

RESEARCH ARTICLE

TREATMENT PLANT FOR DOMESTIC EFFLUENT DISCHARGE – (HOUSING AREA)

H. Mohammed Ali, K.C. Udaiyakumar

Department of Mechanical Engineering, SRM Institute of Science and Technology, Ramapuram Chennai, Tamil Nadu, India.

*Corresponding Author Email: mohammeh@srmist.edu.in, kuppusac@srmist.edu.in

This is an open access article distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ARTICLE DETAILS

Article History:

Received 04 August 2021
Accepted 06 September 2021
Available online 10 September 2021

ABSTRACT

People in developing nations, like INDIA, INDONESIA, MALAYSIA, BANGLADESH, SRILANKA, AFRICA, THAILAND and Developing Countries etc., face a great deal of issues as far as sewage the executives. This is on the grounds that sanitation arrangement is horribly insufficient. A great many people don't approach clean toilets, and a lot of fecal waste are released to the earth without satisfactory treatment. In perspective on this, an investigation was done with the point of surveying information, practices, observations, and encounters of family unit on sanitation and sewage the executives in Chennai. The aim of this project is to treat the waste water and reuse the waste water for domestic purpose such as flushing and gardening with minimum cost. The family unit overview results demonstrate that the sewage system stays immature, and there is no reasonable vision to improve the framework created in the family unit isn't re- utilized, it is for the most part discharged outside. In the tempest water seepage framework legitimately. Sewage treatment from the treatment plants is depleted into surface water bodies, for example, waterways and the sea.

KEYWORDS

Sewage system, toilet, flushing, gardening, MDH – Multi Grade Filter, sewage treatment.

1. INTRODUCTION

The Sewage water is a term that contain, household wastage from kitchen, bathroom, washing and faces. This discharge contains, it is over 99% fluid waste also 1% strong waste is described by the amount or the flow of the stream. This comparing generally of dark water, dark water, cleansers, cleansers and bathroom tissue and furthermore had ground spill over relies up to that sewer system (Sarahnya and Shathakumar, 2020). It is created by own; foundations, work and latest footing Sewage is composed of many materials that are broke down to the three normal areas. These territories and the physically, synthetic, and organic qualities of wastewater They are temperature, shading, smell, and solids. The significant point is to reuse the wastewater to such an extent the wastewater is get isolated from the conceivable remainder of the liquid returned to spouting is discharged to nature. The condition made the compound are sulfur (s), Co₂, N₂, H₂ and P₄. Untested animal wastewater had a assortment of pathogenic living things, they are join, defilements, microorganisms, eggs, and protozoa that helminthes are disorder causing living animals. The closeness of this earth causes various sort of sicknesses.

They are given below:

- Faeces – normal moving courses by that pathogens at waste accomplish the week by nether arm, pieces of clothing substance, etc.
- Insect-vector borne which the pathogen is spreading by bugs that gives or breed in wastewater for instance mosquito's and flies.
- Sand – related that they released animals and human being is passing with the help of soil.
- Water borne that pathogen are accessible in water supplies.

2. OBJECTIVE

- An effective treatment process cost effective and suitable for the housing society.
- The water can be reused for horticulture.
- There are bundle of significant side interests why keeping our water clean is a fundamental need.
- The imperative inspiration driving wastewater treatment is to be empty regardless unprecedented bit of the suspended solids as could sensibly be run of the mill before the remainder of the water returned to overflowing is discharged to nature.
- As solids materials decays, it experiences O₂, that is required to the living things and plants in earth.
- Treatment and safe trade of wastewater is basic and this will enable security of condition and natural protection. Our fundamental point is to re-utilize the sewage water for flushing and creating.

3. RESULTS AND DISCUSSION

The research was conducted in Chennai. It is located in the sample was conducted from the apartment for research contain four houses in a compound. The details of the members, water used in bathroom and kitchens were noted.

Quick Response Code



Access this article online

Website:
www.enggheritage.com

DOI:
10.26480/gwk.02.2021.45.48

Table 1: Sample Collected in Litres			
S.no	Number of family members	Water used in bathroom (in Litre)	Water used in kitchen and other appliance (Litre)
1.	1 Member	30	20
2.	2 Member	70	35
3.	3 Member	100	45
4.	4 Member	150	60

4. THEORY AND OPERATION

Growing minimal effort innovation to sewage testing offers the option then observed progressively viable for treatment of household sewage water. In fact, due to the straight forwardness of waste adjustment lakes even rich countries, which can bear the cost of the advantage of costly wastewater treatment, are intending to utilize increasingly more minimal effort treatment innovation (Thunnissen et al., 2021). Prior to the twentieth century, sewers generally released into waterway, lakes, cove, or ocean. Sewage treatment results under way of sewage ooze which requires sewage treatment before safe transfer or reuse. The sewage water management is classified into four types:

- Sewage accumulation,
- Sewage treatment,
- Tested sewage transfer,
- Executive of sludge.

