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SEWAGE TREATMENT UNIT USING DUAL MEDIA FILTER- A STEP TOWARDS WATER CONSERVATION

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Abstract – *Waste water, is any water that has been adversely affected in quality by anthropogenic influence. The sewage from colonies as well effluent from industrial units has been identified as main cause for water pollution across our country. Sewage is a water – carried waste, in solution or suspension that is intended to be removed from a community. Also known as waste water, it is more than 99% water & is characterized by volume or rate of flow, physical condition, chemical constituents and the bacteriological organisms that it contains. During recent year, there has been an increasing awareness and concern about water conservation all over the world. Hence, new approaches towards achieving sustainable development of water resources have been developed internationally. The BOD, COD, TSS concentration of sewage ranges from 80-150 mg/l, 180-230 mg/ l & 90-180 mg/L respectively. Under this research paper, a cut to suit treatment technology has been developed to treat sewage. Treatment technologies adopted are sequencing batch reactor (SBR), Chlorination. A new approach Dual media filter results were very encouraging. The treatment system achieved 94% BOD, 96% COD and 95% TSS removal respectively.*

***Key Words*: Sequencing batch reactors, Activated sludge Process, BOD, Chlorination, COD, TSS, Dual Media Filtration, Reuse, Sewage etc.**

1. INTRODUCTION

Waste water is liquid waste discharged by domestic residences, commercial properties, industry, agriculture which often contains some contaminants that result from the mixing of waste water from different sources [1]. Based on first origin wastewater can be classed as sanitary, commercial, industrial, agricultural or surface runoff. Term wastewater need to be separated from the term sewage, the terms sewage and sewerage are sometimes interchanged. Sewage is contaminated with feces or urine. The sewage generates from residence, hospitals, offices, industries etc.

Domestic sewage contains a wide variety of dissolved and suspended impurities and is the primary source of pathogens and organic substances. All sewage from cities and towns is likely to contain pathogens of some type, potentially presenting a direct threat to public health. There has been an increasing awareness and concern about water conservation all over the world. Hence, a new approach towards achieving sustainable development of water resources has been developed internationally.[1]

1.1 Methods and Material

Methodology:

In this research paper the treatment technologies adopted for the treating sewage are as follows:

1. Sequencing batch reactor (SBR) Process
2. Filtration

1.2 Sewage Treatment Plant

Sewage treatment is the process of removing contaminants from wastewater and house hold sewage, both runoffs (effluents), domestic, commercial and institutional. It includes physical, chemical and Biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe fluid waste stream and solid waste (or treated sludge) suitable for disposal or reuse. The treatment of waste water is not important for our own health but also kept our environmental clean and healthy.[1]

In a sewage treatment plant, the Sequencing batch reactor (SBR) process is a biological process that can be used for one or several of the purpose like oxidizing carbonaceous biological matter, oxidizing nitrogenous matter. Mainly ammonium & nitrogen generation a biological matter, removing phosphate, driving off entrained gases such as carbon dioxide, ammonia, nitrogen generating a biological floc that is easy to settle, generating a liquor that is low in dissolved or suspended material.

SBR (Sequencing batch reactors) are a type of activated sludge process for the treatment of waste water. SBR reactors treat wastewater such as sewage or output from anaerobic digesters or mechanical biological treatment facilities in batches. SBR is a modification of activated sludge process which has been successfully used to treat municipal and industrial wastewater. The difference between the two

technologies is that the SBR performs equalization, biological treatment and secondary clarification in a single tank using a timed control sequence. SBR technology is a method of waste water treatment in which all phase of the treatment process occur sequentially within the same tank.[6]

The SBR is fill draw activated sludge system. In this system, waste water is added to a single "batch" reactor, treated to remove undesirable components, and the discharged.

Five phase of SBR process:

Fill Phase: During this phase, the basin receives influent wastewater. The influent brings food to the microbes in the activated sludge, creating an environment for biochemical reactions to take place.

React Phase: During this phase, no wastewater enters the basin and the mechanical mixing and aeration units are on. This phase allows for further reduction of wastewater parameters.

Settle phase: During this phase, activated sludge is allowed to settle under quiescent condition. The activated sludge tends to settle as a flocculent mass.

Decant phase: Clarified treated effluent is removed from the tank.

