In House Greywater Treatment

Group #60 Coach: Dr. Hammad Khalid
Abdulrahman Alghamdi - 201630560 – CE, Amjad Alsadiq - 201866080 - CHE
Moath Mahroos - 201821540- CHE, Nasser Almarhoon - 201857800- ISE, Ahmed Saif - 201822980 - ISE

Introduction and Background

Problem Statement: Design a suitable filtration system using greywater from the house's wastewater to filter, treat, and reuse it for irrigation, and agriculture.

Elevator Pitch: The proof of concept of our project, using household greywater for irrigation and agriculture purposes, directly supports the "Saudi Green Initiative" of Saudi Arabia's Vision 2030, promoting sustainable water resource management, and environmental progress, and contributing to the reduction of homeowners' water bills

Greywater Characteristics:

- Contents: Soap, detergents, occasional food particles.
- Pathogens: Few, but some bacteria possible.
- Nutrients: Contains phosphorus, and nitrogen for plant growth.
- Treatment: Suitable for non-drinking purposes after treatment.
- Sources: Sinks, showers, washing machines, etc.
- Appearance: Greyish color, typically odorless.

Constraints:

1. Nature of grey water from source to others
2. Governmental policies and regulations
3. Infrastructure limitations
4. Budget
5. Adoption time

Targeted Specifications for Greywater (Irrigation Uses):

Parameter	Unit	Target
PH		6 – 8.4
Total Suspended Solids (TSS)	mg/L	<= 10
Chemical Oxygen Demand (COD)	mg/L	<= 50
Biological Oxygen Demand (BOD)	mg/L	<= 10
Turbidity	NTU	< 5

Testing

Proof that specifications were met:

Parameter	Testing		Meet Specifications
	Before	After	
PH	8.05	6.9	✓
Total Suspended Solids (TSS)	13.8	8.4	✓
Chemical Oxygen Demand (COD)	280	167	-
Biological Oxygen Demand (BOD)	91.5	54	-
Turbidity	69.3	3.8	✓

Calculations

Greywater Production:

Average consumption per person = about 503.38 L/ Day

The share of grey water = 65%

Total Greywater consumption for a family of 5 persons

= 5 x 503.38 x 0.65= 1635.95 L/Day

Design of Coagulation Unit (After Rapid Mixing):

Detention time 40 minutes

Volume = (2000 L/24x60 min) x40 minutes = 55. 5 L taken as 60 L

Design of Settling Tank:

Detention Time required for the settling tank= 6H

Flow Rate = Volume of the Coagulation tank/ Retention time

Volume of the settling tank = (2000 L/ 24 hr) x4 hr= 333.33 L

Design of Coagulation Tank :

Rapid Mixing Unit:

Flat bladed Mixture Recommended G Value (Velocity gradient) = 300 S-1

$G2 = P/\mu V$

Where P: Power (W) / μ: Dynamic viscosity (Table 1) / V= Volume / G=Velocity Gradient

By taking the Volume of the Mixing tank as V= 250 L

Design of Alum/PAC Dosing System:

Using the Equation C1V1=C2V2

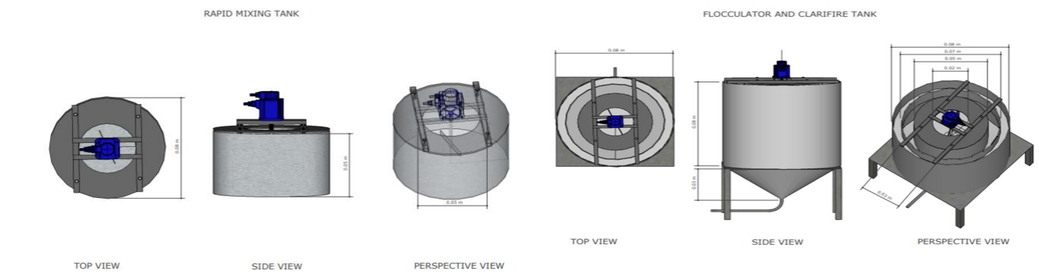
For dosing 1 mg/L, require dosing rate V1, 1000xV1=2000(L/day)x1

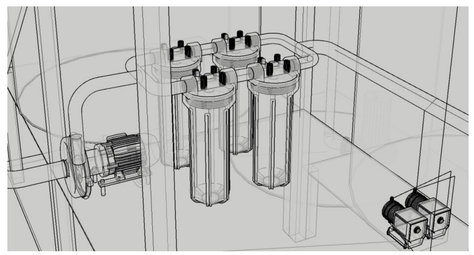
V1=2L/day= (2,000ml/24 hr)=83 ml/hr

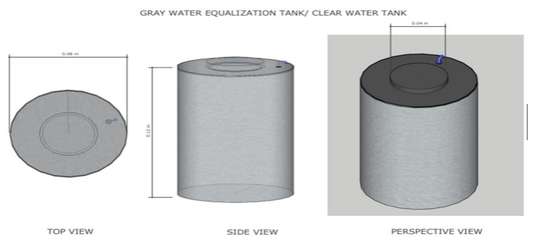
For dosing 100 mg/L, require dosing rate V1', 1000xV1'=2000(L/day)x100

V1'=20L/day= (20,000ml/24 hr)=833 ml/hr

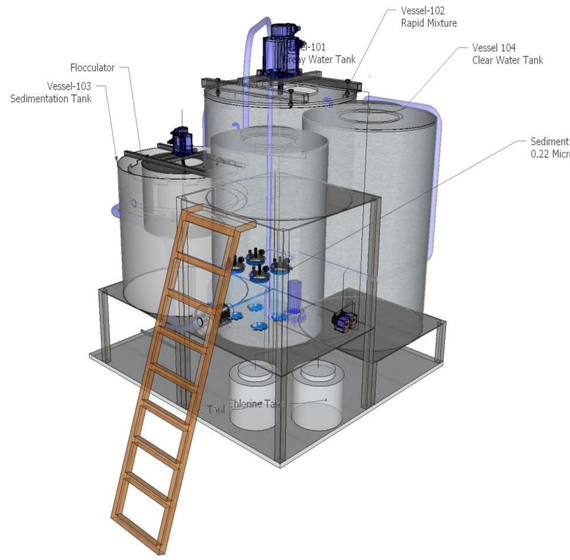
Design and Prototype







3D Model



Conclusion

In conclusion, our senior design project has mainly discussed the importance of greywater treatment for irrigation especially in houses, and illustrated how other exterior factors might affect the treatment process. However, our filtration system has not only a beneficial for environmental aspect, but it also has excellent impact on cost saving and encouraging the management of water resources sustainably.