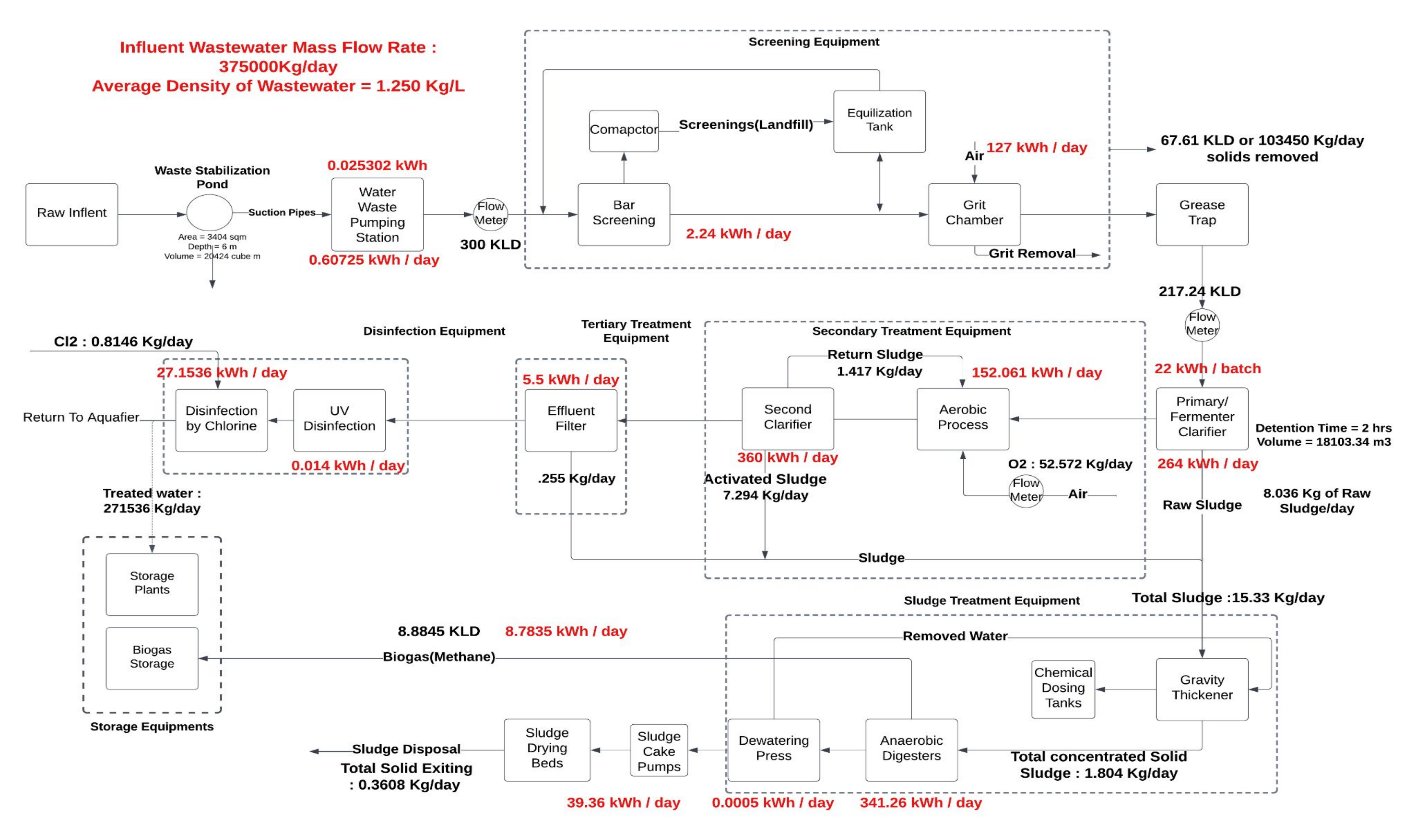
Fig .2 : Chalaila Village



Material Balance



Equipment Design



Energy Balance

SCREENING EQUIPMENTS

Screening equipment plays a crucial role in wastewater treatment plants by removing large solids and debris from the incoming wastewater stream before it enters subsequent treatment processes.

Bar Screening :

Bar screens capture large debris like **plastics and rags** at the inlet, preventing clogs and damage to equipment.

Fig .3 : Bar screens

Grit Removal :

Grit removal systems eliminate heavier solids such as **sand and gravel** to protect pumps and pipes from abrasion.

Fig .4 : Grit Removal chamber

Equalization Tank :

Equalization tank regulate variations in flow rate and pollutant concentrations to ensure consistent and efficient treatment downstream.

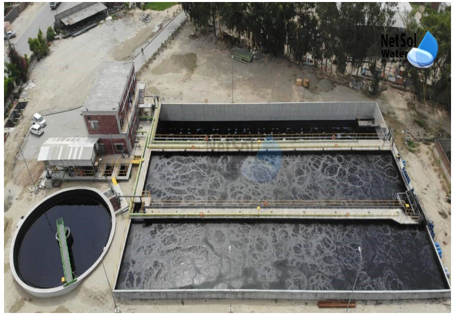


Fig .5 : Equalization Tank

COMPACTOR

A compactor compresses solid waste material, often used in wastewater treatment to **condense sludge**. It reduces volume for easier disposal or processing.

