

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 8, Issue 7, July 2019

## Modified Rotary Biological Contactor using Bio-Media in Dairy Wastewater Treatment

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**ABSTRACT:** Dairy industry is one of the biggest industries in India next to the sugar industry. The rural Indian economy is largely dependent on this industry. As this wastewater contains protein, fats; which are organic in nature and biodegradable and create colour and turbidity. Irrigation utility of treated dairy wastewaters is a common discharge alternative but treatment need to be extended up to Tertiary Treatment. Rotary Biological Contractor (RBC) is one of biological methods available for treatment of wastewater. RBC is a low cost, natural and energy saving technology for wastewater treatment. The study focused on the efficiency of modified RBC with respect to BOD, COD, and TS of wastewater and design of RBC for improvement of efficiency. The water sample used in this study is collected from Katraj dairy. A laboratory scale Rotary Biological Contractor assembly was designed and tested on site. A use of banana leaves was adopted as biological media which was sustained up to 20 days against disintegration. The model was operated at detention time of 24 hours and rotational speed of 10 rpm. The analysis the performance of waste water sample was carried out on the basis of different parameter like BOD, COD and TS are performed.

**KEYWORDS:** Banana leaves, Biological treatment, Dairy wastewater, Rotating Biological Contractor

### I. INTRODUCTION

India has a large market of dairy products due to the increasing demand for variety of milk products in the urban as well as rural sectors.(Verma, Singh, Mathur, & Atri, 2012).By increasing the demand of various dairy product the large amount of waste is generated from dairy industry due to their operational process. The dairy waste possess protein, fats, organic and inorganic matter oil and grease.(Leena, Meiaraj, & Balasundaram, 2016).Therefore treatment of dairy waste has given importance and care should be taken before disposing to environment. It depends on the milk process and the operation unit and manufacturing process of milk product.Hence it is necessary to treat the wastewater before discharge to the environment. There are various type of Secondary treatment used now a days widely because of low cost and effectiveness. The various method are available to treat the wastewater .The Rotatory biological contractor is low cost energy saving technology give the best result. (Birwal, G, Priyanka, & SP, 2017)A rotating biological contactor (RBC) is aBiological treatment that offers asubstitute technology to the conventional activated sludge process. Because RBC has several advantage then activated process like it required less power consumption, low surface area , no silk person will required because of theselow maintenance and operation cost it generated low amount sludge.

### II. LITERATURE REVIEW

(Kamath et al., 2018)has performed experimental study and designed the RBC plant.The study area taken is Mahanand farm at Mumbai, Goregaon.This paper deals with application of RBC in dairy farm trade.The treatment plant currently used ancient technique of activated sludge method, the objective of this study is designed of unit treatment plant exploitation by rotating biological contactor.(Shete,Bharati & Shinkar, 2013) Explained the various processes are concerns farm trade and from that operational processes the kind of waste generated,the sources of

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wastewater in several units of dairy industry and their impact on the environment. They recommended that using coir as a media the affordable and pronto accessible material during a fixed film fixed bed reactor for dairy industry to reduce the losses to be developed to the ecosystem that is useful in protecting the environment. (Nitin, Hampannavar, Gadag, Pradeep, & Vishal, 2013) has developed the 3 stage lab scale RBC reactor. Were experimental can administrated to determine the COD removal efficiency of RBC reactor for wastewater treatment of dairy industry. They additionally analyzed that at totally different interval hydraulic loading and the concentration of COD. The study was administrated to know the performance of the RBC and to guage the practicability of the RBC to treat dairy wastewater (Cortez, Teixeira, Oliveira, & Mota, 2008) studied regarding the performance of Rotating biological contactors (RBC). This paper offer data regarding the various parameters however have an effect on performance like flow rate, bacterial growth, inlet and outlet characteristics of wastewater, staging, temperature and their impact on RBC plant. (Mba & Bannister, 2007) Have studies the performance of RBC and issue affecting the RBC operation process. They offer detail cause for defects related to RBC's this paper mentioned a completely unique designed approach for shaft less RBC's. This paper design takes of the operation and reasons for system failure, thereby reducing prevalence of depletion operation of RBC units and make sure that wastewater continuously meets discharge standards.

