

# SEWAGE TREATMENT AND REUSE – A STEP TOWARDS WATER CONSERVATION

1-Mohd Mudassir khan 2-Divya Pandey 3-Shalini Lodhi 4-Brijesh Kumar 5-Shivam Pandey  
Civil Department  
Rajarshi Rananjay Singh institute of management and technology, Amethi, Uttar Pradesh, India

**ABSTRACT**-Waste water is any water that has been adversely affected in quality by anthropogenic influences. Effluent from industries as well as sewage from colonies has been identified as main cause of water pollution across our country. Sewage is a water carried waste normally contains 0.05% to 0.1% of total solids, in solution or suspension that is required to remove from a community. It is characterised by volume or rate of flow, physical condition, chemical characteristics, biological organism it contains. The essential element for the existence of living being are air, water, food, shelter etc out of which water is the 2<sup>nd</sup> most important. People has been increases their awareness towards water conservation and reuse. Hence new techniques towards achieving sustainable development of water resources have been developed internationally. The BOD (180-200) ppm, COD (280-340)ppm, TSS (150-200)ppm are concentration of sewage range. Treatment technologies adopted are ACTIVATED SLUDGE PROCESS, CHLORINATION, and FILTRATION. The results are very good it achieved 96.8% BOD, 92.5% COD, 95% TSS and 99% total coliform removal. The treated sewage can be used for the following purposes like irrigation, toilet flushing, road washing, gardening, etc thus leading towards water conservation.

**KEYWORDS** – BOD, COD, TSS, activated sludge process, filtration, and chlorination.

**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 wastewater from different sources. Based on its 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 a type of waste water that comprises domestic waste water and is therefore contaminated with feces or urine from people's toilets, but the term sewerage is a physical infrastructure, including pipes, pumps, and screens, channels etc. used to convey sewage from its origin to the point of eventual treatment or disposal.

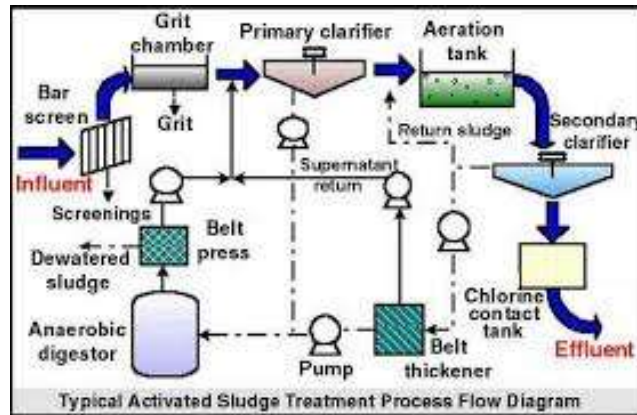
India is recognized as has having major problems with water Pollution, predominantly due to untreated Sewage. Rivers such as the Ganges, the Yamuna all flowing through highly populated areas, are polluted. 80 % of sewage in India is untreated and flows directly into the nation's rivers, polluting the main sources of drinking water. Indian cities produce nearly 40,000 million litres of sewage every day and barely 20 percent of it is treated. Hence treatment of sewage and its reuse is the need of the hour.

**MATERIALS** -In this research work the commercial sewage is to be taken for analysis of BOD, COD, & TOD. Commercial waste consists of waste from premises used mainly for the purposes of a trade or business or for the purpose of sport, recreation, education or entertainment, but excluding household, agricultural or industrial waste.

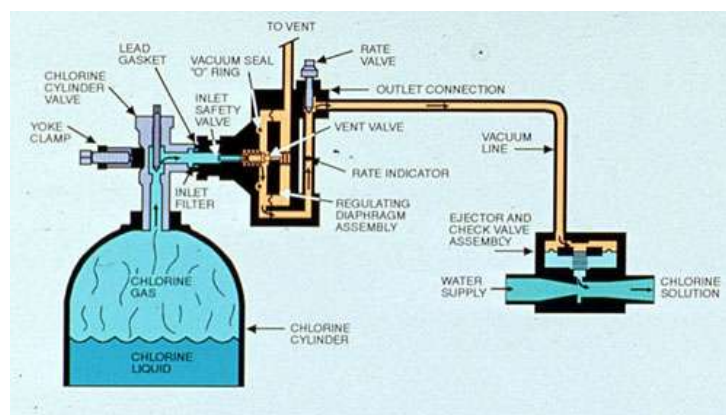


**EXPERIMENTAL WORK**-There are following process are performed sequentially.

**Activated Sludge Process** - The activated sludge process is a type of wastewater treatment process for treating sewage or industrial wastewaters using aeration and a biological floc composed of bacteria and protozoa, discovered in 1913 in the UK by two engineers, Edward Ardern and W.T. Lockett. (Beychok, 1967) who were conducting research for the Manchester Corporation Rivers Department at Davyhulme sewage works. Activated sludge is also the name given to the active biological material produced by activated sludge plants.