Idle Phase: This step occurs between the decant and the fill phase. The idle period is used when the system is waiting for enough effluent to process.[6]

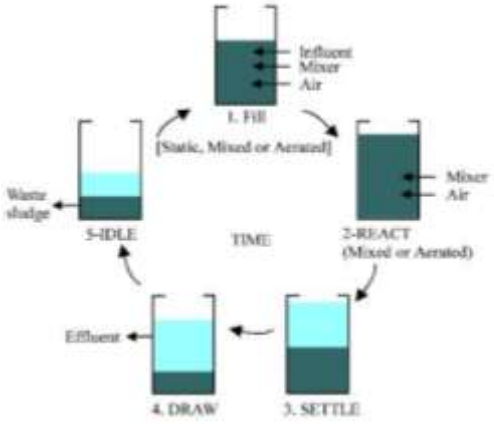

Fig -1: SBR operation for each tank for one cycle

Disinfection of sewage is necessary for healthy rivers and streams. Chlorination is by far the most common method of wastewater disinfection and is used worldwide for the disinfection of pathogens before discharge into receiving streams, rivers or oceans. Chlorine is known to be effective in destroying a variety of bacteria, Viruses and protozoa, including Salmonella, Shigella and vibrio cholera.

1.3 Filtration

Filtration is commonly the mechanical or physical operation which is used for the separation of solids from fluids by in reposing a media through which only the fluid can pass. The fluid that passes through is called filtrate. Two types of sand filter are in use: Slow sand filter and rapid sand Filter. Slow sand filters require much more surface area than rapid sand filters and are difficult to clean. Most modern water treatment plant now use rapid dual media filers following coagulation and sedimentation. A dual- media filter consists of layer of anthracite coal above a layer of fine sand. The upper layer of coal traps most of the large floc, and the finer sand grains in the lower layer trap smaller impurities. This process is called in depth filtration, as the impurities are not simply screened out or removed at the surface of the filter bed, as is the case in slow sand filter. In order to enhance in depth filtration, so calls mixed media are used in some treatment plants. These have a third layer, consisting of fine grained dense mineral called granite, at the bottom of the bed.[4]

2. Dual media Filter:

For this research paper a treated water from the Sewage treatment plant based on SBR (near Ahmedabad) will recycle and reuse water can be used for cooling water makeup, gardening, landscape development, toilet flushing, road washing etc. thus leading towards water conservation. A new Approach is "Sewage treatment plant followed by Dual media filter achieve very encouraging results. The Result achieved 94% BOD, 96% COD and 95% TSS removal respectively.

At Sewage treatment plant preliminary treatment (includes Screening, grit chamber, Parshall flume), SBR tank (Biological treatment) and chlorine contact tank were fabricated.

A lab scale study was conducted to testing of the results.

Table -1: Inlet and Out let parameter of Sewage Treatment plant

Sr no	Parameters	Inlet (mg/l)	Outlet (mg/l)
1.	pH	7.22	7.40
2.	BOD	85	10
3.	COD	190	20
4.	TSS	114	15

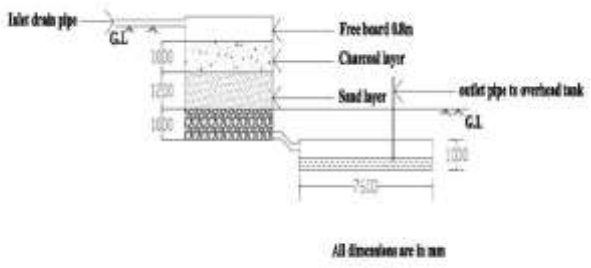

Fig-2: Plan of the Filtration Tank

Fig-3: Dual media model

Dual media filtration has been increasing interest and application in water treatment as well as in advance treatment of effluents for water renovation and for pollution control.[4] It consist of Activated Carbon AC at the top of the filter media, and sand in the bottom portion. The AC with a specific gravity of 2.55 is greater than the sand with sp. Gravity of 2.65. Therefor a lager AC gain has the same settling velocity as much smaller sand gain. This characteristics allows larger AC grains to be placed on the top of the smaller sand grains.[5]Dual media filter may behave much like the two single – medium filters, placed in series, one above the other, each with a different grain size. The top layer of AC particles removes the larger sized impurities as well as some smaller one; while the bottom sand, in its turn, captures the smaller impurities. As a consequence, more depth of filter is utilized for the removal of solids than in the stratified single medium filter.[5]

Sand either fine or core is generally used as a filter media. The size of the sand is measured and expressed by the term called effective size.[4] The layer of Sand may be supported on gravel, which permits the filtered water to move freely to the under drains, and allows the wash water to move uniformly upwards.[4]

The diameter of the activated carbon filter be selected to be 25% larger than the sand filter to reduce the frequency of the servicing.[4]

Filtration unit details:

Materials: Activated charcoal, Sand and Gravel
Top layer: Activated charcoal (granular),
Middle layer: Sand
Bottom Layer: Gravel

The rate of Filtration is 6 $m^3/m^2/hr$. (for this small unit)

Advantages and Disadvantages of Dual media Filter
Advantages:

-Higher filtration rate
-Requires small area
- Automated cleaning using backwash
- Can handle a wide range and more variable water quality than a rapid sand filter.
- Operation can become more automated are requires less man power.

