International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.8, pp 684-687, 2017

Experimental Investigation of Sanitary Sewage and Treatment for Garden use

Priya V*, Gokulbalan M, GnanaPrakash R.,Gogulkannan T, Karthick T

Department of Civil Engineering, Dr.N.G.P. Institute of Technology, Coimbatore, Tamilnadu, India

Abstract : Water is the basic element of social and economic infrastructure and is essential for healthy society and sustainable development. Due to rapid increase in density of population, fast urbanization, and agriculture, use the demand of water is increasing day by day. As a result surface water and ground water is polluted and finally leads to scarcity of water. Waste water is an immense resource which could have significant application in regions of water scarcity. Therefore the sanitary or grey water is treated by adopting suitable methods. Our study deals with experimental investigation of sanitary waste water and treatment for garden use. Initially the parameters of wastewater was tested in the laboratory conditions. According to the values suitable water treatment method is adopted. The filter media used for this treatment method is the root of Eichhoria Crassipes. The sanitary wastewater is taken and the various parameters such as Ph, turbidity, chloride, sulphate, BOD, COD, Nitrate, Alkalinity, Total Suspended Solids were tested. The fine roots of the plant trap suspended solids, and present a suitable environment for the growth of microscopic organisms that feed off the organic materials present in the wastewater, transforming them into simple inorganic material. After the treatment various parameters were tested from the treated water. Both the parameter values were compared and results were given. After the startup Chemical Oxygen Demand (COD) removal efficiency of Eichhoria Crassipes was 42% and Biological Oxygen Demand (BOD) removal efficiency was 48%.The turbidity,Chloride, Sulphate,Nitrate content in the waste water has also removed to some extent properly.Therefore the condition of the Eichhoria Crassipes somehow seems to contribute to remove organic matter from the wastewater and the treated water can be used for garden use.
Keywords : Sanitary water, Eichhoria Crassipes, Testing parameters.

1.0 Introduction

The presence of organic matter and heavy metals in the environment is a major problem due to their toxicity to many life forms. Technologies such as reverse osmosis, while able to meet the standards, are expensive. What needed are the innovative technologies that are cost-effective and are able to reduce the concentration of contaminants to low levels.The removal of wastewater constituents are achieved by different mechanisms like sedimentation, filtration, chemical precipitation, adsorption, microbial interactions, and uptake of vegetation, among which, the one of the most effective technology is using strategy using the root of Eichhoria Crassipes in filtering technology. These systems are generally cost effective, simple, and environmentally non-disruptive ecologically sound with low maintenance cost. The principles of this treatment system are to clean up contaminated water, which include identification and implementation of efficient aquatic plant.

Many researchers have used different plant species like Water Hyacinth (Eichhorniacrassipes (Mart.) Solms), Water Lettuce (Pistiastratiotes L.), Duckweed (Water Lemna), Bulrush (Typha), Vetiver Grass (Chrysopogonzizanioides) and Common Reed (Phragmites australis) for the treatment of water [2]. They have used these species for different types of contaminated waters, effluents etc. Mkandawire and Dudel have used duckweed and they found its growth was restricted above 34°C and pH sensitive. Mashauri et al. used bulrush and his study revealed that the total dissolved solids (TDS) and electrical conductivity (EC) concentration was increased after treatment. Baskar et al. in his study of kitchen wastewater treatment found only 4% TDS removal by common need . Hence water hyacinth, water lettuce and vetiver grass were selected for review because they efficiently removes the heavy metals and other pollutants with high reproduction rate, efficiency and tolerance of ecological factors [4]. In this paper, role of these plant species have been discussed for the removal of water contaminants [10].

2.0 Sanitary Sewage

Domestic waste is flushed as sewage (comprising feces, urine and sullage) or nightsoil (feces and urine). Sanitary sewage consists of water coming out from bathroom, toilet, flushed water, kitchen waste etc [3].Water-borne sewage flows in sewers draining the raw sewage from home to a wastewater treatment plant, from where the effluents are discharged to a recipient water body. Raw sewage contains considerable concentrations of the pathogens associated with infectious diseases. Removal or significant reduction of these pathogens by microbial competitors and predators within biological treatment processes is a stringent requirement.

One of the environmental effects of wastewater discharge which was first recognized was the depletion of oxygen in receiving waters. Thus, the biochemical oxygen demand (BOD) was introduced as a measure of the oxygen consumption caused by wastewater. The BOD test was an ingenious test for its time and is still in use to express the strength of sewage. BOD values of 400 to 800 mg L-1 are common, reflecting a release of 40 grams of BOD per person per day. The numerous compounds can be identified using biological and chemical analytical tools and methods [7]. In a sample of sewage taken to a laboratory, it is possible to analyze the composition of wastewater and to identify groups of compounds of special concern, as shown in Table 1.

Table 1. Typical quality of raw sewage (mg/L) where pH values are unitless, electrical conductivity units are mmhos, while total and fecal coliform values are logarithms of their total numbers.

S.No	Quality Parameters	Raw Sewage (mg/l)
1	pH	7.3
2	Total Suspended Solids	380
3	Total Dissolved Solids	930
4	Chemical Oxygen Demand	1010
5	Biological Oxygen Demand	330
6	Chloride	270
7	Sulphate	145
8	Total Coliforms	8.2
9	Turbidity	32
10	Fecal Coliforms	6.2
11	Electrical Conductivity	1562

From the testing of parameters of the taken water sample, the Ph of the water is 7.3 which falls under alkalinity stage.Since alkalinity is safe for using water for irrigation. The Total Suspended Solids and Total Dissolved Solids of the sample is 380 and 930mg/l.The suspended solids present in the water can be used for irrigation since it will not affect any features. The Chemical Oxygen Demand and Biological Oxygen Demand of the water 1010mg/l and 330mg/l respectively which affects the oxidising of microbes in water. Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cations. The sulphate content in water sample is 145mg/l since it produces pungent smell. Therefore the water sample requires treatment method for reducing the certain level of parameters which are more harmful.

