International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

# WASTE WATER TREATMENT BY USING INNOVATIVE FILTRATION TECHNIQUE

**A.R.Kothale[1], Abhishek.Y.koli[2], Atharv.B.Tashildar[3], Rohit.P.Jadhav[4], Pranav.D.Belkude[5]**

*[1]Assistant professor, Dept. of Civil Engineering, DBATU University, Maharashtra, India*
*[2,3,4,5]UG Student Dept. of Civil Engineering, DBATU University, Maharashtra, India*

---

**Abstract –** *water is life to us and all living organism and this water is polluting and scarcity of water is increasing due to large amount of unnecessary use of water. Also the increase of the rate of building construction besides increasing also construction waste so that need of best solution on the treat of waste water and reuse of construction waste. Especially in rural area no awareness about water and effluent water directly discharged into water bodies, due to improper system disturbed our ecosystem. Solution in that problem we design a filter media and utilized construction waste as an ingredient of filter media. So we used Aerobic Brickbat Gravel Sand filter (ABGS) filtration technique and we designed 3 units. After the passing of waste water we seen very excellent results. And the treatment of waste water reuse the treated water for different purposes like horticulture, toilet flushing, car wash, and floor wash etc. also used in construction site for as a curing purpose. In case of grey water the performance of filtration showed overall efficiency are : Biochemical Oxygen Demand ( BOD ) - 74.89 %, Chemical Oxygen Demand ( COD ) - 81.85 % , Total Dissolved Solids ( TDS ) - 100% , Hardness - 25.13% , Permanent hardness - 47.22% .And increase the DO and Ph value.*

***Key Words***: **Grey water, Reuse construction waste, under gravity Zig-zag flow, Eco-friendly, BOD, COD, DO, TDS.**

## 1. INTRODUCTION

Waste water treatment is an essential process to protect our Biodiversity. Water is becoming limited resource in the world. Water shortage and treatment of sewage is become a worrying issue in India. Increasing population and development growth results in producing large amount of wastewater. Which destroying environment and economic problems in the world. More than 70% of our fresh water sources are polluted. Groundwater table goes lower fastly and the population facing the problem of water. So to save water and to increase water table and to produce awareness about wastage of water the government and different NGO'S are working on it. Proper treatment of wastewater is in need of our country. Wastewater treatment management has significant importance with growing population. Wastewaters treatment is opportunity to treat the water and reuse it to avoid problem of water. The wastewater treatment plants are useful for the country. The wastewater which is treated is useful for many works of government or houses. In future the world will face lot of water scarcity if we can't avoid the unnecessary usage of water and treatment of waste water and reuse it instead of wasting the water. So that it is very essential to treat the waste water and reuse it for different purposes.

Also the world is growing fastly and the population is increasing. Due to increasing population the demand of building construction is increasing. So that the construction industry is increasing fastly resulting a large amount of construction waste is producing such as demolished buildings waste, and demolition materials mostly used as a land filling. So to reduce this waste and to reuse it, we used this constructional waste materials in our experimental model as a filter media. So we can treat the waste water from construction waste and also we can reduce the building construction waste and Reuse the treated water.

### 1.1 Filtration technique

Filtration is a process for removing pollutants from waste water by passing through the filter media. The present experimental setup is based on filtration technique of horizontal roughing filter. Horizontal roughing filters have a large silt storage capacity. It is very useful method to treat waste water which is useful for different purposes. Roughing filter is efficiently removes small suspended particles without forming any chemical reaction and thus it does not form any harmful byproduct. The working model consists four stages that is first settling tank, unit-1, unit-2, and unit-3 and collection tank. Consisting of three units with baffle wall in zig-zag manner each unit. The baffle wall is placed to the travelling time of influent water so that time of contact increased. Filter media consists different constructional waste materials are used such as broken brick bat, broken AAC block pieces, waste course aggregates, ceramic crush, pebbles, hardcoke, coal and cinder aggregates ( industrial waste ) these are easily locally available materials. Unit-1 contains brickbat and pebbles placed such that brick bat are placed starting half portion and pebbles are placed remaining half portion. Unit-2 contains pieces AAC blocks and course aggregate placed same as first unit. The third unit contains ceramic crush, coal, hardcoke and cinder aggregate and the flow is up flow-down flow manner and the media is placed coal, hardcoke and cinder aggregate is placed at the

top and ceramic crush is placed as bottom. In this filter media a large space for filtration is provide for sedimentation, adsorption, and biological process takes place smoothly which results excellent purification of waste water and improves quality of treated water.