Fig. 6 Screw compactor

GREASE TRAP

A grease trap, also known as a grease interceptor or grease separator, is a device used in wastewater treatment systems **to prevent fats, oils, and grease** (often referred to as FOG) from entering the sewer system.

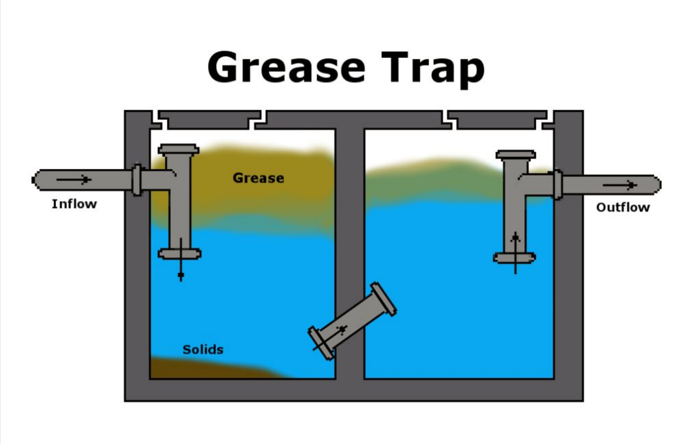


Fig. 7 Grease Trap

i) Equipment design

Bar screening:

Q = 300 KLD = **0.0034 m³/s**

Spacing between bars(b) = **0.025 m**

Inclination for Mechanical Process : **60°**

Velocity(Va) : **0.4 m/s**

Now, Q = A*V

= > A = **0.0085 m²**

Depth/Width ratio : **1.5** (for a efficient section)

Thus, **W = 0.075m** & **d = 0.1129 m**

L = 2 m

H = 0.0353 m

Also, Head loss = $\dfrac{(Vb^2 - Va^2)}{2g}$

Hence, **V_b = 0.248 m/s**

Cross Sectional Area, As = $\dfrac{A}{\sin\theta}$

= 0.0099 m²

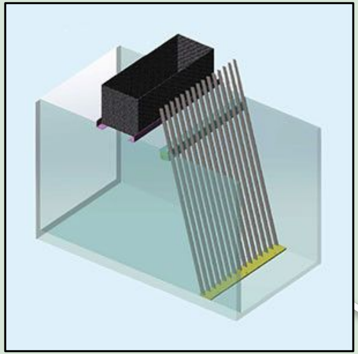
Net area available for flow: $As \cdot \dfrac{b}{b + t_{bar}}$

= 0.007 m²

No of bars : $n \cdot t_{bar} + (n-1)b = W$

=> **n = 2.83 = 3 (approx)**

Dimensions : 2m x 0.075m x 0.1129m (LBH)



ii) Material Balance

1) Bar screening:

Effluent :

Tss = 58 mg/liter

BOD = 87 mg/liter

COD = 212 mg/liter

pH = 7.65

Q_{out} = 211.85 KLD

= **0.00245 m³/s**

Solids in : Q_{in} x Influent TSS = 22200 g/day

Solids out : Q_{out} x Effluent TSS = 12287.5 g/day

Solids removed : **9912.5 g/day**

Q : KLD

T_{ss} : mg/L

iii) Energy balances Bar Screening :

By Kirshner's equation : H = $\beta(\frac{W}{b})\left(\frac{4}{3}\right) * hv * sin\theta$

β = 2.42 (for sharp edge rectangular bar)

W = width of bar(m)

b = clear spacing(m) [bar screens have a 0.64 to 2.54 cm clear spacing]

Inclination for Mechanical Process : 60º – 90º

We take : **60º**

Velocity range : 0.3 – 1.2 m/s

We take : **0.4 m/s**

Velocity head of approaching rack (h_v) = $\frac{Va^2}{2g}$

h_v = 0.0081 m

Let. Bar Dimensions be: 1 x 5 cm

= 0.01 x 0.05 m (W x L)

H = 0.0353 m

Energy Required : 3Hp

: **2.24 kWh / day**

[Effluent Treatment](#)
[Automatic Self Cleaning Bar Screen](#)

Grit Chamber (Equipment Design):

Velocity in grit chamber, V_b = 0.248 m/s

Q_{out} = 0.00245 m^3/s

Let ,Detention Time, t = 1 min = 60 s

Length : V_b*t = 15 m

Volume : Q*t = 0.147 m^3

Cross Sectional Area of grit chamber = V_b/L

= **0.0136 m^2**

Let width : depth = 1 : 1

Thus, width = depth = 0.116 m

Let 25 % additional length to accommodate inlet and outlet zones

Thus, Total Length = 1.25*L = **18.75 m**

Let Free board = 0.15 m and 0.05m for grit accumulation

Thus, **Total depth = 0.316 m**

Dimensions: 18.75m x 0.116m x 0.316m(LxBxH)

Material Balance for Grit Chamber:

Influent flow rate = 0.00245 m^3/s = 211.68 m^3/day

Influent grit concentration = 500 mg/L
(can range from 500 to 2000 mg/L)

