

WASTE WATER TREATMENT BY USING CAVITATION METHOD

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ABSTRACT:

Due to rapid industrialization and the advanced processing technologies adopted by the industries to fulfill the demands of ever growing populations, the waste water coming out from this industries are not very effectively treated by the conventional methods and this half treated effluent are directly released into the environment. Hence there is a need to introduced new advanced technology to treat the waste water and in this work the hydrodynamic cavitation method is selected to treat this waste water and the results obtained are compared with the conventional method.

KEYWORDS: Hydrodynamic cavitation (HC), Industrial Wastewater treatment, Total Dissolve Solids (TDS), Liquid Per Millions (LPM), Chemical oxygen demand (COD, Biological oxygen demand (BOD).

of that effluent to the environment when it is released in to the stream if not treated properly. The physical characteristics such as colour, odour, temperature, turbidity does not plays a vital role in polluting the stream but the chemical characteristics which includes total dissolve solids, pH value, chemical oxygen demand, bio-chemical oxygen demand plays a vital role in polluting the stream and extent and the type of treatment required for its safe disposal.

A. SELECTION OF PARAMETERS:

As stated above the chemical properties of the effluent are main concern for its safe disposal, hence for analyses we select the chemical properties such as pH, Total Dissolved Solids, Chemical Oxygen Demand (C.O.D) and Bio-chemical Oxygen Demand (B.O.D) to be analysed by using cavitation method for the treatment of waste water coming out from industry.

I. INTRODUCTION:

Availability of water is becoming an increasing concern in the globalized world, both in developed and in developing countries. A sustainable use of water sources could result in the search of additional water sources or even in recycling wastewater treatment plant effluents. The goal of biological wastewater treatment is a stepwise oxidation of organic pollutants aiming to achieve complete mineralization. Yet, numerous wastewater constituents are persistent to biodegradation or they are only subjected to minor structural changes instead of complete transformation into carbon dioxide and water. Alternatively, they may be eliminated by applying advanced biotic treatment processes such as membrane filtration, UV degradation, and ozonation, advanced oxidation processes, one of them being cavitations. It can be defined as the breakdown of a liquid medium under pressures or Cavitation is defined as the phenomena of the formation, growth and subsequent the collapse of micro bubbles or cavities occurring in extremely small interval of time(milliseconds), releasing large magnitudes of energy..

II. PARAMETERS TO BE ANALYSED:

The waste water coming out from industry has gone tremendous change in their physical and chemical characteristics. Depending upon the operation of the industry, physical and chemical characteristics of the effluent will vary and which ultimately decides the impact

III. METHODOLOGY:

As the cavitation method has been selected for treating the waste water collected from industry it is needed to setup a small scale hydrodynamic cavitation reactor for which a cavitation producing devices has be selected. For this project work we select the venturimeter and orifice meter as the cavitation producing devices for the small scale hydrodynamic cavitation reactor.

A. EXPERIMENTAL SETUP :

Following is the schematic diagram of a small scale hydrodynamic cavitation reactor for waste water treatment by using cavitations method. The setup consists of an orifice meter, 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.

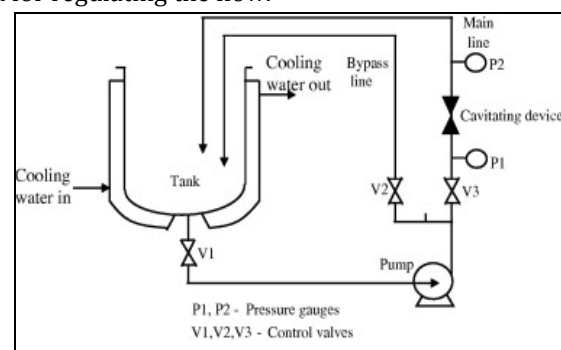


Fig 1: Setup of hydrodynamic reactor

B. CHECKING OF PARAMETERS:

After collecting the samples of waste water passing through secondary treatment from industry, the water is treated by cavitation method by 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.

IV. RESULTS AND DISCUSSIONS:

After collecting the samples of waste water and giving treatment from all the three methods for every 10 minutes interval following are results obtained for all the parameters values.

RESULTS OF WASTE WATER TREATED BY CONVENTION METHOD:

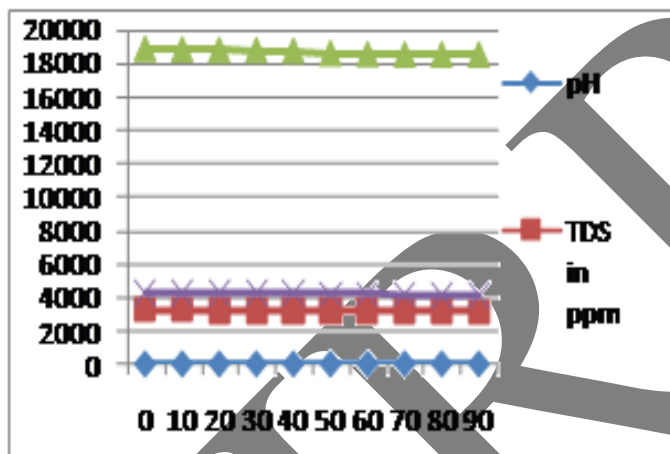


Fig 2: Changing Time (minutes) Vs. Reduction of pH, TDS, COD and BOD.