**Chlorination**- Water chlorination is the process of adding chlorine ( $\text{Cl}_2$ ) or hypochlorite to water. 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 (Haas, 1987) and (White, 1978). Chlorine is known to be effective in destroying a variety of bacteria, viruses and protozoa, including Salmonella, Shigella and Vibrio cholera. Wastewater chlorination was initially applied in 1910 in Philadelphia, PA, and was soon implemented in many other cities in the United States



**Filtration**-Filtration is commonly the mechanical or physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass. The fluid that passes through is called a filtrate. A dual media filter consists of a 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 filters. In order to enhance in-depth filtration, so-called mixed-media filters 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



**Process-** In this research paper a lab scale study was conducted to evaluate the performance of Activated Sludge Process followed by Chlorination & Dual Media Filtration for treating Sewage and reusing the treated sewage. The general arrangement of an activated sludge process for removing carbonaceous pollution includes the following items:

- Aeration tank where air (or oxygen) is injected in the mixed liquor.
- Settling tank (usually referred to as "final clarifier" or "secondary settling tank") to allow the biological flocs (the sludge blanket) to settle, thus separating the biological sludge from the clear treated water.

Treatment of nitrogenous matter or phosphate involves additional steps where the mixed liquor is left in anoxic condition (meaning that there is no residual dissolved oxygen).

**Bioreactor and final clarifier** -The process involves air or oxygen being introduced into a mixture of screened, and primary treated sewage or commercial wastewater combined with organisms to develop a biological floc which reduces the organic content of the sewage. This material, which in healthy sludge is a brown floc, is largely composed of saprotrophic bacteria but also has an important protozoan flora component mainly composed of amoebae, Spirotrichs, Peritrichs including Vorticellids and a range of other filter-feeding species. The combination of wastewater and biological mass is commonly known as mixed liquor. In all activated sludge plants, once the wastewater has received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new wastewater entering the tank. This fraction of the floc is called return activated sludge (R.A.S.). Excess sludge is called surplus activated sludge (S.A.S.) or waste activated sludge (W.A.S). W.A.S is removed from the treatment process to keep the ratio of biomass to food supplied in the waste water in balance, and is further treated by digestion, either under anaerobic or aerobic conditions prior to disposal. Activated sludge refers to biological treatment processes that use a suspended growth of organisms to remove BOD and suspended solids. The process requires an aeration tank and a settling tank.

Aeration Tank, Chlorine contact tank and Dual media Filter were fabricated. Freshly sieved cow dung slurry was added in the Aeration Tank for developing aerobic microorganism. Artificial oxygen was provided by means of aerators. Sewage was added to aeration tank. It was kept undisturbed for 24 Hours for aerobic degradation. The sewage then was taken in clarifier for settling of biological sludge. Supernatant from clarifier was then collected and pH, COD, BOD, TSS, MLSS were analyzed. The same procedure of collection and analysis was conducted at a gap of 24 Hours, for 96 Hours. In 96 Hours, activated sludge process achieved 90% BOD and 80% COD reduction. The Mixed Liquid Suspended Solid (MLSS) concentration inside the aeration tank showed a steady rise upto 4000 mg/L, showing adequate population of aerobic microorganisms in Aeration tank. Once the maximum, degradation in BOD & COD concentrations was achieved, the biologically treated sewage was subjected to chlorination for disinfection. Chlorination was carried out by adding sodium hypochlorite. The optimum dose was determined by Jar testing. The supernatant was passed to Dual Media Filter, comprising of layers of gravel, sand and activated carbon for removal of suspended solid and colour. Final treated sewage was estimated for various parameters such as pH, BOD, COD and TSS. The final treated sewage showed drastic reduction in TSS @ 95 % reduction. The removal of TSS also effected a simultaneous reduction of the COD.