Effluent grit concentration = 50 mg/L

Typical, Aeration time = 60 sec

Influent Grit Load=Influent Flow Rate × Influent Grit
= **105.84 Kg/day**

Effluent Grit Load=Effluent Flow Rate×Effluent Grit Concentration
= **10.584 Kg/day**

Grit Removed by Settling=Influent Grit Load−Effluent Grit Load
= 105.84 Kg/day – 10.584 Kg/day
= **95.256 Kg/day**

Energy Balance for Grit Chamber:

Influent flow rate = 0.00245 m^3/s = 211.68 m^3/day

Influent grit concentration = 500 mg/L
(can range from 500 to 2000 mg/L)

Effluent grit concentration = 50 mg/L

Assumed, Aeration time = 60 sec

Energy required : 0.5 – 1 kWh/m^3 of water treated
Let's use : 0.6 kWh/m^3

Energy used : 127 kWh / day

Effluent Treatment
The Impact of Advanced Treatment Technologies on the Energy Use in Satellite Water Reuse Plants

Equalization tank:

Let , Detention Time = 3 hrs

V = Q*t = 0.0034*3*3600 = 36.72 m^3/s

This Volume can be considered as a tank of dimensions :

4m x 3.5m x 2.6m (LxBxH)

Note : Equalization tank is not necessary for low flows

PRIMARY FERMENTER CLARIFIER

- ***Purpose*:** The primary fermenter serves as a tank or vessel for the **initial treatment of wastewater**.
- ***Process*:** It allows solid materials, including large particles, debris, and organic matter, to settle out of the wastewater.
- ***Settling Mechanism*:** The primary fermenter **facilitates settling** by providing sufficient retention time for solids to settle to the bottom.

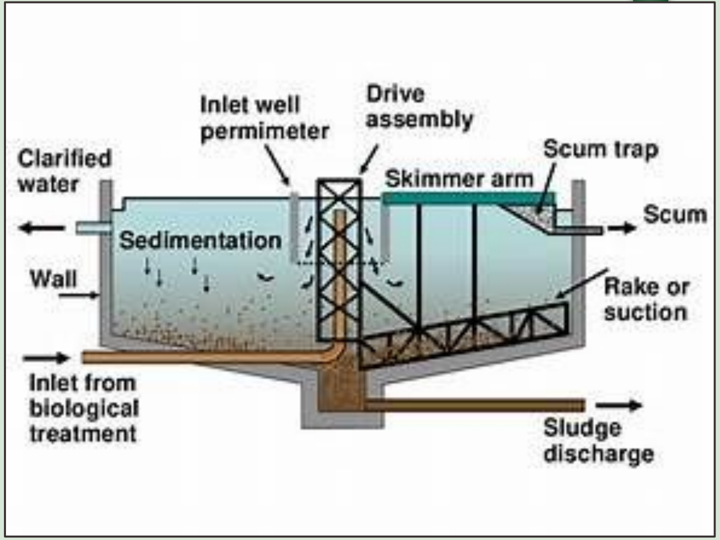


Fig.9 Primary Fermenter Clarifier

i) Equipment design

Tank volume(V) =(Flow Rate * Detention Time)/(24*density)

Where,

Flow rate=271550 Kg/Day

Detention time= 2 hours= 2/24 Days

Density of Liquid being clarified =1250 Kg/m³

L/D = 2

V = 18.12 m³
L = 6 m
D = 3m

ii) Material balances

Detention time	= 2 hours
V	= 18.12 m^3
BOD % removal	= 25 %
Inlet BOD: (87 mg/liter in mass)	= 22168.489 g/day
Remaining BOD	= **16625.869 g/day**
Tss % Removal	= 55 %
Tss removed	= 6929.956 g/day
Tss remaining	= **5669.96 g/day**
Sludge production coefficient	= 0.2 * 5669.96
	=1107.924 g/day
Treated Water mass Rate	= 271550 kg/day
Water left	= **271543.22 kg/day**

iii) Energy balances

Batch size (volume processed) = 18.12 liters

Density of fermenting mixture = 1250 kg/m³

Operating time per batch = 2 hours

Assumptions:

Power consumption of mixing mechanism = 5 kW

Power consumption of inlet and outlet pumps = 3 kW each

Energy consumption=Power×Time

Energy Consumption :
E_Mixing : 10 kWh / batch
E_pumps : 6 kWh /batch

Total Energy Required : 13*12
: 264 kWh / day

SECONDARY TREATMENT EQUIPMENTS

AEROBIC PROCESS

- **Conversion Process:** Aerobic treatment breaks down organic pollutants into CO_2 and H_2O.
- **Microbial Action:** Aerobic bacteria and microorganisms use oxygen to oxidize organic compounds.
- **Objective:** Goal is to degrade organics, enhancing water quality.
- **Oxygen Dependence:** Oxygen enables efficient breakdown of organic matter.