Disadvantages:

-Not as efficient a filtration process and additional monitoring may be required before a high filtration rate can be used.
- A biologically active layer does not form
- Need frequent cleaning using significant amount of treated water.
- Operation requires a higher level of skill and thus more training.

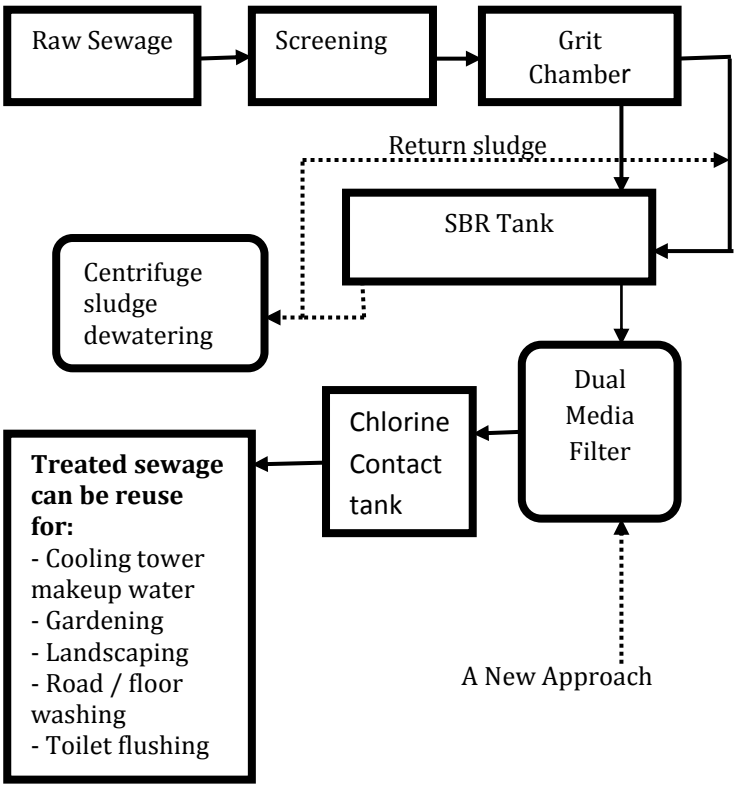

Chart 1: Flow chart of Sewage treatment plant with new approach

3. RESULTS AND CONCLUSIONS

Table -2: After dual media filter Reduction Results

Sr no.		pH	BOD (mg/l)	COD (mg/l)	TSS (mg/l)
1.	Raw Sewage	7.22	90	200	115
2.	SBR tank outlet	7.3	10	20	15
3.	After Dual media filter	7.3	6	8	6
	Reduction in %	**-**	**94%**	**96%**	**95%**

Conclusions:

With the Rapid Development of the cities and domestic water supply, quantity of sewage generation is increasing in the same proportion. Treatment of sewage and its reuse is the need of the hour. One of the Main pollution of surface water in our country is discharge of untreated sewage.

This research paper attempt has been made to treat sewage and put it back for reuse. The sewage has been treated by sequencing batch reactor (SBR) and the results have been very encouraging. BOD, COD and TSS reduction achieved were 10 mg/l, 20 mg/l and 15 mg/l respectively. After Dual media filtration BOD, COD and TSS results very encouraging 6mg/l, 8mg/l and 6mg/l respectively. [2]

The dual media filter system archived 94% BOD, 96% COD, and 95% TSS removal.

The treated sewage can be reused for various purpose like cooling water makeup, gardening, landscape development, toilet flushing, road washing etc. thus leading towards water conversation.

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REFERENCES

[1] Shrirang Vrushali and Chatterjee Kaustav, Sewage Treatment and Reuse – A Step towards water Conservation, DAMA international science journal.

[2] Wesley W. Eckenfelder and Nandor Porges (1957). Activity of microorganism in organic Waste disposal. IV. Bio-Calculations. Applied Microbiol. 5(3): 180–187.

[3] Abraham Francics et.al, Waste Water Treatment Unit Using Activated Charcoal, International Research Journal of Engineering and Technology (IRJET),2018

[4] Piyali Das ME Thesis, " Study on the performance of dual media filter for surface water treatment" Jadavpur University Kolkata, May 2013

[5] CPHEEO (Central Public health and Environmental engineering organization) on Sewage and Sewage treatment.

[6] https://www.slideshare.net/shrigajanan/sequencing-batch-reactor-ppt.