Attached Growth System Assisted Oxidation Ditch

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Abstract— The Oxidation Ditch process is a version of the activated sludge process in which the wastewater is subjected to an extended period of aeration. Oxidation ditch is widely used treatment option adopted by many engineers and scientists for treatment of waste water, however research is still continued to make existing system more efficient. A lab scale model is developed which encompasses a normal oxidation ditch with introduction of some novel features. Biocarriers are introduced in Oxidation ditch. A biofilm is generated on surface of media which represents attach growth system. In this paper attempt is made to improve efficiency of Oxidation Ditch by combining suspended growth system with attached growth system. Lab study shows the enhanced performance of oxidation ditch model with domestic wastewater.

Key words: Oxidation Ditch, Growth System

I. INTRODUCTION

The oxidation ditch originally proposed by pasveer as variation of activated sludge system has been used for domestic waste water. The idea of using the process was observed by engineers who noted the simplicity of the aeration device and the container. The oxidation ditch is a biological treatment facility. In principle it functions through microbial growth in much the same way as activated sludge, trickling filter or contact stabilizer processes. There have been variations in the operation of the ditch that modify the original concept of pasveer. This paper analyzes the modifications of the process that characterizes existing oxidation ditch and recommends the most efficient method in operation of oxidation ditch. Many modifications were made in oxidation ditch in order to attain stringent effluent requirement such as introduction of media for purpose of attached growth system in oxidation ditch.

II. METHODOLOGY

The oxidation ditch which works on the principle of suspended growth process will reduce considerable amount of BOD and COD. To achieve higher efficiency in modified oxidation ditch biocarriers will be introduced. Two surface horizontal rotors will be provided for aeration purpose. Domestic wastewater parameters of influent wastewater will be analyzed before treatment. Once wastewater is introduced in ditch organic matter remains in suspension initially with bioreactions taking place in the ditch, biofilm will be created on the surface of biocarriers providing better biological action. Rate of digestion of organic matter will be increased leading to higher removal of BOD. Due to formation of biofilm on media amount of suspended solid in wastewater will be reduced. A comparative study will show increase in efficiency of modified oxidation ditch.

III. OBSERVATIONS

A lab scale model was developed with horizontal surface rotors for aeration. Domestic wastewater was treated in the lab model for varying detention time and rotational speed. Rotational speed was selected using visual indicator turbulence, rotor speed for optimum turbulence was selected. Efforts were made to lower the detention time and increase BOD, COD and TS removal efficiency. Model was tested for 12,15,18,21,24 and 27 hrs with rotational speed of 40, 50 and 60 pm. However it was observed that oxidation ditch gave best result at 24 hr and 50 rpm. Overall efficiency of model increased beyond 24 hrs but was very less compared to previous rate, also at 24 hr operation of oxidation ditch model becomes easy. It was also observed that variation in rotational speed did not have much effect on TS removal efficiency.

	40 rpm	50 rpm	60 rpm
12 hr	43.16	46.22	46.8
15 hr	49.04	49.42	52.52
18 hr	57.32	60.8	59.7
21 hr	66.68	68.8	69.2
24 hr	73.2	74.7	75.16
27 hr	75.6	76.4	77.3

Table 1: Average % Bod Removal At Varying Rotational Speed And Detention Time

	40 rpm	50 rpm	60 rpm
12 hr	49.04	53.08	56.56
15 hr	56.08	59	61.6
18 hr	62.5	65	67.08
21 hr	68.7	71.4	72.3
24 hr	75.8	77.5	78.4
27 hr	77.6	79.2	80.1

Table 2: Average % Cod Removal At Varying Rotational Speed And Detention Time

	40 rpm	50 rpm	60 rpm
12 hr	42.1	43.4	43.9
15 hr	48	50.5	51.3
18 hr	55	56.3	57.8
21 hr	59	61	62
24 hr	63.2	64.1	64.8
27 hr	65.5	66.4	66.8