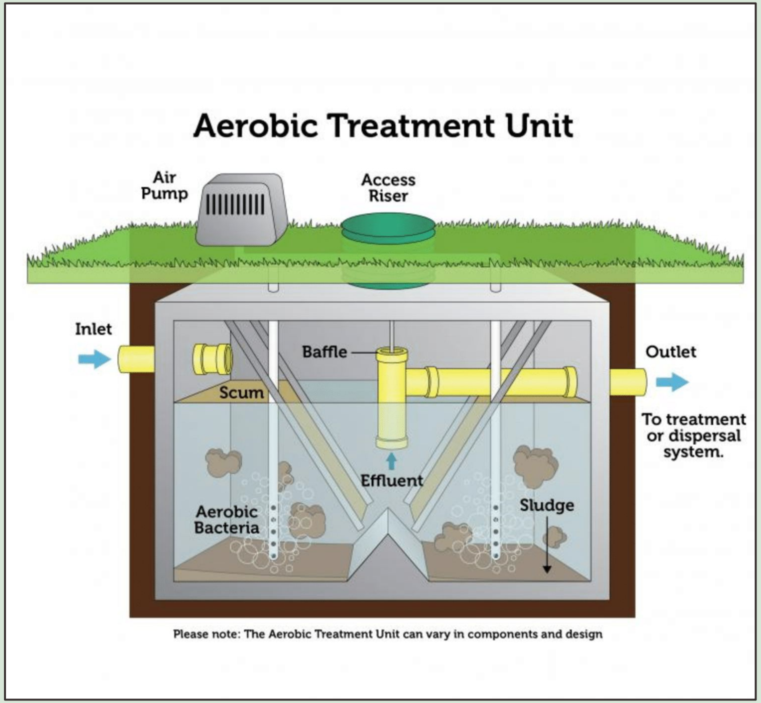


Fig. 10 Aeration tank

i) Material balances

AERATION TANK :

O_2 required	= Flow Rate * COD
	= 217.24 kL/day * 242 mg/liter
	= 52572 g/day
Aeration time	= 24 hours/day
O_2 demand rate (kg/hour)	= 2190.5 g/hour
	= 2.190 kg/hour

Calculation of Required Oxygen Flow Rate:
Typical FINE BUBBLE DIFFUSER oxygen transfer efficiency is 2.0% per foot of diffuser submergence, i.e. 20 foot submergence equals 40%.
(Let's say diffuser is submerged to a depth of 20 feet below the water surface)

Required Oxygen Flow Rate	= O_2 demand rate/ Oxygen Transfer Efficiency
	= 2.190 kg/hour / 0.40
	= 5.475 kg/hour
Required Air Flow Rate	= (5.475 Kg/hr) / 0.21 [O_2 conc in air to be 21 %]
	= 26.07 kg air/hour

i) Equipment Design

Calculation of Aeration Tank Volume:

Flow rate = 217.24 kL/day = 293.76 m^3/day

Aeration time= 24 hours

Volume=Flow rate×Aeration time

= 293.76 m^3

Height = 20 feet + 20 %

= 7.315 m

L = 10 m

W = 4 m

Consider rectangular aeration tank, a length of 10 meters, and a width of 6 meters.

[The aeration tank L/D ratio should be between 1.5 and 3]

L/D = 10/4 =2.5

Dimensions :

10m x 4m x 7.315m (LBH)

SECONDARY CLARIFIER

- ***Role*:** Secondary clarifiers are vital in wastewater treatment plants, especially **post-primary treatment**.
- ***Focus*:** They target dissolved and suspended biological matter after primary treatment.
- ***Process*:** Clarification methods, like sedimentation or flocculation, **separate remaining solids from treated water**.
- ***Outcome*:** Enhances water quality by **effectively removing biological contaminants**.

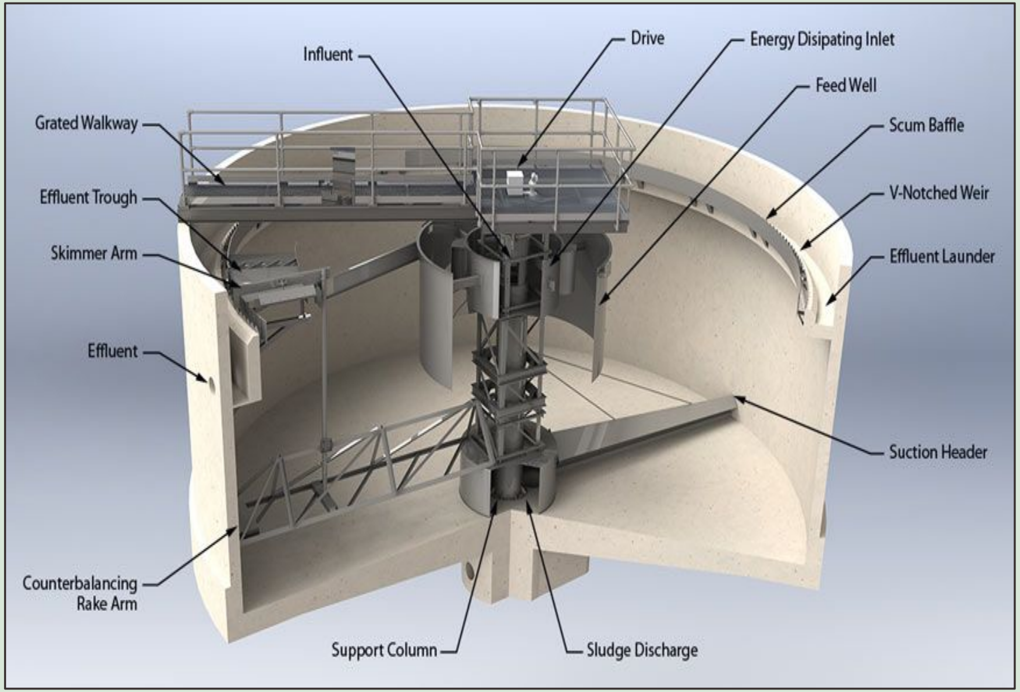


Fig. 11 Secondary Clarifier

SECONDARY CLARIFIER:

i) Equipment design

Detention time = 2 – 3 hrs

Mass flow rate = 271543.2 Kg/day

Volume Flow rate = 217.23 m^3 / day (assuming density = 1250 kg/m^3)

Detention time = Volume / Flow rate

Thus, Volume = 543.075 m^3 (assuming 2.5 hrs as detention time)

L/D = 2

L = 14.03 m

D = 7.01 m

Dimensions : 14.03 x 7.01 (LD)

ii) Material Balance

Assuming efficiency = 70 %

Therefore, activated sludge removal = 70 % of 5669.76

=3968.97 g/day

Remaining Tss = 1700 g/day

20 % return sludge = 1417 g/day

Remaining Tss = 283.79 g/day

Hence, **Water remaining = 271537.22 kg/day**

iii) Energy balances

Assume,

- Motor Rating (P_motor) = 5 kW(**Typically ranges from 5 to 20 kW for medium sized secondary clarifier)**
- Operational Time (t) = 24 hours/day
- P = P_motor * t

Also there is energy required for sludge recirculation

- Power required for sludge recirculation = 10kW(Typically ranges from 10 to 100kW)

E_Motor : 120 kWh / day
E_recirculation : 240 kWh / day
Total Energy required : 360 kWh / day

TERTIARY TREATMENT EQUIPMENT

EFFLUENT FILTER

- **Function:** Effluent filters capture solid particles from wastewater as it flows through.
- **Materials:** Typically constructed from plastic or stainless steel.
- **Design:** Features a fine mesh or screen that traps particles while allowing liquid to pass through.

Fig. 12 Effluent Filter

i) Material balances

EFFLUENT FILTER:

Assuming 90 % efficiency

Tss removal = 0.9 * 283.75
= 255.375 g/day

Tss remaining = 28 g/day

Water remaining= 271536 kg/day

TSS Removed: 0.255 Kg/day
Water Out : 271536 kg/day

ii) Energy balances

The energy consumption (P) can be estimated using the motor rating and operational time.

Additionally, some filter designs might use pressurized air for cleaning

Assume:

- Backwash motor rating (P_motor) = 0.5 kW
- Backwash operation time (t_backwash) = 1 hour/day
- Compressed air energy consumption (P_air) = 5 kWh/day (assumed value)
- P = P_motor * t_backwash + P_air

  = 0.5 kW * 1 h/day + 5 kWh/day

  = **5.5 kWh/day**

Total Energy Required: **5.5 kWh/day**

iii) Equipment design

Incoming mass flow rate to effluent filter = 271537.22 kg/day

Density of the liquid flowing inside the effluent filter = 1000 kg/m^3

Volumetric flow rate of the incoming liquid = 271537.22/1000
= 271.53722 m^3/day

Retention time in the effluent filter = 5 mins = 0.084 hrs

Volume of the effluent filter = Volumetric flow rate * Retention time

=271.53 * 0.084 / 24
= **9.504 m^3**

Required Volume of Effluent Filter : **9.504 m^3**

DISINFECTION EQUIPMENTS

UV DISINFECTION

A UV disinfection filter, in the context of wastewater treatment, is a technology that utilizes ultraviolet (UV) light to kill or deactivate pathogens and microorganisms present in wastewater.

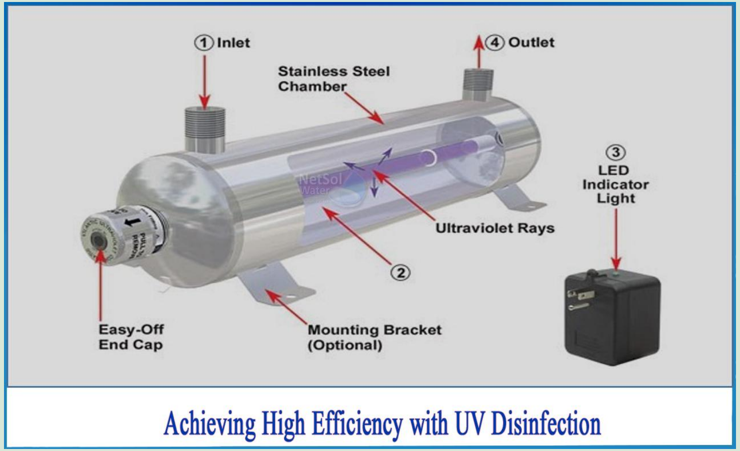


Fig. 13 UV Disinfection Equipment

UV DISINFECTION UNIT

Incoming mass flow rate to unit = 271536 kg/day => 271.536 m^3/day
Density of the liquid flowing inside the unit = 1000 kg/m^3