RESULTS OF WASTE WATER TREATED BY USING VENTURIMETER:

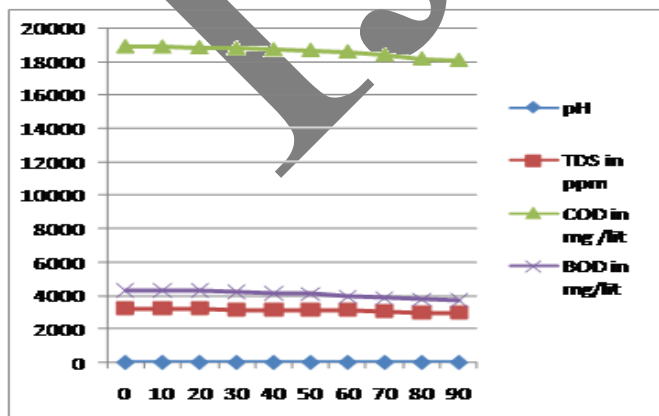


Fig 3: Changing Time (minutes) Vs Reduction of BOD, COD, TDS and pH.

RESULTS OF WASTE WATER TREATED BY USING ORIFICE METER:

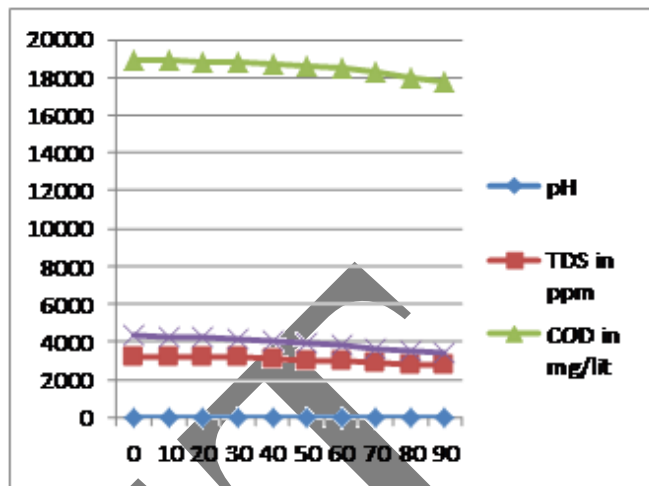


Fig 4: Changing Time (minutes) Vs Reduction of BOD, COD, TDS and pH.

TABLE I: 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 it has been found that the cavitation method for waste water treatment is showing better results over the conventional method from which especially cavitation method by using orifice shows the best results compared with the venturimeter method. In all three methods the pH value remains unaffected but rests all three parameters shows better results.

V. CONCLUSION:

Based on the work carried out, following conclusions are drawn; the cavitation method for waste water treatment shows better results over the conventional method. Cavitation method can be used as a tertiary treatment to waste water. The cavitation method by using orifice meter is proven to be most effective over the other two methods. The parameter such as TDS, COD, and BOD shows effective changes over conventional method. Since the cavitation method is not using any

chemicals addition for treatment of waste water hence it can directly release in to the environment.

ACKNOWLEDGMENT:

This paper would not have been come into reality without the able guidance, support and wishes of all those who stand by me in the development. I wish to give my special thanks to my guide, Prof.P.J.Salunke, for their timely advice and guidance.

REFERENCES:

- 1) *A Review of Imperative Technologies for Wastewater Treatment I: oxidation technologies at ambient conditions* Parag R.Gogate, Aniruddha B.Pandit Chemical Engineering Section, M.U.I.C.T., Matunga, Mumbai 400019, India April 2003.
- 2) *Hydrodynamic cavitation: a technique for augmentation of removal of persistent pharmaceuticals?* Mojca Zupanc Department of Environmental Sciences, Jozef Stefan Institute, Ljubljana, Slovenia.
- 3) *Cavitation as a Novel Tool for Process Intensification of Biodiesel Synthesis.* Mandar.A Kelkar, Parag R.Gogate and Aniruddha B. Pandit Chemical Engineering Department, Institute of Chemical Technology, of Mumbai, Matunga, Mumbai – 400 019.
- 4) *Effect of different design features of the reactor on hydrodynamic cavitation process* J. Ozonka, K. Lenik a,* aInstitute of Environmental Protection Engineering, Lublin University of Technology, ul. Nadbysztrzycka 38D, 20-618 Lublin, Poland b Department of Fundamental Technics, Lublin University of Technology, ul. Nadbysztrzycka 38D, 20-618 Lublin, Poland.
- 5) *Hydrodynamic Cavitation: for Water Treatment* Prof. Aniruddha B. Pandit Institute of Chemical Technology University of Mumbai India.
- 6) *Industrial Wastewater Treatment Using Hydrodynamic Cavitation and Heterogeneous Advanced Fenton Processing* Anand G. Chakinala¹, Parag R.Gogate², Arthur E. Burgess¹, David H. Bremner¹ Bremner School of Contemporary Sciences, University of Abertay Dundee, DD1 1HG Dundee, United Kingdom ²Chemical Engineering Department, Institute of Chemical Technology, University of Mumbai, Mumbai, 400 019 India.
- 7) Dr.R.K.Bansal, *A Textbook of Fluid Mechanics and Hydraulic Machines.*