5. WORKING

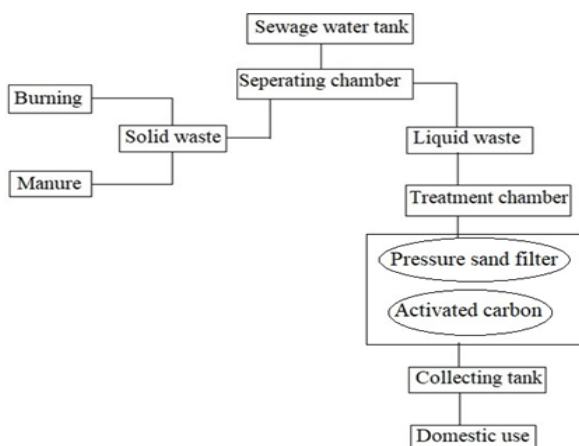


Figure 2: Sewage Treatment Flow Chart

In our home and apartments wastewater will be collected in the septic tank or it will be drained into drainage. In our project we are collecting wastewater from the sewage and treating it. At first the solid and liquid are separated in the separating chamber. In separating chamber there are three layer of sieve attached which consist of different holes with three different type of diameter. The solid is collected in a separate chamber, it can be used as manure.

4.1 Block diagram

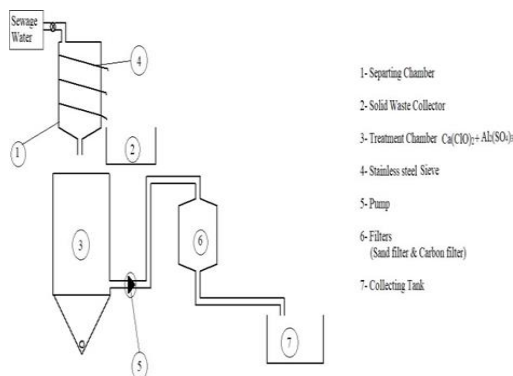


Figure 3: Treatment Flow Process Diagram

Then the separated liquid is collected in the treatment chamber where the chemical is added and the settlement process is carried out, Ca(ClO)₂ and Al₂(SO₄)₃ are the two types of chemicals which is added by 12v dc pump motor, when the settlement process is completed the deposited particle and bottom layer of water is removed through the separating valve (Varjani et al., 2020). Then the treated water is passed into the pump which will pressurize the water which will flow through the filter, then the treated water is collected in the collecting tank.

6. CONSTRUCTION

6.1 Separating chamber

Separating chamber is a type of chamber in which the solids and liquids get separated. The separating chamber consists of three layer of stainless steel sieve with different diameters. At the bottom of the chambers the outlet pipe has been attached. The dimensions are given below.

6.2 Stainless steel sieve

Three different layers of stainless-steel sieve has been fitted inside the separating chamber. Each stainless-steel sieve has holes of different diameter. The dimensions are given below.

Table 3: Dimensions of the Sieve	
Number of plates	3 nos.
Length (L)	370mm
Breadth (B)	300mm
Thickness (T)	1mm
1 st plate hole diameter	7mm
2 nd plate hole diameter	3mm
3 rd plate hole diameter	2mm

6.3 Solid waste collecting tank

It is used to collect the sewage waste, which get separated from the water in the separating chamber. The dimensions are given below.

Table 4: Dimention of Solid Waste Collecting Tank	
Length (L)	150mm
Breadth (B)	300mm
Height (H)	150mm
Volume (V)	6750000mm ³

6.4 Treatment chamber

The liquid which get separated in the separating chamber is got collected in this chamber. When the water is collected to the desired level the sensor will be indicated and the chemicals will be automatically added to the chamber. It consists of two outlets one is for sludge and another outlet connected to the pump both outlet pipe diameter is 12.7 mm.

It consists of two parts cuboid and prism cuboid dimension:

Thickness of the metal= 3 mm Length (L) = 500 mm

Breath (B) = 300mm Height (H) = 350mm

Volume of cuboid (V1) = L*B*H = 52500000 mm³ Prism dimension:

Thickness of the metal= 3 mm Base (B) = 300 mm

Length (l) = 500 mm Height (h) = 150 mm

Volume of prism (triangle) (v2) = 1/2 B * l * h = 11250000 mm³

Total volume = V1 + V2

52500000 + 11250000

63750000 mm³

Litres capacity = 63. 75 litre

6.5 Pressure sand filter

Filter consists of different layers such as, pebbles, MnO₂, green sand, fine sand and activated carbon. We have designed the filter in a different way so that backwash is also possible. The filter body is in cylindrical shape made of plastic material, the capacity of filter is about **9.62 liters**. Inlet of the filter is connected with pump and outlet is open for collecting the filtered water. The different filter medias are given below.