## III. MATERIAL AND METHODOLOGY

### 3.1 Sampling:

Samples were collected from Dairy Industry located in Pune, Maharashtra, India. The capacity of dairy unit was 3 lakh litres per day. Accordingly the effluent was found to be generated around 2 lakh lit/ day. The reconnaissance survey was conducted to identify sources of effluent generation. The samples were collected from common sump. The effluent from various processing stages like vehicle cleaning, tank cleaning, processing section etc. was collected in this tank. Sampling and characterization was carried out as per APHA guidelines.

To collect the sample, the container of glass material was rinsed by dilute nitric acid and then distilled water. The samples were carried out through icebags and then preserved below 4 degree Celsius.

### 3.2 Characterization:

The characterization was carried out at two stages, once that of untreated samples and the other after treatment.

**Biological Oxygen Demand (BOD):** Is the quantity of oxygen needed by organism. It is a chemical process for determinant the quantity of dissolved oxygen element required by micro-organisms in a very body of water to interrupt down organic material gift in a very in a wastewater at sure temperature over a selected fundamental measure.

**Chemical Oxygen Demand (COD):** Higher COD level mean a larger quantity of reactive organic material within the sample, which is able to cut back dissolve chemical element level. The COD check is usually us as associate alternate to BOD because of shorter length of treating time

**pH:** Is an important factor in wastewater treatment which is serve as index for pollution. It plays an important role in both chemical and biological wastewater treatment systems. pH scale will have effect on the biological reaction in wastewater and growth of being. In order that hydrogen ion concentration are going to be maintained

**Total Dissolved Solid (TDS):** By definition, the solid contained within the filtrate that passes through a filter with traditional pore size of 2.0 micrometre. Is a measure of the dissolved combined content of all inorganic and organic substance present in a liquid in molecular, ionized or micro- granular suspended form. The principal application of TDS is within the study of water quality for streams, river and lake.

Analysis the performance of waste water sample on the basis of different parameter and method will be used for pre-treatment like

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**Table No.1: Different parameter and method**

SR. NO	PARAMETER	METHODS
1	pH	Electrometric method
2	TDS	Electrometric method (Digital Portable device)
3	Dissolved Oxygen	Idoimetric method
4	Biochemical Oxygen Demand	Idoimetric method
5	Chemical Oxygen Demand	Open reflux method
6	Nitrate and phosphate content in sample	spectrophotometric method

### PART B

#### Lab Scale Experimental Set –Up of RBC

##### Designed Material and Fabrication of Model

For this study the raw water samples were collected from katarj dairy industry at Pune and analysed the parameter in the laboratory. A laboratory scale model is prepared.

The concept design consists of circular drums cast out of plastic which is placed in container in a concentric fashion where banana leaves are to be placed as bio-media

The circular drum length = 34cm, Diameter = 21cm

The drums connected in such way that they are welded to the steel shaft of

Diameter = 6mm, length = 40cm

A coupler of length = 6.5cm

One end of steel shaft is connected to the DC Geared Motor (steel body) of = 12V 3 Ampere

The drum rotated at 10 RPM through coupler for maintain the rotational speed.

This assembly is held over by the edges of a steel cage of size = 50 x 30 cm.

The detention basin is of plastic container placed inside off the cage below the drum assembly. Size of detention basin = 90 x 70 cm

The edge consisting of the motor also holds the AC to DC converting circuit. AC adapter = 100-240VAC, 1.0 A, 47-63 Hz

About 40% of the circular drum area is submerged in the wastewater.

As the drum starts rotating it is exposed to the atmospheric air. A slime layer is formed at the surface of circular drum where microorganisms are attached to that surface. As it is exposed to air the oxygen is consumed by microorganisms to degrade the organic and inorganic matter present in wastewater.

