

Waste Water Treatment by Cavitation Method

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ABSTRACT

cavitation is the phenomenon of generation, growth and rapid collapse of the cavities in the fluid. In this work, the waste water coming out from the industries are treated by one of the advanced oxidation processes that is by cavitation method. In this cavitation process the waste water readings for pre-treatment and post-treatment will be compared by altering various operating parameters with main concentration on BOD, COD, TDS, TSS and pH as these are the major constituents in the waste water.

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I. INTRODUCTION

Generation of Hydrodynamic cavitation's: Hydrodynamic cavitation's can be generated by the passage of the liquid. This liquid should pass through a constriction such as venturi plate, orifice plate, venture or throttling valve. When the liquid passes through the constriction, kinetic energy or velocity of the liquid increases at the expense of the local pressure at the constriction. If the throttling is sufficient to cause the pressure around the point of vena contract (point of lowest local pressure) to fall below the threshold pressure for cavitation's (usually vapor pressure of the medium at the operating temperature), cavities are generated. Subsequently, as the liquid jet expands, the pressure recovers. This results in the collapse of the cavities.

II. LITERATURE SURVEY

Mojca Zupanc et al. (2012) state that due to insufficient wastewater treatment of various pharmaceutical residues enter in the environment. During conventional wastewater treatment to this pharmaceutical, many pharmaceuticals are not easily or readily degraded, therefore it is need to be investigated the advanced technologies to remove them. In this research work it examined the removal of pharmaceutical using a combination of hydrodynamic cavitation and hydrogen peroxide. They performed the experiments in distilled water under different operating conditions

Dhermendra K. Tiwari et al. (2008) carried out in the area of water purification, nanotechnology in Water Treatment offers possibility of an efficient removal of pollutants and germs. Today nanoparticles, Nano membrane and Nano powder

used for detection and removal of chemical and biological substances.

Parag R. Gogate and Aniruddha B. Pandit (2003) analyzed that due to the increase in various processing units in industries there are presence of various heavy toxic substances and large molecules in the wastewater streams, due to this the present conventional biological methods cannot be used for complete treatment of the effluent and hence, introduction of newer technologies to degrade these refractory molecules into smaller molecules, which can be further oxidize biologic

III. EXPERIMENTAL SETUP

The schematic diagram of a small-scale hydrodynamic cavitation reactor for waste water treatment by using cavitation's method is as shown in Figure 5.3. The setup consists of an orifice meter of 5 mm diameter, venturi plate of inside diameter 8 mm that operates at atmospheric pressure to be used. The tank (10 lit) is used for waste water storage and collection. The pump is use for circulation of waste water and valves are used for regulating the flow.

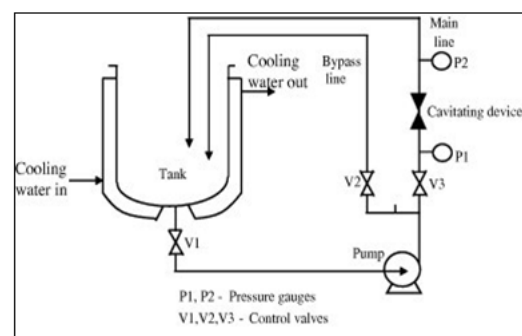


Fig 1: Setup of hydrodynamic reactor

Following are the specifications / operating condition of hydrodynamic reactor:

1. Pipe size- 1/2 inch.
2. Regulating valves –3 in numbers.
3. Feed Tank size – 10 liters.
4. Pump capacity – 150 LPM.
5. Number of orifice plate-1 number.
6. Number of venturi -1 in number.

IV. OPERATING PROCESS

After the successful setup there will be conduction of series of trial for analysis the effect of cavitating device on waste water by changing the various operating parameter with respect to time, following are the steps for operating process

Step 1: take 10lit waste water into the tank

Step 2: take venturi plate and place in union joint at shown in fig.