Volumetric flow rate of the incoming liquid = 271.536 m^3/day

Retention time in the unit = 15 secs
= 4.1×10^{-3} hrs(Typically between 5 to 30 s)

Volume = Volumetric flow rate * Detention time
= 271.536 * 4.1×10^{-3} / 24 = **4.6×10^{-2} m^3**

Energy Required : 100 - 250 kWh/MG
Let's take : 200 kWh/MG
1 million gallons = 3,785,411.78 cubic meters

Volume of UV Disinfection Unit: **4.6×10^{-2} m^3**
Energy Required : **0.014 kWh / day**

CHLORINATION

Chlorination in wastewater treatment involves the addition of chlorine or chlorine compounds to disinfect or treat wastewater. The process helps to kill or deactivate harmful microorganisms, such as bacteria and viruses, present in the wastewater.

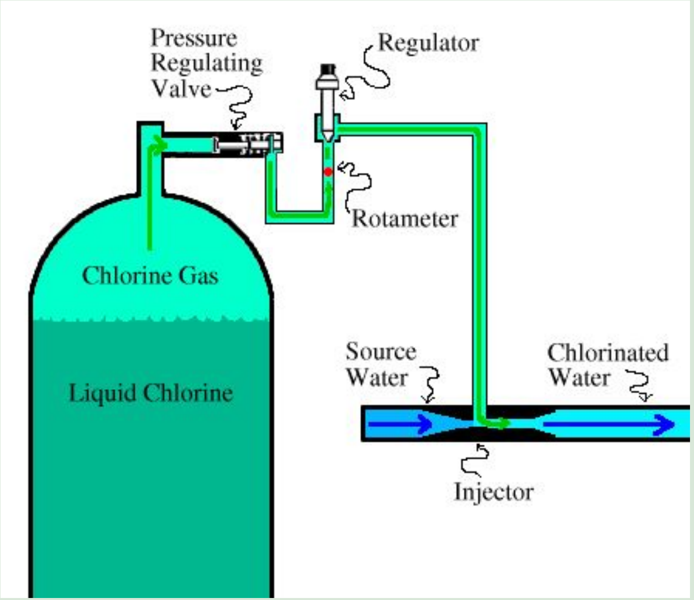


Fig. 14 Chlorination tank

i) MATERIAL BALANCE

Chlorination unit :

3 mg/liter of Cl_2 is used

To calculate Total chlorine demand:

For flow rate of water = 271536 kg/day

Density of water = 1 kg/liter

flow rate = 271.536 kL/day

Hence, Cl2 required = (271536*3)/100
= 814.608 g/day

Also, 0.005 – 0.014 kWh/ m^3
Energy is consumed during chlorination

Required Chlorine: 0.814 Kg/day

Energy required : 27.1536 kWh/day (assuming energy constant is 0.01 kWh/ m^3

iii) Equipment design

CHLORINATION UNIT

Incoming mass flow rate to Chlorination unit = 271536 kg/day
Density of the liquid flowing inside the Chlorination unit = 1000 kg/m^3

Volumetric flow rate of the incoming liquid = 271536/1000
= 271.536 m^3/day

Retention time = 1 hrs (Typically should be less than 2 hrs)

Volume of the Chlorination unit = Volumetric flow rate * Retention time
= 271.536 * 1 / 24
= **11.314 m^3**

Volume of the Chlorination unit = **11.314 m^3**

STORAGE PLANT

FOR CLEAN WATER

- The tank is often constructed from materials resistant to corrosion and leakage to ensure the quality of the stored water.
- It may include mechanisms for monitoring water levels, maintaining water quality, and facilitating distribution to the intended end-users

FOR GAS

- Common storage methods include gas holders, gasometers, or even underground storage tanks, depending on the volume of biogas generated and site-specific considerations.
- Biogas storage systems must be constructed with materials that are resistant to the corrosive nature of biogas and designed to withstand pressure fluctuations.

SLUDGE TREATMENT EQUIPMENTS

GRAVITY THICKENER

"Gravity thickening" in wastewater treatment refers to a process where sludge (a semi-solid material consisting of water and solid particles) settles and accumulates at the bottom of a tank due to gravity. This process is employed to separate solids from liquid in sewage sludge, making it easier and more cost-effective to handle and dispose of the waste.

