

# Treatment of Waste Water by Using Rotating Biological Contactor (RBC)

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**Abstract**— As the whole world is facing water scarcity due to global warming and other reasons; many cities, nations are running out of water, the only source of water is in the form of precipitation or we can say rainfall. As the world population is growing rapidly, demand of water is also increased. Generally 80-85% of total water supplied is converted into waste water. Due to climatic changes rainfall intensity is not constant and it is not fulfilling requirement of water for the various purpose. And due to excess use of ground water, ground water level is so decreased that around 21 cities including few states in India are likely to run out of water by the year of 2020. To reduce/overcome such water crises, we have to recycle the waste water. Therefore, an attempt has been made in this paper to design the RBC to treat the waste water. RBC has several advantages over the conventional treatment processes like ASP SBR etc. (i.e. Low land requirement, simplicity, low energy requirement, no recirculation of secondary sludge.) This paper focuses on the working of RBC and the efficiency for removing various impurities when the media is 40% immersed in the waste water. For this study, a glass tank of total volume of 270 liter and effective volume of 190 liter is fabricated. 10 HDPE discs as a media were mounted on rotating shaft and the distance between two discs was 50 mm. Media rotates at 10 rpm for 2 hours, after completion of process tests are carried out. Impurities removal efficiency was found more than 80%.

**Keywords:** Rotating Biological Contactor, Domestic Waste Water, Treatment, COD, BOD, TSS & DO

## I. INTRODUCTION

In today's life water pollution and water scarcity is the major issue which is getting bigger worldwide. Nearly about 80-85% of the Water supplied to the community is converted in the waste water; such waste water may come from kitchen, wash basin, toilet and bathroom. It is having more than 99% of water, but remainder is dissolved solids, suspended solids and other micro-organism which are harmful to the human as well as other living creature. Hence such waste water should be treated and then it should be discharged into streams or we can reuse it for the recreational purpose.

For treatment of waste water there are several treatment methods that are adopted worldwide i.e. activated sludge process, sequential batch reactor, trickling filter etc. but Rotating Biological Contactor is one of the most beneficial and more reliable method than the above mentioned methods.

## II. INTRODUCTION OF RBC

Rotating Biological Contactor is commonly used to treat the wastewater. The first RBC system was used in early 1900's and wooden slats were used as media, due to clogging problem wooden slats were replaced by metal discs in the 1930's, after innovation these discs were replaced by

polyethylene to reduce cost of fabrication, these discs mounted on horizontal shaft which rotates about its axis. The discs used as media are partly submerged in wastewater and partly exposed to the air. Then shaft is rotated about 1-10 rpm with the help of compressed air or motor. As the disk rotates, the micro-organism attached as biofilm alternatively immersed in the waste water gets the oxygen from the atmosphere and makes the whole process in aerobic condition. Basically the Rotating Biological Contactor is based on the principle of bio absorption.

RBC is attached growth system in which the micro-organisms are attached to the media. Main advantage of attached growth system is that micro-organisms can't get easily washed out when flow is high unlike the suspended growth system.

RBC has some advantages as follow:

- RBC's are capable of handling wide range of flows.
- Lower power consumption.
- Operational cost is low.
- No skilled supervision required.

However, there are certain limitations which include:

- Additional dissolved oxygen cannot easily be provided to the micro-organism.
- Continuous power supply is required
- Requirement for covering RBC units in northern climates to protect against freezing.

## III. OBJECTIVES

- To design lab scale model of Rotating Biological Contactor.
- To Study of controlling parameter of Rotating Biological Contactor.
- To investigation of performance of Rotating Biological Contactor for waste water treatment.

## IV. MATERIALS AND METHOD.

### A. Influent Characteristics of Waste Water

The waste water was collected after the screening unit. Characteristics of waste water were found out before the treatment.

Following values were obtained,

Sr. no.	Parameter	Obtained value	Unit
1	pH	6.88	-
2	TSS	145.0	mg/l
3	COD	464.0	mg/l
4	BOD	135.0	mg/l
5	DO	1.3	mg/l

Table 1: Characteristics of influent waste water.

### B. Fabrication of RBC Unit

A single stage RBC unit was fabricated using glass for making tank, and High Density Polyethylene circular disc of

3mm thickness. The dimension of unit/ tank was 0.75m X 0.6m X 0.6m with an open slots of 0.150m X 0.150m on opposite face of tank for adjust the submerging area of discs. The overall capacity of tank was 270 liters and effective capacity was about 190 liters. Provision for inlet and outlet was also made. An opening was provided at the bottom of tank for sludge removal.

There are 10 discs mounted over the shaft, diameter of discs was 0.450m and spacing between two discs was 50mm.