**Fig -1**: Experimental setup

### 1.2 Design Experimental model

The dimensions of experimental setup of Aerobic Brickbat Gravel Sand filtration (ABGS) with length 0.50m, breadth as 0.40m and height 0.25m was constructed with consideration of detention time of 4 hours. All this three units have provided an inlet and outlet at adequate level. The model is designed for flow of 25 to 30 liters per hour. The treatment unit is divided in 3 units to provide sufficient time to pass the water and to improve quality of water.

## 2 MATERIALS AND METHODOLOGY

The material which is used for filter were washed in clean water and soaked for 24 hours, and then the material is placed as the coarser particle at beginning and finer particle at end.

**Fig -2**: Material media

### 2.1 Materials

The present study has three units and material media has sieving properly as per standard size then it is use. The first unit consisting brickbat (50 to 90 mm) size, Pebbles (50-65 mm) size with brickbat in first two and half compartment and pebbles at next two and half compartment hence there is 5 compartment is 1st unit. The second unit consist of pieces of AAC blocks (30-40 mm) placed in first two and half compartments and aggregates of (20-25 mm) in last two and half compartments. The third unit consist of ceramic crush at bottom and coal, hardcoke and cinder aggregate at top.

### 2.2 Methodology

The waste water (grey water) is collected from source in SIT college campus, an approximate 50 lit of grey water sample was collected on the day of the experimental run. After the grey water was collected it was directly kept to a settling tank/storing tank for Proper mixing and settled suspended solid parts. Then the sample of influent was collected asides for its testing of physiochemical properties, the tests like BOD, COD, DO, Hardness, TDS, and pH are taken on sample. Meanwhile the influent sample was set for testing of pH, DO, BOD, COD, TDS, and Hardness etc. Then the sample was slowly discharged through unit-1 under gravity zig-zag flow and checking different parameters and then same procedure carried out for second and third units and each unit took 2 to 3 hours of retention time, and accumulate the water some hours. Then it is ready to use some purposes, after the completion of treatment Process treat water collected in collection tank. Treated water can be used as per our need for some different purposes like horticulture, car wash, floor wash, toilet flushing, curing etc. After the experimental run the entire model was cleaned and washed with clean water. The material media were saturated with clean water for about 24 hrs.


**Fig -3**: Top view of filtration units

## 3 RESULTS

A total of seven important parameters which define the wastewater characteristics were tested at the three different units in the experimental setup. Overall efficiency of all parameters are excellent.

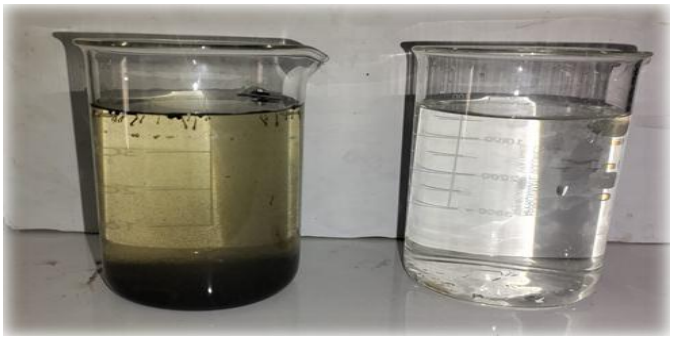

**Fig -4**: Untreated to Treated greywater

All the results from each unit is computed in following table.

| GREY WATER PARAMETER | INFLUENT | UNIT 1 | UNIT 2 | UNIT 3 |
|---|---|---|---|---|
| PH | 7.7 | 7.8 | 7.8 | 7.9 |
| BOD (mg/l) | 281.7 | 246.5 | 105 | 70.43 |
| COD (mg/l) | 735 | 400 | 266.66 | 133.33 |
| DO (mg/l) | 0 | 5 | 5.3 | 5.8 |
| TDS (mg/l) | 800 | 600 | 200 | 0 |
| HARDNESS (mg/l) | 374 | 332 | 298 | 280 |
| PERMANENT HARDNESS (mg/l) | 360 | 310 | 294 | 190 |

**Fig -5**: Influent (left) and effluent from the three units in series for greywater

## 4. ANALYSIS

Analysis of the removal of wastewater contamination parameters from inlet to outlet was done from each of its treatment unit.