Specific Estimation Conducted:

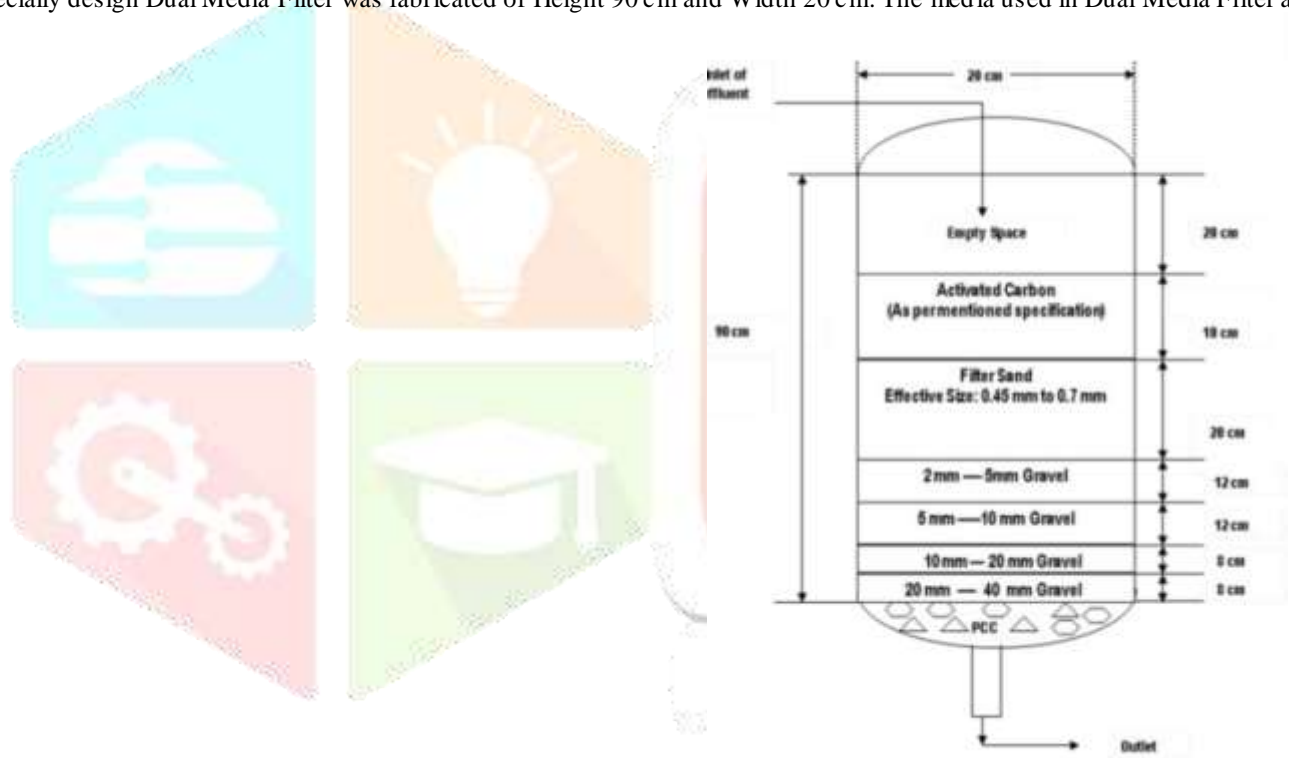
- pH
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Suspended Solids (TSS)
- Mixed Liquor Suspended Solids (MLSS)

**Table 1 inlet characteristic of raw sewage**

Sr. No.	P a r a m e t e r	V a l u e
1	p H	7 . 2
2	C O D	3 2 0 p p m
3	B O D	1 9 0 p p m
4	T S S	2 0 0 p p m
5	T o t a l c o l i f o r m	1 0 M P N / 1 0 0 M L