Table 5: Dimension of Filters			
Filter Medium	Depth, mm	Range, mm	Mass, gms.
Pebbles	50 mm	9 - 6	780
MnO ₂	40 mm	12 - 7	684
Green sand	40 mm	3.5 - 1	432
Fine sand	40 mm	2 - 0.5	407
Activated carbon	150 mm	7 - 3	597

7. AERATION

Aeration is otherwise called air flow or air circulation. Aeration is a strategy in which water and bubbles will get connecting to clear separated gas, (for instance, CO₂) and O₂ broke down materials, for instance, iron, H₂, (SO₄)₂, then flighty normal manufactured substances (VOCs). In treatment plant air course is the principle genuine methodology. In the midst of air flow, constantly is cleaning or balanced. The fluid & bubbles obtained nearly connected through revealing slight papers for fluid to bubble through exhibiting little ascents for bubbles (the more diminutive to air take, the good) also enabling to move by liquid. Cleaning framework acknowledged through agitating impact for wind current mechanically expels isolated gas for strategy also enables them to wrapping air.

7.1 Chemicals removed or oxidized by aeration

- Volatile natural synthetic compounds, for example, (found in gas), or benzene, dichloroethylene, trichloroethylene, and perchloroethylene (utilized in dry-removing the waste or mechanical procedures)
- Methane
- Hydrogen Sulphide
- Carbon dioxide
- Iron and Manganese
- Chlorine
- Ammonia

8. DOSING SYSTEM

The majority of Partech's concoction dosing frameworks pursue a similar fundamental example despite the fact that altogether different. Every framework has two concoction segregated to take into account upkeep. Concoction goes progression of segregation valves to the inline channels. These channels expel trash from the synthetic, which can diminish the pumping effectiveness, or square pump. These channels need customary widely recognized reason for issues inside the dosing framework. In the event that they become hindered the pump can't convey the required portion rate. It is fitting to clean the two channels preceding aligning a pump. When the concoction has experienced the channels it goes to one of two dosing pump (obligation/backup) for each dosing point.

8.1 Hardware requirement

The following hardware are required to set of the Dosing system are given below:

- 12volt Dc sump pump
- Arduino
- IR module
- Jump wires.

8.2 Chemicals used for treatment calcium hypochlorite Ca(ClO)₂

As a pool concoction, it is mixed with different synthetic compounds less frequently than different types of chlorine, because of perilous responses with some normal pool synthetic substances. In arrangement, calcium hypochlorite could be utilized as a universally useful sanitizer, however because of calcium build-up.



Figure 4: Structure of Calcium Hypochrite

8.3 Aluminium sulphate Al₂(SO₄)₃

Anhydrous aluminum sulfate is a white crystalline strong. Aluminum sulfate is additionally gotten as a 18- hydrate Al₂(SO₄)₃.18H₂O. The two structures are dissolvable in water, non-flammable, and nontoxic. The basic hazard is the peril to the earth. Brief advances should be taken to bind its spread to the earth.

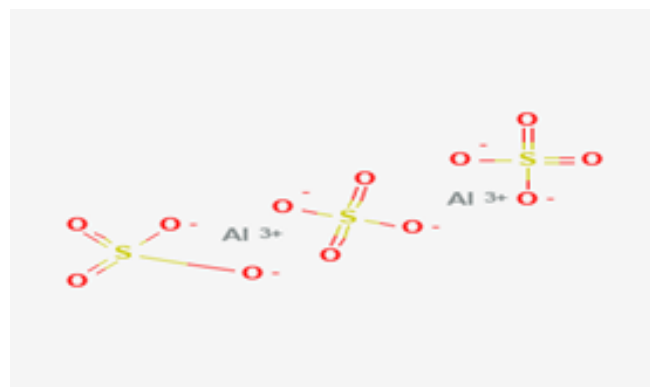


Figure 3: Structure of Aluminium Sulphate

9. AGITATOR

The agitator is fitted on top of the treatment chamber with the help of flat bar which is welded on treatment chamber. The fomentation is practiced by improvement of the heterogeneous mass (liquid solid stage), to the impeller. This is a direct result of mechanical instigators, to the upheaval of an impeller. The mass can be made out purpose errand developed to profitability of a reaction by a prevalent contact between responsive item. This method our fomenters can be utilized without trouble in a wide range of tank geometries. Modern fomenters are machines utilized in enterprises that procedure items in the compound, sustenance, pharmaceutical and corrective businesses, in a perspective on:

- The liquids are mixed together and
- Very useful for Increasing the chemical reaction

10. FILTER

A channel empties contaminating impacts corrupting physically block, manufactured system, characteristic methodology. Layer shapes are dynamically used for removal of organisms, microorganisms, particulates, to water and react with disinfectants to structure cleaning by things. As progressions are made in layer creation and module plan, capital and working costs keep on declining.