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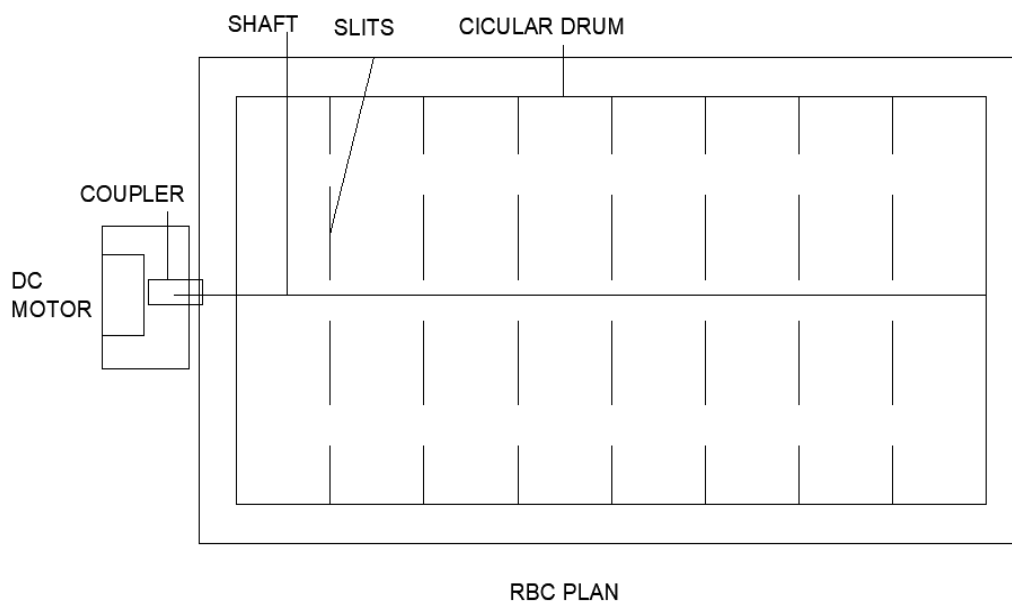
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**Table No.2: Description of Designed Parameter**

SR.NO	PARAMETER	Unit	DESIGNED VALUE
1	Diameter of disc	Cm	21
2	HRT	Hrs.	24
3	Rotation	Rpm	10
4	Submerge fraction	%	40



**Figure1: Plan section of RBC**

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Figure2: Experimental Set –Up of RBC

## IV. RESULT AND DISCUSSION

On the basis of experimental work we analysed the different characteristics like pH, TDS, BOD and COD to know the concentration of this parameter in wastewater so that to improve the quality of wastewater. We check inlet result to know whether the parameter are in acceptable limit or not and then compare with the result of RBC method (post characterization) to improve the quality of wastewater.

Table No.3: Concentration of different parameter of dairy effluent

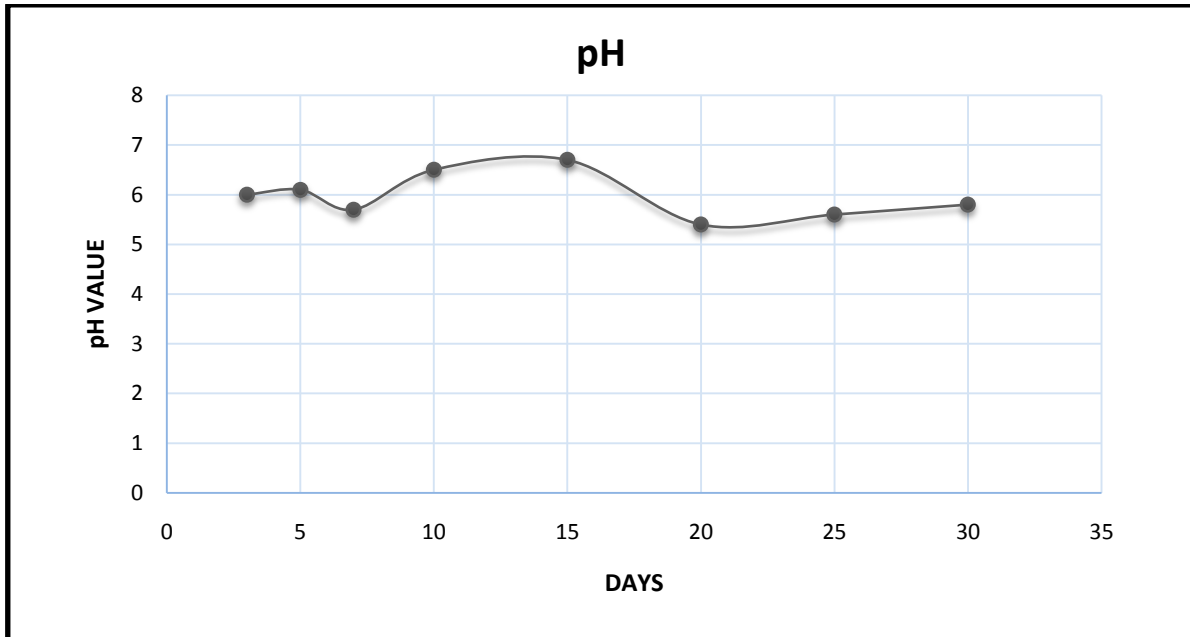
PARTICULARS	MONITORING AT	pH	TDS Milligram/ Liter	BOD <sub>5</sub> Milligram/ Liter	COD Milligram/ Liter	SLUDGE OBSERVED
RBC + Banana Leaves	NO.OF DAYS	6.8	310	134	1000	EXTREMELY LOW
	3	6.0	230	120	970	
	5	6.1	140	118	820	
	7	5.7	110	90	650	LOW
	10	6.5	90	42	550	
	15	6.7	78	30	475	
	20	5.4	81	28	315	LOW
	25	5.6	95	20	228	
	30	5.8	102	22	185	