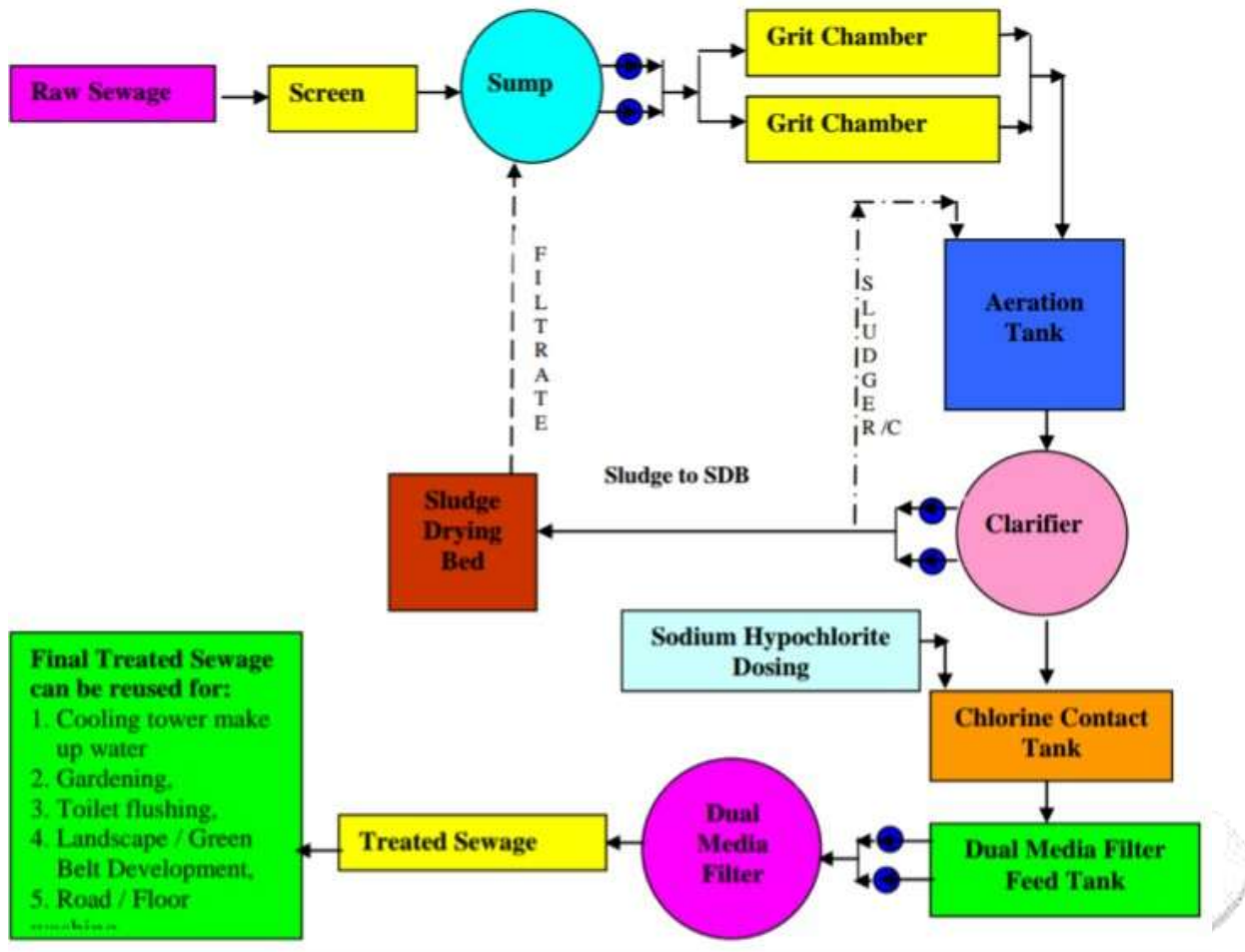
**Figure 1 Schematic Diagram of Dual Media Filter**

A specially design Dual Media Filter was fabricated of Height 90 cm and Width 20 cm. The media used in Dual Media Filter are



gravel, sand and activated carbon as shown in Figure 1

**Figure2. Schematic Diagram based on this Research Study - Proposed Treatment Scheme for Treatment and Reuse of Sewage**

