International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

Wastewater Treatment by Locally Available Materials Using Bio Filter

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Abstract - *Wastewater treatment and disposal is a serious problem globally. Several methods are available to treat the domestic wastewater. Domestic wastewater contains high amount of organic matter as compared to chemical materials. Biofilter is a novel and efficient to treat the domestic waste water. Bio-filter uses locally available natural materials like sand, brick graduals, gravel, river sand, partially weathered rock and wood chips, agricultural wastes those acts as filter materials. In this study Biofilter used local available materials as filter media in vertical flow column to treat waste water. These natural materials have different filtering efficiencies. Bio-filter is highly influenced by hydraulic loading rates, less energy, less sludge generated, high dissolved oxygen and green ambience are the salient features which proves economical and serves to recycle the wastewater for non-potable use.*

Key Words: *Bio filtration, Biomass, CSF, Biodegradation, COD, Dissolved oxygen.*

1. INTRODUCTION

India is rich in water resources, having a network of as many as 113 rivers (the figure does not include tributaries) and vast alluvial basins to hold plenty of groundwater. The most significant environmental problem and threat to public health in both rural and urban India is inadequate access to clean drinking water and sanitation facilities (CPCB December, 2016).

Bio filtration is a pollution control technique using a bioreactor containing living material to capture and biologically degrade pollutants [1]. Common uses include processing waste water, capturing harmful chemicals or silt from surface runoff, and macrobiotic oxidation of contaminants in air. Bio filtration is used to treat wastewater from a wide range of sources, with varying organic compositions and concentrations. Biological filters (bio-filters) are invariably cited as a low-cost and low-maintenance technology, especially compared with conventional treatment technologies, such as activated sludge [1]. For example, it is practically impossible for activated sludge to treat low-strength wastewater with BOD lower than 20 mg l-1 as the difficulty of maintaining a normal value for MLSS and conventional efficiency. Substrate-transforming microorganisms in the bio-filter are often grown as biofilm on surfaces that can be either synthetic media, or natural media (i.e., gravel, sand, tuff, zeolite) [2].

The technology is applicable to water purification (primary processing prior to disinfection), wastewater purification and air purification. Typical applications include rain water harvesting, storm water purification, primary purification of drinking water, primary purification of swimming pool water, sewage treatment for reuse in construction, cleaning and gardening, utility water for industries, industrial wastewater treatment, industrial air purification, organic solid waste conversion, municipal solid waste processing, commercial production of soil, animal house waste processing, hospital waste disposal, etc [3]. Soil filters imitate permeable upland areas that soak up and cleanse runoff water as it travels through the soil toward groundwater. The soil acts as a filter by removing sediment and other pollutants. Oxygen inside the soil filter aerates the wastewater and fuels the microbes that break down pollutants. Soil filters are effective for wastewater treatment producing good quality water [3,4].

Several researchers found the related bio filtration applications for treatment of sewage. Bio filters have been developed and commercialized for the wastes, landfill leachate and domestic waste water. So, our work is totally depending on how we treat the waste water generated from the overall S. B. Patil Educational Campus using bio filter that we constructed using various locally available material.

The objective of the present study is,

- To find characteristics of domestic sewage in S. B. Patil educational campus.
- To fabricate the laboratory based Soil Bio Filter.
- Performance of Soil bio–filter treating waste water and analyze the characteristics of raw and treated waste water.

2. Materials and Methods

2.1 Materials

Biofilter consists of filter media used from locally available area of Indapur having specific mineral composition, and developed culture containing natural microflora. Culture, media, plantation and additives, these are the four elements of Biofilter shown graphically in Fig. 5 and Fig. 6 and discussed below,

Underdrain: Rock of a variety of sizes ranging up to gravel (2.0–20 mm), very coarse sand (1.0–2.0 mm), coarse sand: (0.5–1.0 mm), medium sand (0.2–0.50mm) rock dust, coconut coir fibre and fine sand; (0.1–0.25 mm) as shown in Fig 1.

One small layer will added on top surface for for capturing CO_2 and regulates the pH. Green plants root ecosystem serves as bio-indicator for the filter media environment also helps in biodegradation.

Fig.1: Material used as filter media (Gravel, sand, coconut shell and Coconut husk, basalt rock, rock dust)

2.2 Methodology

Actual process adopted for the working is as per the following flow-chart shown in Fig.2.

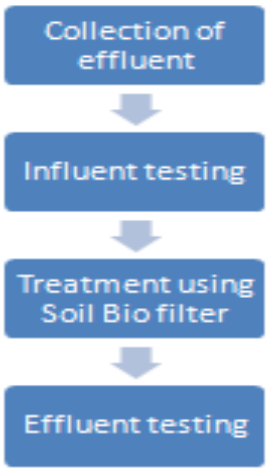

Fig.2 : Flow-chart of treatment process

Fig 3: Sample collection

Fig 4: Laboratory testing of water (Influent & Effluent)

Table -1: Characteristics of waste water (Influent)

Parameters	values
pH	8.77
DO	3.4 mg/l
BOD	13.3 mg/l
COD	421.5 mg/l
TDS	1.8 mg/l
TSS	10.8 mg/l
EC	1470 µs/cm

Table 1 shows the actual properties that obtained by testing of the waste water generated from the overall SB Patil Campus, Indapur.

Fig 5: Working model of Soil Bio-Filter

Bio filtration is the natural process which consists of natural filtration using locally available filter media (i.e. gravels, coarse sand, murum, crushed sand).coconut coir fibre is used for the generation of biomass microbiology. Bacteria culture is developed by passing cow dung through filter media and through wastewater.