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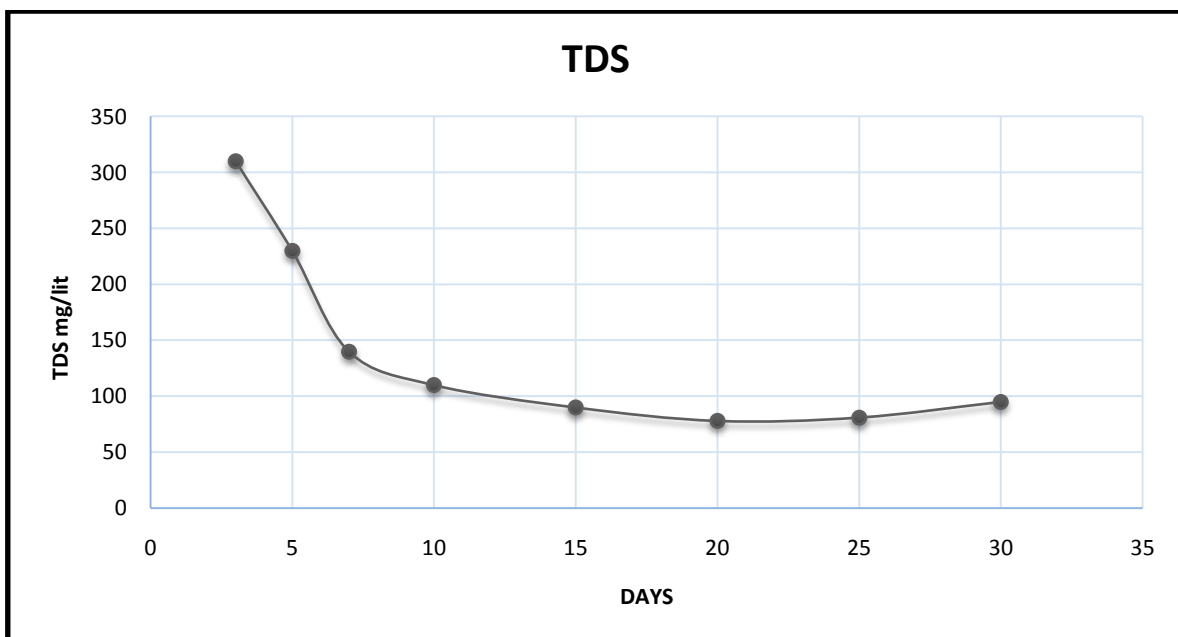
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Graph 1: Showing the pH Variation