2.1 Efficiency of Eichhoria Crassipes roots in Treating the Wastewater

Water hyacinth is fast growing perennial aquatic macrophyte and prolific free floating aquatic weed. It is a member of pickerelweed family - Pontederiaceae and Genus - Eichhornia. This plant is rounded, upright with shiny green leaves, lavender flowers with dark blue root system. It has the great reproduction potential as it grows double in 5 to 15 days. Only ten plants in just eight months can produce population of 655,330 individuals. It commonly forms dense, interlocking mats due to its rapid reproductive rate and complex root structure.

The root of Eichhornia crassipes has a huge potential for removal of the vast range of pollutants from wastewater. It is also used to improve the quality of water by reducing the levels of organic, inorganic nutrients and heavy metals. Presence of its fibrous root system and broad leaves help them to absorb higher concentrations of heavy metals. It readily reduces the level of heavy metals in acid mine drainage water and silver from industrial wastewater in short time. This capability makes them a potential biological alternative to secondary and tertiary treatment for wastewater.

2.2 Wastewater Treatment Process

Treatment andsafe disposal of wastewater is necessary. This will facilitate protection of environment and environmental conservation, because the wastewater collected from citiesand towns must ultimately be returned to receiving water or to the land. Once the minimum effluent quality has been specified, for maximum allowable concentrations of solids (both suspended and dissolved), organic matter, nutrients, and pathogens, the objective of thetreatment is to attain reliably the set standards.

The wastewater treatment process comprises of Screening, Coagulation, Sedimentation, Filtration and finally includes Chlorination[1].In which Eichhoria Crassipes is used as filter media for treating the wastewater. Initially Screening process is selected to remove the objects such as rags, paper, plastics, and metals to prevent damage and clogging of downstream equipment, piping etc. Following that Coagulant like Alum is added to the screened water and stirred thoroughly for about 20 minutes. Then the stirred water allowed to remains stand for about 30 minutes in order to make the clogged particles to settle at the bottom. Next is the filtration process where Eichhoria Crassipes is used for filtering the water coming after the sand filtration process. The roots of Eichhoria Crassipes are like wire mesh which easily filters the organic matters present in the wastewater and the process is very speedy while comparing with other filter media. In order to kill the microbes present in the water after filtration, chlorine is added. Therefore the water is taken to laboratory again for testing parameters after the treatment.

Hence the tested values of the treated water are mentioned in the table 2.

S.No	Quality Parameters	Treated Sewage (mg/l)
1	pH	7.8
2	Total Suspended Solids	80
3	Total Dissolved Solids	525

4	Chemical Oxygen Demand	55
5	Biological Oxygen Demand	37
6	Chloride	115
7	Sulphate	90
8	Total Coliforms	3.6
9	Turbidity	15
10	Fecal Coliforms	2.9
11	Electrical Conductivity	1600

3.0 Results and Discussions

The sanitary grey water formulation that was developed as part of this research was proven to meet the parameter range criteria and mimic an average sanitary water in composition as well as providing a suitable medium for the transport of micro-organisms for testing. The content of water out flowing from the sewage stations is considered acceptable to some extent as a result of not using Chlorine in eliminating microbes. There is no specific mechanism to manage and use waste water, and raw water is sometimes opened by farmers before it reaches the station because the lands located before the station are higher than the level of main hole in the end of treating basins. The quality of sewage water from the station is not suitable to irrigate vegetables, especially those eaten fresh, while it is suitable to irrigate forage crops for grazing livestock or sale in markets and it helps the farmers get an economic return. This method was found to remove most of the components in grey water that might be detrimental to the environment and produced high quality product water that would be suitable for many applications around the home such as toilet flushing, surface and sub- surface garden irrigation, and car washing.

4.0 References

1. APHA. Standard Methods for the Examination of Water and Wastewater. Baltimore, USA: Port City Press, 2005.
2. Brown R, Palmer A. Water Reclamation Standard; Laboratory testing of systems using greywater. Technical Note TN 7/2002 BSRIA Ltd., Bracknell, UK, 2002.
3. Christova-BoalD, Eden R, McFarlane S. An investigation into grey water reuse for residential properties. Desalination1996; 106:391-397.
4. Comber S. Gunn A. Heavy metals entering sewage- treatment works from domestic sources. Journal of the Chartered Institution of Water and Environmental Management. 1996; 10(2):137-142.
5. Ajayi, T.O., Ogunbayo, A.O., 2012. Achieving environmental sustain-ability in wastewater treatment by phytoremediation with waterhyacinth (Eichhorniacrassipes). J. Sustain. Develop. 5 (7), 80–90.
6. BintiAwang, R., 2010. Removal of malachite green from aqueous solution by using dried water hyacinth (Eichhorniacrassipes) (Thesis). University Malaysia Pahang.
7. MWE, Ministry of Water and Environment, (2003) Feasibility study for effluent and sludge reuse in Aden ,Amran, Hadjjah, Ibb and Yarim, Ministry of Water and Environment, Yemen.
8. WHO (1989). Health guidelines for the use of wastewater in agriculture and aquaculture.Technical Report No. 778. WHO, Geneva, PP.74
9. Diaper C, O'Halloran R, Critchley M, Anderson N. proposed grey water system testing protocol, On-site '05: Performance Assessment for On-site Systems- Regulation, Operation and Monitoring. Armidale, New South Wales, 2005, 27-30.
10. DPIWE. Environmental Guidelines for the use of recycled water in Tasmania, 2002.

*****