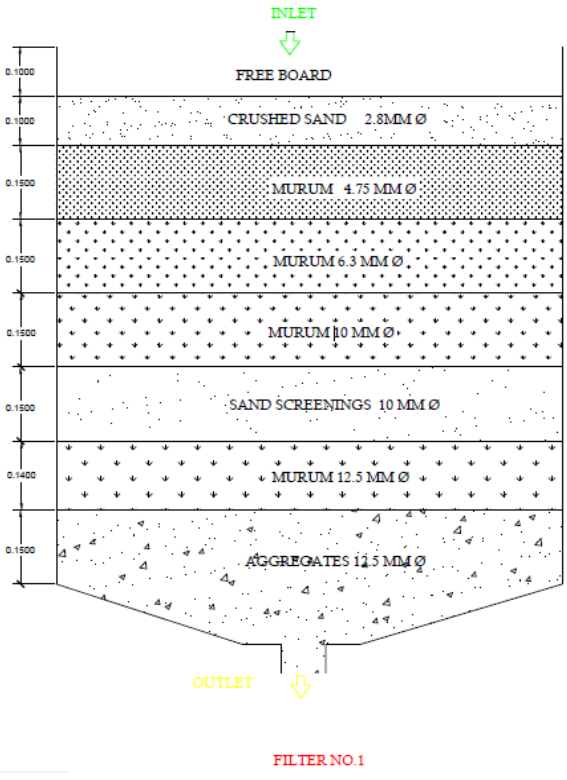

Fig 6:

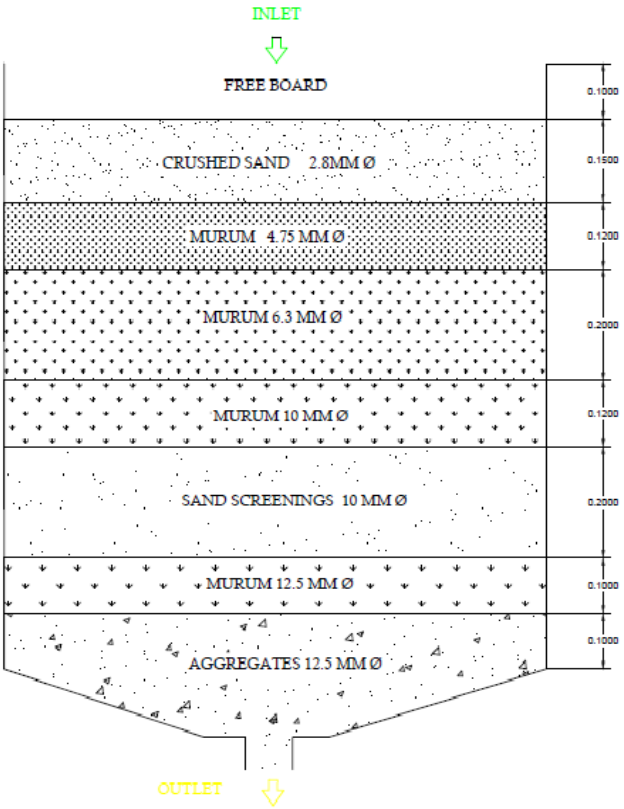

Fig 7: Layer forms by filter media (filter column 2)

In the fig.5 shows working model of Soil Bio-Filter that we have prepared for the purpose of treating waste water generating from various units as a source of generation from waste water. Fig. 6 & 7 shows the detailed specification of filter columns 1 & 2 with respect to media layers.

3. Analysis

Physiochemical and microbial analysis reported here is as per the standard methods for water and waste water analysis (7) . pH and dissolved oxygen (DO) were measured using pH meter and DO meter. BOD, suspended solids and other parameters were measured as per standard protocols.

4. RESULTS

4.1 Characteristic of treated water of column 1

We have conducted test for several flow rate (3ml, 5ml, 10ml, 15ml, and 20ml) and the best results obtained are for 3ml/min discharge.

Table 2: Characteristics of treated sample (Effluent flow rate 3ml/min)

DAY	pH	DO	BOD	TSS	TDS	COD	EC
1	7.10	13.7	4.0	1.65	0.6	120.8	455
2	6.92	13.88	4.0	1.6	0.6	115.5	448
3	6.86	13.9	3.7	1.58	0.59	111.6	441

4.2 Characteristic of treated water of column 2

We have conducted test for several flow rate (3ml, 5ml, 10ml, 15ml, and 20ml) and the best results obtained are for 3ml/min discharge.

Dissolved oxygen (DO) percentage also increased in final effluent from 0.65 mg/l to 6.2mg/l). Tracer study also conducted by CSF and found the similar result for DO (2, 8).

Table 3: Characteristics of treated sample (Effluent flow rate 3ml/min)

DAY	pH	DO	BOD	TSS	TDS	COD	EC
1	6.86	14.01	3.8	1.7	0.6	118.6	430
2	6.90	14.20	3.72	1.6	0.55	105.4	424
3	6.85	14.17	3.6	1.6	0.55	101.6	428

5. CONCLUSION

Bio-filter works on Carbon cycle naturally maintained the ecosystem which degrade the contaminants present the wastewater and reduced the COD within permissible standards. It works without any chemicals requirement, less machine/ parts, having high dissolved oxygen with less generation of sludge under natural aeration while penetrating the wastewater through the pores of filter media. Bio-filter acts as green garden from top and earned carbon credit also.

ACKNOWLEDGEMENT

The authors would like to express sincere thanks to Department of Civil Engineering, S. B. Patil College of Engineering, Indapur for providing the laboratory facility and instruments for analysis and carryout experimental work.

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