Table 3: Average % Ts Removal At Varying Rotational Speed And Detention Time

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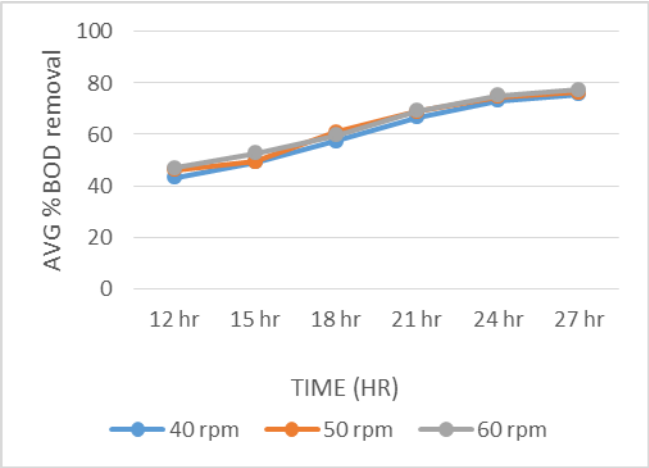

Fig. 1: Average % BOD Removal vs Detention time at 40,50 and 60 rpm

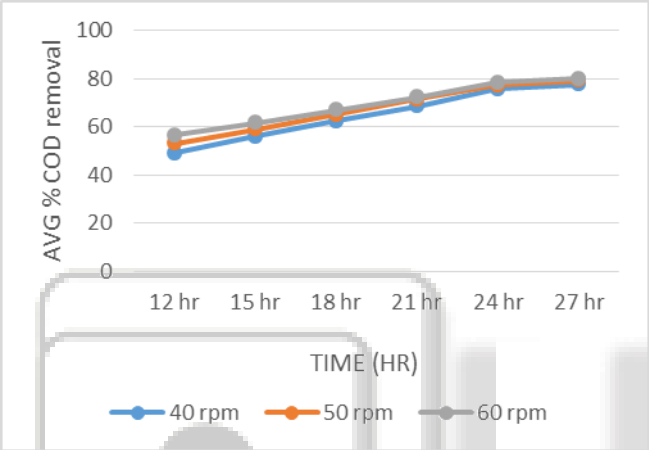

Fig. 2: Average % COD Removal vs Detention time at 40, 50 and 60 rpm

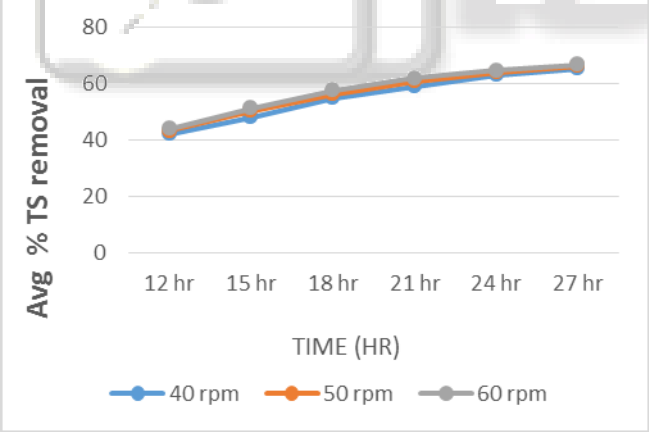

Fig. 3: Average % COD Removal vs Detention time at 40, 50 and 60 rpm

IV. Result and Discussion

The lab scale model was tried for different rotational speed and detention time in order to find optimum combination. By analyzing turbulence factor 40, 50 and 60 rpm were selected and wastewater was treated for time of 12,15,18,24 and 27 hrs. The optimum combination of 24 hr and 50 rpm resulted in removal efficiencies of BOD, COD and TS as 74.5%, 77.3% and 64.1% respectively.

V. Conclusion

From this study it was concluded that combination of attached growth system and suspended growth system in an oxidation ditch gives effective increase in removal efficiencies of BOD, COD and TS.

VI. Acknowledgement

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