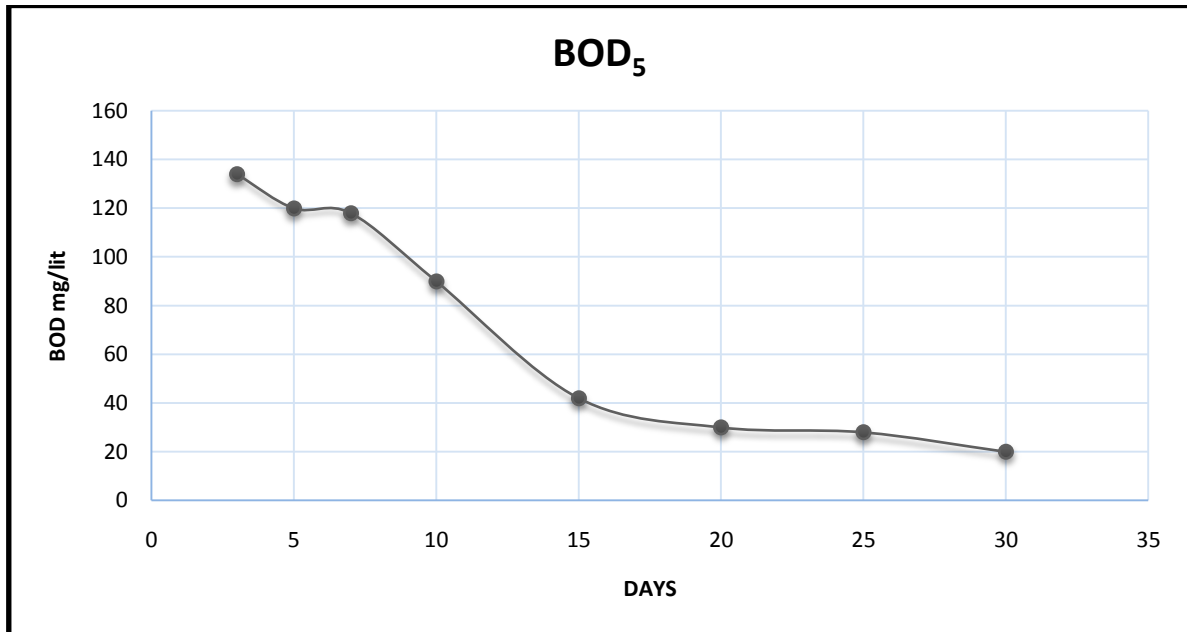
Graph 2: Showing the TDS Variation

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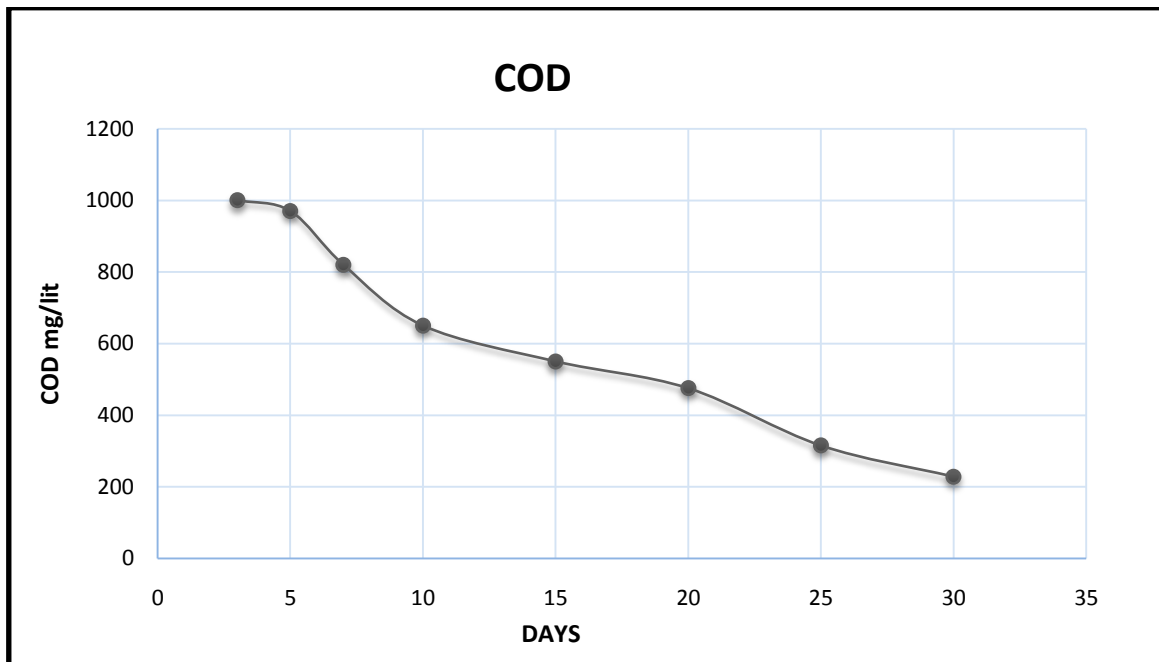
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Graph 3: Showing the BOD<sub>5</sub> Variation



Graph 5: Showing the COD Variation

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## V. CONCLUSION

Based upon the observation and result this study give the information about amount of waste generated by dairy industry and quality of wastewater. RBC is an best method to treat the wastewater hence it required less area, low power consumption it is easy to maintain and operate no skill person will be required so that it gives alternative technology to conventional activated sludge process Due to the changes in the design of Conventional RBC with the introduction of silts through which air is provided were banana leaves are put as bio-media there was considerable increase in the removal efficiencies. Therefore for small wastewater treatment plant, we can use the RBC treatment so that capital cost of plant will reduced.

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