**PH -**

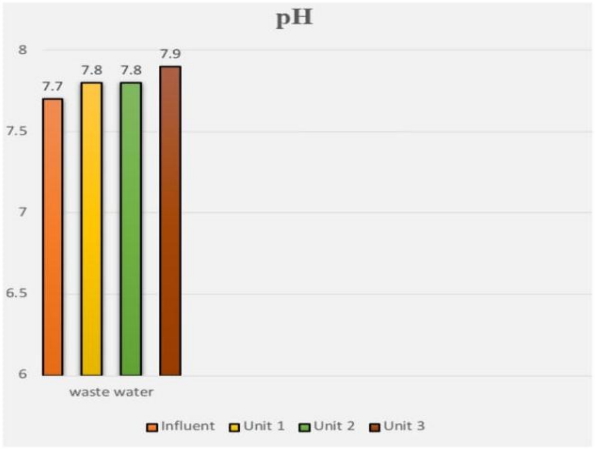


**Chart -1**: Analysis of PH

Above graphical representation chart 1 shows the PH values. In case of greywater the steady increasing trend was observed with 7.7 as PH value of influent to 7.9 as value of effluent.

**Dissolved Oxygen (DO) -**

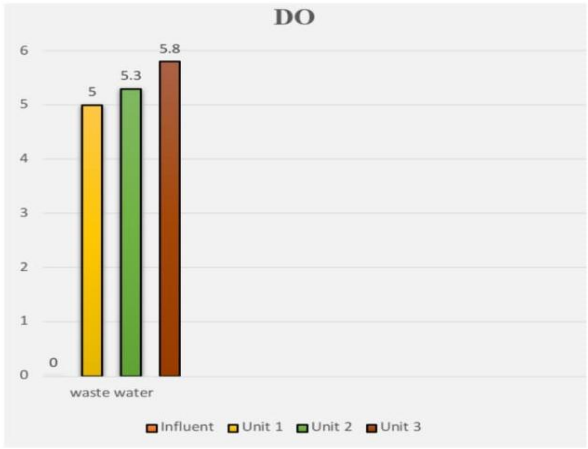


**Chart -2**: Analysis of DO

Above graphical representation chart 2 shows the DO values. It can be clearly seen that the dissolved oxygen level has been increased. It was observed that the unit first that is (brickbat and pebble filter purifier) contributed to an increase 0 to 5, and overall 0 DO value of influent to 5.8 as value of effluent.

**Biochemical Oxygen Demand (BOD)-**

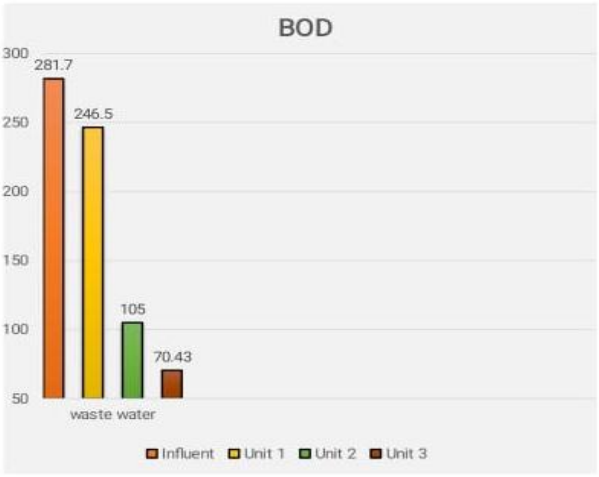


**Chart -3**: Analysis of BOD

Above graphical representation chart 3 shows the BOD test results. The BOD was determined by performing standard 3-days BOD tests on the samples. It can be clearly seen that the BOD value showed decreasing trend from unit first to unit third. The BOD value of influent is 281.7 to 70.73 as value of effluent, and overall efficiency was 74.89%.