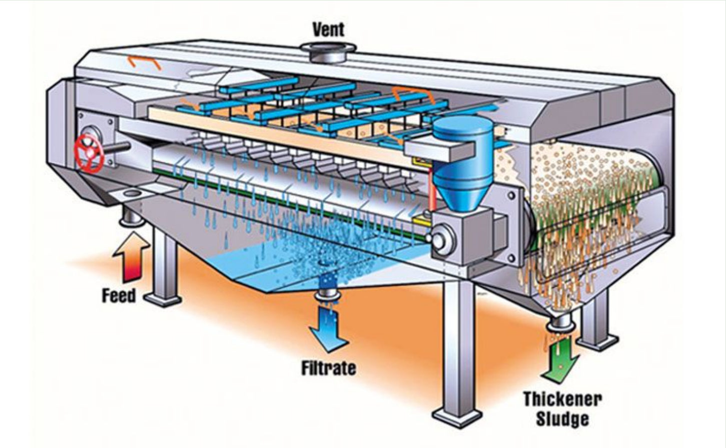


Fig. 15 Gravity Thickener

i) Material balances

SLUDGE TREATMENT PROCESS(BIOGAS PRODUCTION):

Total BOD removed from clarifier = 25384.44 g/day
Biogas yield coefficient = 0.35 L/g BOD removed
Total Biogas Production = 0.35*25384.44
= **8884.56 L/day (Biogas produced)**

GRAVITY THICKENER :

Assuming the current average solids concentration entering the gravity thickener is 75%, we calculate the initial solids flow rate as follows :

Total Dry Weight = Mass Flow Rate x Solids content
= (15.33 Kg/Day) x 0.75
= **11.4975 Kg/Day**
Solids Flow Rate = Total Dry Weight x Solids concentration
= 11.4975 Kg/Day) x 0.75
= **8.623 Kg / Day**

The solids concentration increases to 95%.

Concentrated Solids Flow Rate = Initial Solids Flow Rate ×(Increase in Concentration) / (1 – Increase in Concentration)

= 8.623 x (.95- .75)/(1-.2)

= **2.155 Kg / Day**

New Total Solids Flow Rate = (Concentrated Solids Flow Rate / Concentration Factor)

= 2.155 / 0.78

= **2.763 Kg / Day**

This means that the gravity thickener has successfully increased the solids concentration by a factor of 8.623/2.763= **3.12**

ii) Energy balances

Gravity Thickener: Increases the TS concentration from 2% to 6%. This reduces the volume of sludge requiring further treatment, saving energy downstream.

Anaerobic Digestion(Biogas Production):

Let's assume a conservative estimate of 0.5 m^3 biogas per kg TS fed to the digester.

Here, with 60% methane in Biogas:

Lower Heating Value (LHV) of biogas ≈ (0.6 * LHV of methane) + (0.4 * LHV of CO_2)

Assuming LHV of methane = 50 MJ/m^3 and LHV of CO_2 = 10 MJ/m^3,

LHV of biogas ≈ (0.6 * 50 MJ/m^3) + (0.4 * 10 MJ/m^3) = 32 MJ/m^3

Biogas Energy Output: Biogas production rate (0.5 m^3/kg TS) x LHV of biogas (32 MJ/m^3)

= 16 MJ / kg

Total energy = 16 MJ/kg * 8.8845*1000*0.278/1.158 = 34126.3 Wh/day

= **341.26 kWh / day**

Energy Requirement: **341.26 kWh / day**

CHEMICAL DOSING TANK

The selection and dosage of chemicals for sludge treatment depend on factors such as the characteristics of the sludge, the desired treatment objectives, regulatory requirements, and the specific processes employed in the wastewater treatment plant. Proper chemical treatment is essential to ensure the **effective and environmentally responsible management of sludge** generated during wastewater treatment.

ANAEROBIC DIGESTER

An anaerobic digester in wastewater treatment is a specialized system designed to break down organic matter in wastewater without the presence of oxygen. It's a biological process where microorganisms decompose organic materials, such as sewage sludge or industrial waste, producing biogas (a mixture of methane and carbon dioxide) and a nutrient-rich effluent.

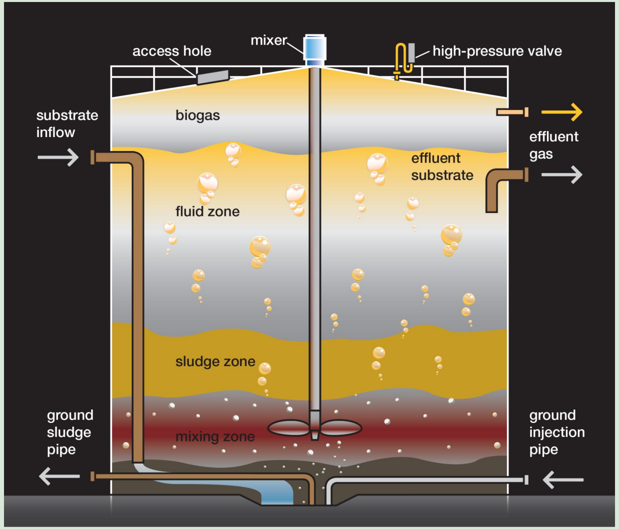


Fig. 16 Anaerobic Digester

Anaerobic digester:

Mass flow rate sludge in the digester= 1.804 kg/day

Sludge density = 1400 kg/m^3

Volumetric flow rate = 1.804 kg/day / 1400 kg/m^3
= 0.00128857 m^3/day

Detention time = 30 hours

Therefore, **Volume = 0.00161 m^3**

DEWATERING PRESS

The dewatering press typically consists of a series of rollers or plates that apply pressure to the sludge, squeezing out the water and leaving behind more solid material. This solid material can then be disposed of more easily, while the separated water can undergo further treatment or be discharged safely.