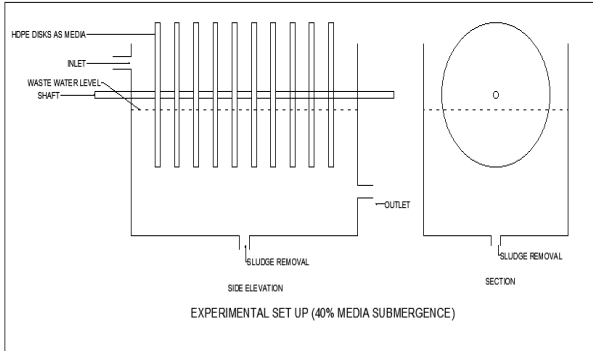


Fig. 1: Schematic diagram of RBC model.



Fig. 2: Fabricated RBC model (front View)



Fig. 3: Fabricated RBC model (Top View)

### C. Experimental Setup

single stage RBC reactor of total volume 270 liters and working volume was 190 liters. Tank was constructed with glass, for media HDPE discs were used, diameter of discs was 0.450m. Here discs were rotated at constant speed of 10 rpm, for shaft rotation a DC motor of 60 rpm was used and to control the rotational speed a chain assembly and a bug convertor was used. The discs were submerged 40% in the waste water. As the shaft rotates the discs gets oxygen from the atmosphere and mixes in the waste water, then a thin layer

is formed on the disc which is called as biofilm, which helps for the treatment of waste water. Whole treatment was done at normal room temperature i.e. 27°C and hydraulic retention time was 2 hour.

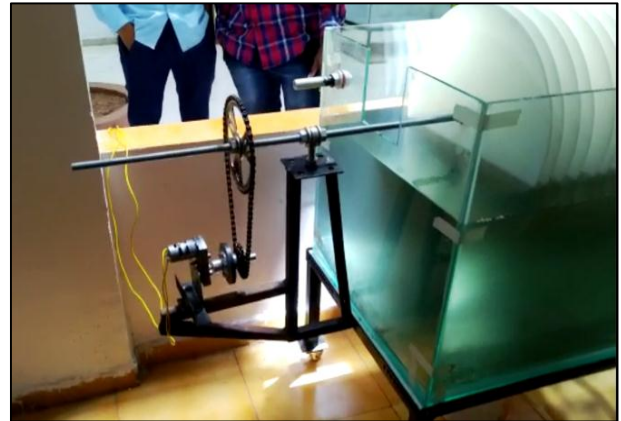


Fig. 4: Experimental setup



Fig. 5: Experimental setup



Fig. 6: Experimental setup

### D. Analysis

After treatment, treated sample was collected and tests were carried out same as of untreated waste water sample i.e. pH, TSS, COD, BOD & DO.

## V. RESULT AND DISCUSSION

The study was carried out to know the efficiency of RBC for treating the waste water. Following results were obtained.

Sr. No.	Parameter	Influent	effluent	CPCB Values (Max.)	Unit
1	pH	6.88	7.1	9	-
2	TSS	145.0	27.2	600	mg/l
3	COD	464.0	99.2	250	mg/l
4	BOD	135.0	26.19	350	mg/l
5	DO	1.3	4.35	4	mg/l

Table 2: Influent, effluent characteristics of waste water compared with CPCB recommended values.

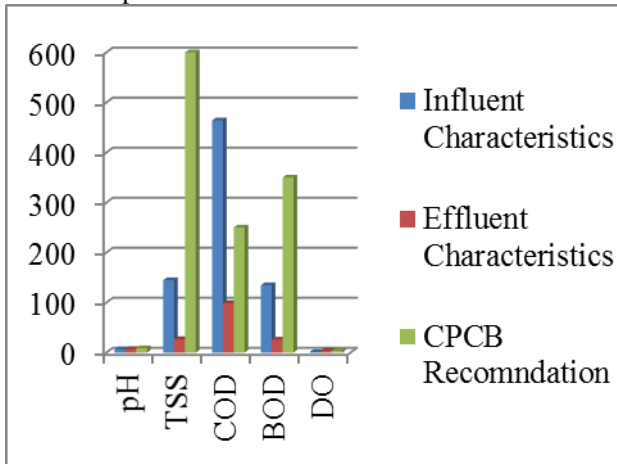


Chart 1: Influent, effluent characteristics compared with CPCB recommended values.

Efficiency for TSS, COD & BOD removal was found to be 81.24%, 82.5%, 80.6% respectively and increase in DO was observed about 235%.

## VI. CONCLUSION

- Lab scale model of RBC was designed and it was working properly.
- Controlling parameter such as speed of rotation, HRT, etc. was studied.
- Overall efficiency of RBC was found more than 80% for waste water treatment, all the parameters of treated waste water lies within CPCB standard.

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