**Chemical Oxygen Demand (COD) -**

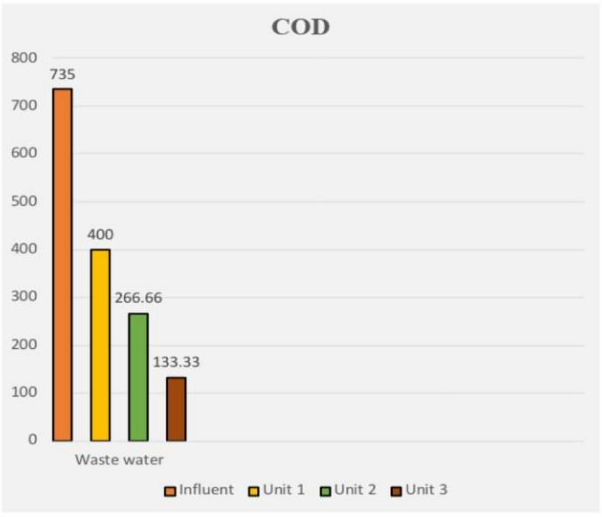


**Chart -4**: Analysis of COD

Above graphical representation chart 4 shows the COD test results and its variation from various treatment units is shown in above graph. It can be clearly seen that COD values decreased from unit one to unit third. The COD value of influent is 735 to 133.33 as value of effluent, and overall efficiency was 81.85%.

**Hardness -**

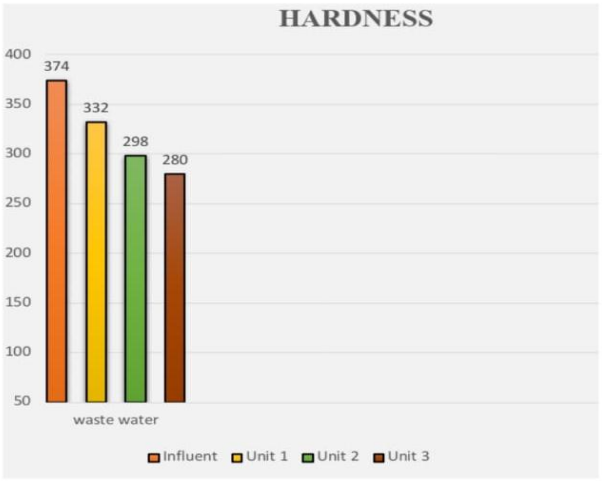


**Chart -5**: Analysis of HARDNESS

Above graphical representation chart 5 shows the Hardness test results. The hardness values was decreased from first unit to third unit. The hardness value of influent is 374 to 280 as value of effluent, and overall efficiency was 25.13%.

**Permanent Hardness -**

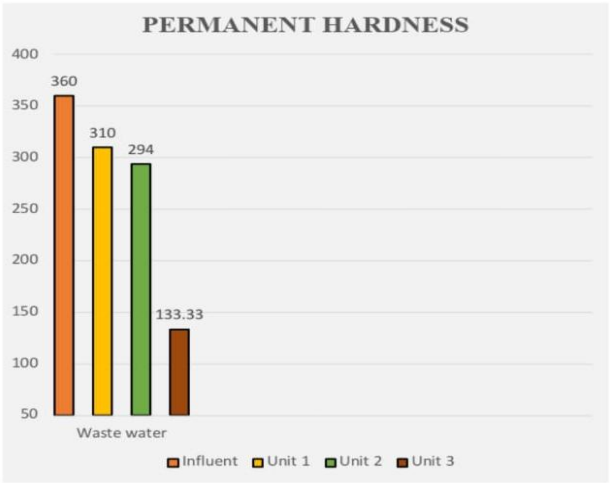


**Chart -6**: Analysis of Permanent Hardness

Above graphical representation chart 6 shows the Permanent Hardness test results. The permanent hardness values was decreased from first unit to third unit. The permanent hardness value of influent is 360 to 133.33 as value of effluent, and overall efficiency was 47.22%.