Step 3: start the pump

Step 4: regulate the flow rate Step 5: circulate water for 15-30min Step 6: check all parameter of waste water

V. CHECKING PARAMETRE

After collecting the samples of waste water passing from venturi and orifice meter the parameters to be analyzed for every 10 minutes intervals are pH, TDS, COD, and BOD. The same parameters values will be compared with the waste water treated by convention method in the industry. Hence the results of all parameters values of waste water treated with conventional method will be compared with the waste water treated by using cavitation method passing through venturimeter and also with orifice meter for every 10 minutes of treatment

VI. RESULTS AND DISCUSSION

After collecting the samples of waste water and giving treatment from all the three methods and the samples has been collected for every 10 minutes interval during 2ampath2t following are results obtained for all the parameters values

Results of waste water treatment by conventional method:

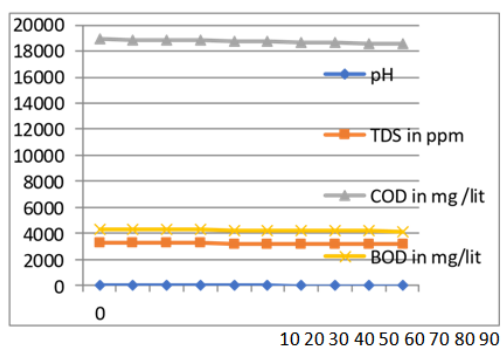


Fig 2: Changing Time (min) vs Reduction of pH, TDS, COD and BOD by Conventional Method.

Results of waste water treatment by using venturimeter

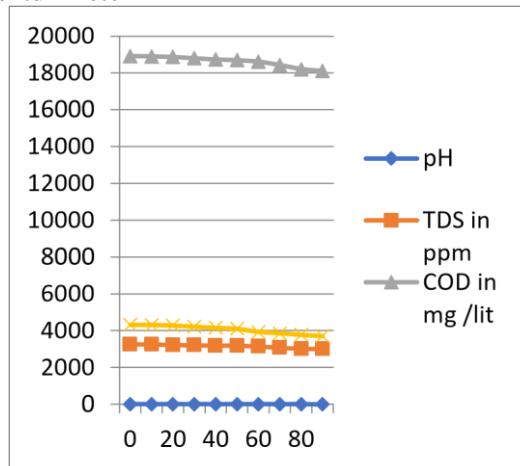


Fig 3: Changing Time (min) vs Reduction of BOD, COD, TDS and pH by venturimeter Method

Results of waste water by using orifice meter

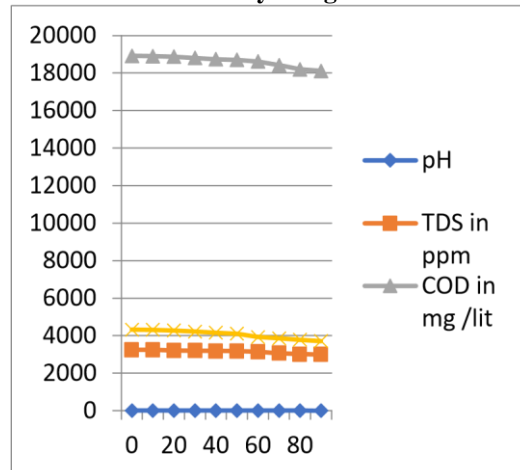


Fig 4: Changing Time (min) vs Reduction of BOD, COD, TDS and pH by Orificemeter Method

TABLE 1: Comparative results of all methods

Method	PH		TDS		COD		BOD	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
By Conventional	7.5	7.4	3250	3180	18920	18592	4318	4110
By venturimeter	7.5	7.35	3250	2995	18920	18110	4318	3710
By orifice meter	7.5	7.35	3250	2798	18920	17740	4318	3435

After the study of comparative results of graphs plotted for initial to final time for all three methods of waste water treatment it has been found that the cavitation method for waste water treatment shows better results over the conventional method of water treatment, from which especially cavitation method by using orifice shows the best results. Orifice method of cavitation showing improved results over venturi meter method because as the diameter of venturi is used as 8 mm compared with the orifice meter having diameter of 5 mm which results in more sudden contraction which results in more difference in inner and outer area of passage of flowing liquid which results in more generation of cavities hence more cavitation in orifice leads to better results over venturi meter method of cavitation.

VII. CONCLUSION

Based on the work carried out, followings conclusions are drawn; the cavitation method for waste water treatment shows better results our the conventional method. cavitation method can be use as a tertiary treatment to waste water. The cavitation method by using Orifice meter is proven to most effective our other two methods. The parameter such as TDS, COD and BOD shows effective changes to conventional method. Since the cavitation method is not using any chemicals addition for treatment of waste water hence it can directly release into the environment.

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