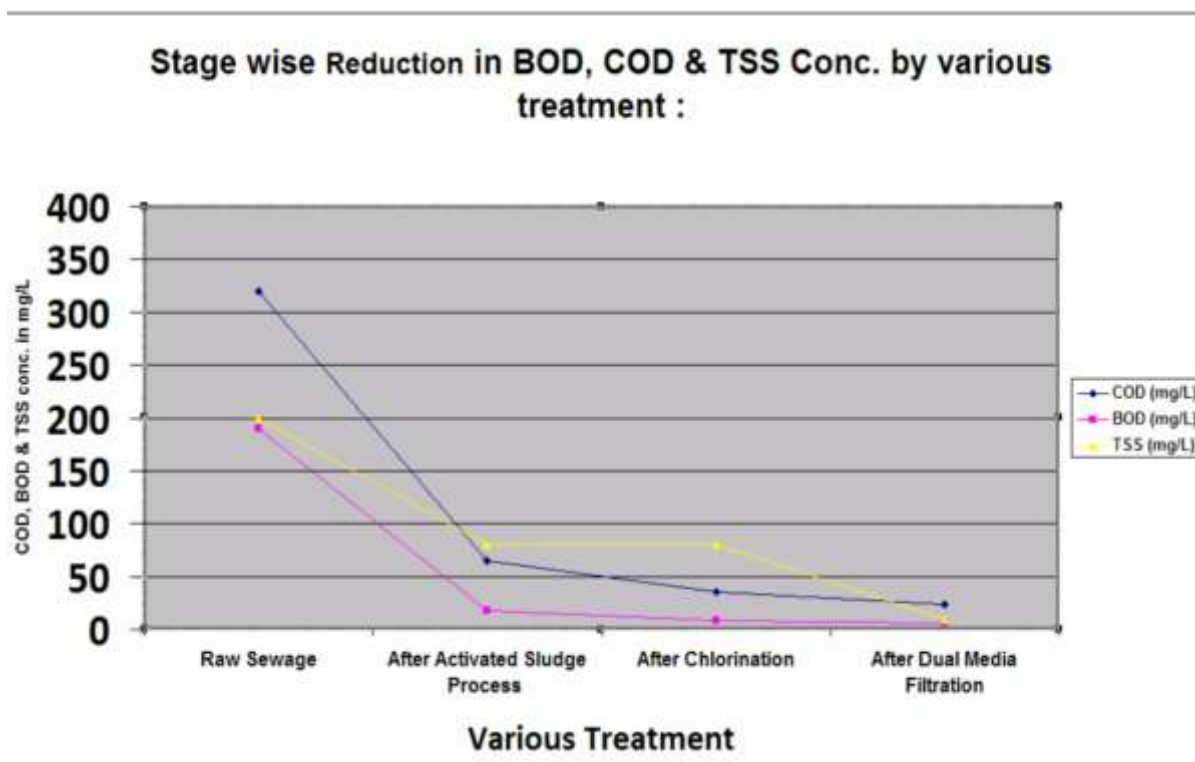


**RESULT**

Table2. Stage wise reduction in BOD, COD, TSS and Total Coliform Concentration by various treatments

Sr. No.	treatment	Initial characteristics					Reduction from initial values				
		pH	BOD	COD	TSS	Total coliform MPN/100ml	%BOD	%COD	%TSS	%coliform control reduction	
1	Raw sewage	7.2	190	320	280	10 <sup>7</sup>	-	-	-	-	
2	After activated sludge process	7.2	18	65	80	10 <sup>7</sup>	90.5%	79.6%	60%	-	
3	After chlorination	7.2	8	35	10	10 <sup>4</sup>	95.8%	89.0%	60%	99%	
4	After dual media filter	7.2	6	24	10	10 <sup>4</sup>	96.8%	92.5%	95%	99%	

Graph No. 1: Showing Stage wise Reduction in BOD, COD, TSS Concentration by various treatment



**Discussion** -With rapid development of 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 reasons of pollution of surface water in our country is discharge of untreated sewage. Thus, in this research paper, an attempt has been made to treat sewage and put it back for reuse. The sewage has been treated by activated sludge process and the results have been very encouraging. In 96 Hours, BOD and COD reduction achieved were 90.5% & 79.6% respectively. The Final BOD has been reported as 18 mg/L and COD as 65 mg/L.

Chatterjee et al. (2003), In the proceedings of 8th International conference on Water Conservation and Reuse of Waste Water held at Mumbai, in their paper Sewage Reuse – A Case Study has reported TSS removal from 150 mg/l to 10 mg/l by Dual Media filtration. Along with TSS removal, COD and BOD removal was also reported. The BOD and COD reduction was achieved by Dual Media Filtration to the tune of 96.8% & 92.5%.

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#### **Author Profile:**



**1. MOHD MUDASSIR KHAN**

He is pursuing the B.Tech in Civil Engineering from Rajarshi Rananjay Sinh Institute of Management & Technology, Amethi.



**2. DIVYA PANDEY**

She is pursuing the B.Tech in Civil Engineering from Rajarshi Rananjay Sinh Institute of Management & Technology, Amethi.



**SHALINI LODHI**

She is pursuing the B.Tech in Civil Engineering from Rajarshi Rananjay Sinh Institute of Management & Technology, Amethi.



**BRJESH KUMAR**

He is pursuing the B.Tech in Civil Engineering from Rajarshi Rananjay Sinh Institute of Management & Technology, Amethi.



**SHIVAM PANDEY**

He is pursuing the B.Tech in Civil Engineering from Rajarshi Rananjay Sinh Institute of Management & Technology, Amethi.