Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 240 – 247

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Modified septic tank treatment system

Rrtu Anil[a], Anand Lali Neera[b]

[a]PG Student, Department of Civil Engineering, Government Engineering College, Thrissur, 680009,India
[b]Associate Professor, Department of Civil Engineering,Government Engineering College, Thrissur,680009,India

Abstract

Water pollution is a major global problem.One of the main causes of ground water contamination is the effluent from septic tanks. Treatment of domestic wastewater using conventional septic tank is found to be inefficient leading to increased soil and ground water contamination. It's very important to protect surface and ground water from contamination. So there is a need for improving conventional septic tank. The purpose of this study was to investigate the effect of a modified septic tank system for treating domestic wastewater. Modified septic tank system is a simple means of treating domestic wastewater using the treatment mechanisms such as anaerobic digestion and disinfection. The effect of vertical baffles coupled with an anaerobic reactor on septic tank system was analysed. The reactor selected for the study consists of copper modified zeolite as an adsorbent which will also act as filter media on which attached growth process takes place. The results showed that vertical baffled septic tank(VBST) coupled with zeolite filter shows a good treatment system. The results also showed that vertical baffled septic tank coupled with zeolite filter with disinfection shows a removal of 99.99% total coliforms, 99.57% of TSS, 46.83% Ammonia nitrogen, 31.08% of nitrate nitrogen, 48.39% of total kjeldahl nitrogen, 94.4% of BOD and 71.74% of Phosphates.This study focuses on an economical and efficient decentralized treatment method for treating domestic waste water.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

Keywords:Anaeobic digestion; disinfection; anaerobic reactor; copper modified zeolite; vertical baffled septic tank; zeolite filter

1.Introduction

Water is essential to sustain life, and a satisfactory supply must be available to all. One of the most essential sources of fresh water contributing a major portion of the world's drinkable water is the Ground Water.

* Corresponding author. Tel.:9447959712;
E-mail address: alneerace@gmail.com

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.032

Due to excessive pumping of ground water and uncontrolled wastewater discharge by man into the ground water, pollution of aquifer has become a common problem. Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels.[2] Residential, municipal, commercial, industrial, and agricultural activities can all affect groundwater quality. In areas where population density is high and human use of the land is intensive, ground water is especially vulnerable.[1]Contamination of ground water can result in poor drinking water quality, loss of water supply, degraded surface water systems, high cleanup costs, high costs for alternative water supplies, and/or potential health problems. The consequences of contaminated ground water or degraded surface water are often serious. Faecal pollution of drinking water has frequently caused waterborne diseases. The presence of E. coli in water is a strong indication of recent sewage or animal waste contamination.Modified septic tank treatment system is a simple means of treating domestic wastewater using the treatment mechanisms such as anaerobic digestion and disinfection. Domestic wastewater is the water that has been used by a community and which contains all the materials added to the water during its use. It is thus composed of human body wastes (faeces and urine) together with the water used for flushing toilets, and sullage, which is the wastewater resulting from personal washing, laundry, food preparation and the cleaning of kitchen utensils. This research was focused on the capability of this modified septic tank system in removing the pollutants.[1]

1. Materials and methods

A modified septic tank is used in this study to treat the domestic wastewater. Anaerobic treatment is performed in this study. Due to the difficulty in conducting the experiment with original domestic wastewater, synthetic wastewater was prepared.

1.1. Synthetic wastewater preparation

The synthetic wastewater was prepared using distilled water and contained peptone of 350mg/l, beef extract of 140mg/l, ammonium carbonate of 50mg/l, urea of 40mg/l, sodium chloride of 35mg/l, calcium chloride of 20mg/l, dipotassium hydrogen phosphate of 20mg/l, and magnesium sulphate of 10mg/l. Synthetic wastewater is seeded with cow dung to get coliform concentration range of 10^9 CFU / 100 ml using trial and error method.

1.2. Experimental setup

The treatment unit is made with a box of closed acrylic glass of dimension 60 X 15 X 26. The box is divided into 3 compartments. The first compartment is provided with 4 numbers of vertical baffles of 5.7cm spacing of size 30cm X 15cm X 26cm inside which anaerobic digestion takes place. Second compartment is acting as anaerobic reactor where an up-flow pattern is made with half the length and volume of the first compartment. Disinfection compartment is also having half the length and volume of the first compartment. They have ‘T’ shaped inlet and outlet pipes and are fitted with sampling ports to collect treated water. After being treated in the anaerobic reactor, as a second step, the treated effluent was disinfected in the disinfection tank which is the third chamber. Bleaching powder dosages used for treatment were 0.25gm/l, 0.50gm/l, 0.75gm/l, and 1gm/l. After each bleaching powder dosages samples were collected for the analysis. The collected effluents are analysed for various parameters.

As a first step, the synthetic wastewater was allowed to pass through septic tank system with vertical baffles. This septic tank has a series of compartments separated by baffle walls where the effluent from one compartment is directed downward to flow up through the settled sludge blanket of the next compartment in series. This experiment was conducted with different HRTs, 24 hour, 48 hour and 72 hour. And the effluent was collected at various HRTs. The collected effluents were analysed for BOD, Total coliforms, TSS, Ammonium Nitrogen, Nitrate Nitrogen and Phosphate according to standard methods. The effluent from this baffled anaerobic treatment tank is made to flow into the second chamber. The second compartment acted as anaerobic reactor filled with copper modified zeolite that acts as adsorbent as well as filter media on which attached growth process takes place. The crushed zeolite have a bulk density of 1.054kg/l, void ratio of 1.28, porosity of 0.56 and a specific gravity of 2.40.