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Sewage Disposal System

Introduction

Currently, world is facing treacherous problems associated with the treatment of wastewater as well as drinking water. In 2010, UNICEF published a report, which showed current status of the virtual water crisis in the world. It has been pointed out that more than 1.4 million children of age less than five years die every year due to diarrhea disease only, and this is the second largest cause of human death in the world. Situation is even graver in the developing countries, as the mortality rate was 1000/day in these countries for similar age group in 2014. This clearly indicates that the existing methods or technologies have completely failed to treat the wastewater to approved discharge standards.

Various processes have been developed to treat waste water, which includes activated sludge process, advanced oxidation process, aerobic granulation, bioreactors, trickle bed reactor, etc. Conventional water treatment plants are costly to construct and rely upon vast tracts of land for large settling and aeration basins, treated effluent does not meet BOD and COD targets and moreover one of major environmental challenge is generation and treatment of secondary waste. Advanced oxidation processes (AOPs) although making use of different reacting systems, are all characterized by same chemical feature; production of OH radicals. Advanced oxidation processes are defined broadly as those aqueous phase oxidation processes which are based primarily on generation and attack of hydroxyl radicals resulting in destruction of target pollutants. Some of AOP's which have shown considerable promise for waste water treatment applications, include cavitation, fenton chemistry and photocatalytic oxidation. Usually a combination of different AOP's has been found to be more efficient for waste water treatment as compared to individual oxidation process.

Cavitation is basically a phenomenon of nucleation, subsequent growth and implosion of vapour/gas filled cavities. It is a process of producing cavities, generated in low pressure region that is a throat or a contraction, because of pressure fluctuation when a fluid is flowing through a constriction. A principle type of cavitation includes acoustic, hydrodynamic, optic and particle cavitation. Acoustic and hydrodynamic cavitation generates desired intensity suitable for chemical and physical processing. However it has been observed that use of sono-chemical rectors pose significant problems for design and efficient operation at large scale operation due to substantially lower energy efficiencies and higher cost of operation. Use of hydrodynamic cavitation reactors which has been recently looked as an alternative to acoustic cavitation is an emerging technology

and there are no instances where these reactors have been investigated for sewage treatment applications.

Hydrodynamic cavitation is a technology that has been successfully developed at laboratory scale and it is also proven to be effective on pilot scale for various applications, viz. extraction, crystallization, degradation and water purification, biodiesel due to its intense effects in terms of mass and heat transfer at otherwise atmospheric conditions. Hydrodynamic cavitation can be generated using venturi, orifice plate, throttling valve and high speed homogenizer. However, it is still lacking in its implementation on large/commercial scale applications. Based on the primary objective, there is an urgent need to develop an affordable technology/process, which can disinfect water so as to avoid water borne diseases. As the major sources of water contamination can be agricultural runoff, human activities and industrial effluents, the new technology has to be capable of treating them effectively.

In the present work, various parameters have been investigated based on venturi hydrodynamic cavitation. Along with cavitation, chemical treatment such as ozone and hydrogen peroxide also being used to intensify the process. The optimized parameters such as pressure, ozone concentration, flow rate, H_2O_2 dosage and pH will be investigated in the future studies. The present technology is versatile, cost effective and energy efficient as well.

STP Facility

a) Sewage Water Input

Sewage wastewater has been collected from the spent water in Laboratories, wash water sinks in the college premises at NSAKCET Hyderabad campus. It has high value of COD, BOD along with odor and color. The initial COD of 1200 ppm. The BOD was content was about 10 ppm.

b) Ozone Generator

Ozone was produced on site using water cooled corona discharge ozonation (Capacity of 10g/hr max, Concentration of 50-100 gm/m^3) was procured from Ozone Engineers. Hydrogen Peroxide (30% w/v industrial grade, with remaining water) was used.

c) Analysis Method

Initial and final samples were taken and analyzed for BOD and COD. Chemical Oxygen Demand (COD) measurement were analyzed using a COD digester (Hanna Instruments, model no: HI 839800) with standard vials and a digital photometer.

Results: ***COD and BOD reduction***

The treatment effects in quantitative terms of COD and BOD reduction. The initial COD of 1200 mg/L with sewage was reduced to 200 mg/L after 45 mins of treatment. The BOD was also reduced from10 mg/L to 4 mg/L. The hydroxyl radicals generated due to hightemperature dissociation of water vapour inside cavities, degrade the organic contaminants present in the sewage by oxidizing them. The secondary radicals are also generated in the bulk water, which further enhances the degradation of pollutants.

Sewage of NSAKCET was efficiently treated using hydrodynamic cavitation and ozone. The foul smell emanating from the water was removed after 45 mins of treatment. These effects were sufficient for removal of color, bacteria [15] as well as organic contaminants present in the sewage. In scientific terms major reduction of COD (83.33%) and BOD (60%) was observed. The present work has enabled us to conclusively establish the efficacy of hydrodynamic cavitation reactors as compared to conventional sewage treatment methods. It can be said that hydrodynamic cavitation reactors offer immediate and realistic potential for scale up sewage treatment application.

Head **Principal**

Department of Civil Engineering