**Total Dissolved Solid (TDS) -**

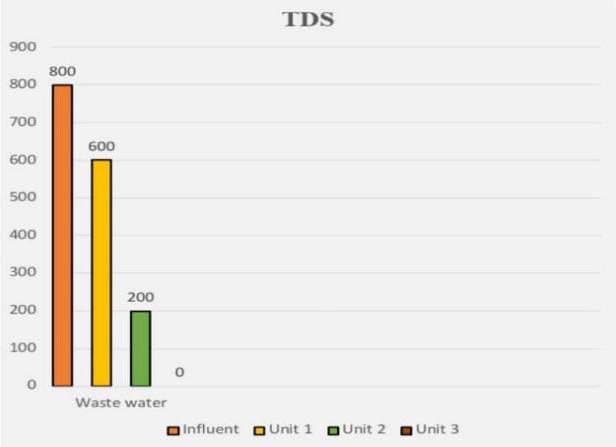


**Chart -7**: Analysis of TDS

Above graphical representation chart 7 shows the total dissolved solid results. The TDS values was decreased from first unit to third unit. The hardness value of influent is 800 to 0 as value of effluent, and overall efficiency was 100%. Hence it was observed that second and third unit contributed more in removal of total dissolved solid concentration.

## 5. CONCLUSIONS

Although the present experimental work focuses on the evaluation of treatment and removal efficiency of quality parameters of wastewater by using innovative filtration technique. The constructional waste which is very effectively work and to remove contaminants from domestic wastewater. All ingredients are waste parts, naturally available, environmental friendly and locally available.

## 6. REFERENCES

[1] Priyanand Agale and Parag Sadgir. "Grey water treatment using novel technique of Aerobic Brickbat Grit Sand (ABGS) purifier system." Eco. Env. & Cons. 24 (3): 2018; pp. (1293-1299)

[2] Medha Khangal, Dr.P.K.Agale, Dr Parag Sadgir "Treatment of sewage and greywater using Aerobic Brickbat Gravel Sand (ABGS) Filtration method." International Journal of Interdisciplinary Innovative Research & Development (IJIIRD) (2020)

[3] Ahmed M., Al Sidari, S., Prathapar, A. and Al Adwai, S., Evaluation of custom made and commercial greywater treatment system: a case study From Oman, Bio-resource technology, 65, 33-40, (2008)

[4] Albalawneh, A; Chang T., Alshawabkeh H., "Greywater treatment by granular filtration system using volcanic tuff and gravel media." Water Science & Technology, 2017, 2331.

[5] Damodhar J Garkal, J V Mapara and Mandar Prabhune. "Domestic waste water treatment by bio-filtration: a case study." International Journal of Science, Environment and Technology, Vol. 4, No 1, 2015, 140 – 145.

[6] Gazala Sayed. "Treatibility Study of Wastewater Using Activated Carbon, Sand Filter and Dual Media Filter." National Conference on Biodiversity: Status and Challenges in Conservation- 'FAVEO' (2013). ISBN: 978-81-923628-1-6.

[7] Jabbar H. Al-Baidhani and Zaid H. AL- Khafajy. "Treatment of Water and Wastewater by using Roughing Filter Technology of Local Materials." International Journal of Current Engineering and Technology, Vol.6, No.6 (Dec 2016), E-ISSN 2277 – 4106, P-ISSN 2347 – 5161.

[8] Mangesh Gulhane and Anuja Charpe. "Multimedia filter for domestic wastewater treatment." Journal of Environment Research and Development, Volume 9 No. 3A, March (2015)

[9] Martinez S. G., Barcelo O. G., Flores-Torres C. A., "Wastewater treatment in an anaerobic filter using small lava stones as filter media without temperature control", Water Science & Technology 2011, 1188.

[10] Onyeka Nkwonta and George Ochieng. "Roughing filter for water pre-treatment technology in developing countries: A review." International Journal of Physical Sciences Vol. 4 (9), pp. 455-463, September, 2009.

[11] Prayong Keeratiurai. "Wastewater treatment with aerobic filtration process by rock layer." ARPN Journal of Agricultural and Biological Science, Vol. 9, no.4, april 2014.