Fig.17 Dewatering press

Dewatering press:

- Mass flow rate of sludge entering the dewatering press = 1.8045 kg/day
- Solids content in the entry = 95%
- Solids content in the exit = 97%

Energy consumption for dewatering: 1.2 kWh/m3 of sludge **[0.3 to 2.1 kWh/m3]**

Water content in the entry = 100% – 95% = 5%

Water content in the exit = 100% – 97% = 3%

Change in water content: 5% – 3% = 2%

Mass of water removed = Change in water content x mass flow rate per day

Mass of water removed = 2% x 2.763 kg/day = **0.055 Kg/day**

Energy required for dewatering = Energy consumption x Mass of water removed

= (1.2 kWh/m3 x 0.055 Kg/day) / 1400 kg/m3

Energy required for dewatering = **0.00047 kWh/day**

[Average density of concentrated sludge is 1400 kg/m3]

DEWATERING PRESS:

- Mass flow rate of sludge entering = 1.8045 kg/day
- Solids content of sludge entering = 95%
- Mass flow rate of dewatered sludge leaving = 1000 kg/h
- Solids content of dewatered sludge leaving = 97%

Mass of Solids Entering = 1.8045 kg/day× 0.95 = **1.7142 kg/day**

Mass of Solids Leaving = 0.902 kg/day× 0.97 = **0.8749 kg/day**

Mass of Water Leaving = 0.9025 kg/day×0.03 = **0.0270 kg/day**

Solids concentration increase = (Solids content leaving – Solids content entering) / (Solids content entering)

= (0.97–0.95) / 0.95

= **2.105 %**

Solid Concentration increases by 2 %

SLUDGE CAKE PUMP

Sludge cake pump in wastewater treatment is a type of pump used to transfer or move sludge cake, which is the solid residue left after the treatment of wastewater. This pump is specifically designed to handle the **thick, viscous consistency of sludge cake**, which **can be challenging to transport due to its high solids content**.

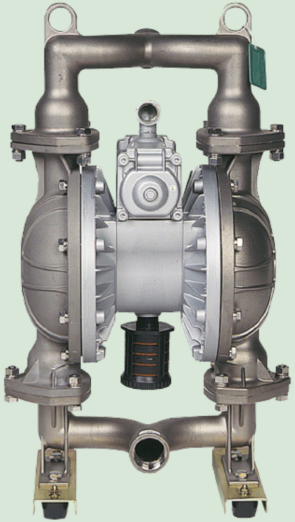


Fig. 18 Sludge Cake Pump

Sludge cake pump:

Diaphragm are capable of handling thick, viscous fluids like sludge cake.

Assumption: Sludge cake density: 1500 kg/m^3 (typical for dewatered sludge cakes)

Cake flow rate: 10 m^3/hr, Pumping distance: 50 meters, Pipe diameter: 0.2 meters

Energy Consumption Calculation:

Mass flow rate ($\dot{m}$) = Density (ρ) * Volume flow rate (Q)

$\dot{m}$ = 1500 kg/m^3 * 10 m^3/hr = 10,000 kg/hr

Head pressure: Assume a head pressure of 10 meters due to friction (ignoring elevation for simplicity).

Pump power (P) depends on the mass flow rate, head pressure, and pump efficiency (η). A typical pump efficiency for this application might be around 60%.

$P = (\dot{m} * g * h) / (\eta) = (10{,}000\ kg/hr * 9.81\ m/s^2 * 10\ m) / (0.6) \approx 1.64\ kW\ /hour$

Energy Requirement = 1.64 kW/hour * 24 hrs = **39.36 kWh / day**

COSTING OF EQUIPMENTS

UV Disinfection Unit price – Rs. 1,00,000[Reference]

The cost of a coarse mechanical bar screen for 12.5m3/hr flow rate is available on IndiaMART for ₹200,000.00 (approximately $2,700 USD) [Reference]

Cost of Grit Chamber – ₹ 3,00,000/ Unit [Reference]

Cost of primary clarifier – ₹ 10,00,000/ Unit [Reference]

Cost of grease trap – ₹ 16,200/ Unit [Reference]

Cost of primary clarifier – ₹ 10,00,000/ Unit [Reference]

Cost of Effluent Treatment Filter Press – ₹ 20,000/ Unit [Reference]

Cost of uv disinfection chamber – ₹ 1,77,000/ Unit [Reference]

Cost of Rev-phc Ph Correction Formulation For Anaerobic Digesters Powder Grade-₹ 42,000/ 5 kg [Reference]

Cost of self cleaning dewatering screw press – ₹ 1,00,000/ Unit [Reference]

Cost of diaphragm pump – ₹ 1,00,000/ Unit [Reference]

Cost of sludge drying beds – ₹ 4,66000/ Unit [Reference]

Cost of air diffuser for aeration process – ₹ 1000/ Unit [Reference]

Total capital cost = ₹ 34,32,200

Total Energy required / day = 1349.99 kWh
Cost of 1 kWh in India = ₹ 7.05
Total cost for Energy per day =**₹ 9518 (approx)**

Biogas production = 8.845 KLD = 10.17 m^3 / day

Price of Biogas = ₹ 70

Thus, income from Biogas per day = **₹ 712**

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Thank you !