10.1 Pressure sand filter

The Pressure Sand Filter is utilized for expulsion of suspended solids and turbidity from Water and Wastewater. We, offer Series of channels

effortlessly, solid and effective approach to channel your water. Pressure Sand Filters are comprising of a numerous layer of sand within an assortment in measurement and explicit gravity. These Filters are hand created to suit the methodology essential. Fouling potential, These Filters are proposed to empty turbidity and suspended particles present in the feed water with least weight drop. These diverts are offered in Mild Steel of plastic improvement with face channeling and related Valves. Unrefined water spills towards down flow through the channel bed and as the suspended solid issue, which is treated by extension of a coagulant like alum or poly electrolyte, is hung on the soil surface and in-between the soil grains rapidly underneath the surface. There is immovable climb in the little of head over some stretch of time and the stream lessens once the weight drop over the channel is superfluous.

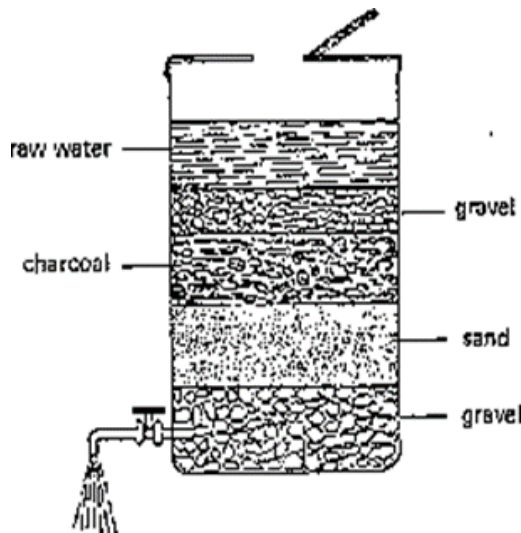


Figure 5: Channel Bed for Water Flow

10.2 Backwash

The discharge procedure is intended to expel contaminants collected on the layer. Every layer unit is discharged independently and in an amazed example to limit the quantity of units in concurrent discharge at some random time. Amid discharge, the bearing of stream is switch for 30 seconds to 3 minutes. The power and course of the stream remove the contaminants at the film surface and wash collected solids out through the release line. Layer filtration frameworks are 15 to an hour between discharge occasions. The discharge procedure diminishes framework profitability 5 to 10 percent because of the volume of filtrate utilized amid discharge.

10.3 Filter medium

Filter consists of different medium such as, pebbles, Mno₂, green sand, fine sand and activated carbon. All these five media will filled inside the cylindrical shape of filter. We have designed the filter in a different way so that back wash is also possible.

11. CONCLUSION

From the analysis in the previous segments, it has been demonstrated that Chennai is on the course of accomplishing the MDG (Multi Grade Filter) focus in supportable access to an improved water source by the end of 2022. Be that as it may, the water supply area in Chennai faces a few issues and difficulties, including lacking offices, poor utilization of existing limit, low efficiency in the part, and powerless inward administration of the framework, among others. On the sanitation side, numerous open restrooms in Chennai, in spite of the fact that restored, stay shut as a result of poor administration and waste issues. Not all family units in Chennai are associated with the sewage framework, and therefore, dim water is by and large discharged outside the family unit, on the ground, or in the tempest water waste framework straightforwardly. Chennai occupants have appeared squander the board is most essential to their families. In any case, most of the families are not happy with the wastewater the board administration conveyance by the specialists and that the ebb and flow state influences the private part in that the city ends up grimy and there is in every case awful stench from the ocean water. In any case, it ought to dependably be remembered that tapping outside sources as a rule implies financing for a restricted timeframe and as indicated by the guidelines of an outer association.

REFERENCES

- Saranya, D., Shanthakumar, S., 2020. An integrated approach for tannery effluent treatment with ozonation and phycoremediation: A feasibility study. Environmental Research publication by Elsevier, Vol-183, Pp:16. doi:10.1016/j.envres.2020.109163.
- Thunnissen, N.W., Van de Meent, D., Struijs, J., Hjort, M., 2021. Simulating behavior of petroleum compounds during refinery effluent treatment using the Simple Treat model. Chemosphere publication by Elsevier, 263, Pp. 8.
- Varjani, S., Rakholiya, P., Shindhal, T., Shah, A.V., 2020. Trends in dye industry effluent treatment and recovery of value added products" Journal of Water Process Engineering publication by Elsevier , Pp:11, doi:10.1016/j.jwpe.2020.101734.

