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Original Research Paper

Treatment of Grey Water By Modified Rotating Biological Contactor (RBC)

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RBC
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Grey water
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ABSTRACT

The laboratory model of Rotating Biological Contactor (RBC) used in grey water treatment was a modified one, in respect of the reactor. The reactor had four blades each of size 350 mm × 100 mm attached to a shaft at an angle of 90º. The partially treated effluent from RBC was allowed to pass through three columns of filter connected in series. The experiments were run for two different filter media namely, granite, stone and coal separately. The experiment was conducted for different influent substrate concentrations and different speeds of rotating blades. Among the different speeds of rotational blades in treating grey water, the rotational speed of 3 rpm was found to yield better percent removal of COD, BOD, TSS, turbidity, *E. coli*, faecal coliforms, and total coliforms than the rotational speeds of 4.5 and 6 rpm.

INTRODUCTION

Grey water is used household water which has not come into contact with toilet waste. Water usage in an Indian residential building is 41% for bathing, 22% for toilet flushing, 15% for laundry, 14% for cleaning, sprinkling and other miscellaneous purpose, 4% for kitchen and 4% for drinking. Increasing the grey water reuse by lowering freshwater use for irrigation is an important step towards better environment and resource management (Jepperson & Solley 1994). Rotating Biological Contactor (RBC) is being used in treating grey water in Arab countries, Israel and Germany.

MATERIALS AND METHODS

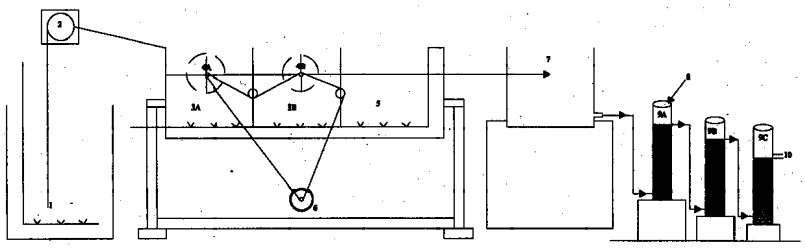
Experimental Set-up

A two-stage RBC model followed by settling facility having 140 litres effective capacity was used in the study. The effluent from the RBC was allowed to pass through three columns of filter media. The experiments were conducted for two different filter media; in the first case with all the three columns packed with granite stones, and in the second case with all the three columns filled with coal. The grey water used in this study was collected daily from a group of residential buildings.

The raw grey water was pumped at a predetermined rate to the model by a peristaltic pump. The schematic diagram of experimental set-up of the modified RBC is presented in Fig. 1. The average composition of the grey water is given in Table 1.

Methodology

The model was run for a flow rate of 0.100m^3/day at three different speeds of the rotating blades (3, 4.5 and 6 rpm) and allowed to pass through three columns of filter filled with stones in one case and



1) Grey water mixing- supply tank
2) Peristaltic pump; Miclins/15pp
3.A,B) Stages of RBC
4.A,B) Rotating blades
5) Clarifier
6) Geared motor- pulley assembly;1HP
7) Effluent collection tank
8) Filter- circular column of size(1000mm x300mm)
9.A,B,C) Containing filter media of Granite, coal of size 18mm,12mm & 8mm
10) Treated grey water

Fig. 1. Schematic diagram of experimental set-up of RBC (140-litre capacity).

with coal in the other case. The samples were analysed for various physical parameters such as turbidity, TSS as per procedures given by APHA (1995) and Trivedy & Goel (1986). For microbiological analysis untreated and treated grey water samples were collected in sterilized neutral glass bottles. MPN of coliforms was determined using MacConkey's broth using multiple tube fermentation technique at 37°C for 48 hours. MPN of coliforms was found in terms of Index/100mL by using standard tables (APHA 1995).

Table1. Physical and chemical composition of the grey water.

Parameter	Average Concentration
Turbidity	62, NTU
Total suspended solids (TSS)	188, mg/L
Chemical oxygen demand (COD)	600, mg/L
Biochemical oxygen demand (BOD)	492, mg/L
Eschericia Coliform (*E. coli*)	420, MPN/100mL
Faecal Coliform (FC)	194, MPN/100mL
Total Coliform (TC)	690, MPN/100mL

RESULTS AND DISCUSSION

The experimental results reveal that the rotational speed of blades affected the performance of the model as also reported by Nehru Kumar (2005). An increase in the rotational speed decreased the removal percentage of BOD, COD, TSS, turbidity and microorganisms. The laboratory model combines the biological treatment (RBC) with physical treatment (filter media of stone or coal). The results of physico-chemical and biological analysis are given in Table 2 and shown in Figs. 2 and 3.

Table 2: Physico-chemical and biological analysis of untreated and treated grey water.

S. No	Parameters	Unit	Stone						Coal					
			3rpm		4.5 rpm		6rpm		3rpm		4.5rpm		6 rpm	
			In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
1.	Turbidity	NTU	62	11	54	10.2	53	10.4	62	10	53.1	10.4	53	11
2.	TSS	mg/L	185	15	172	14	183.2	15.1	185	14.2	175	14.2	188.4	15
3.	COD	mg/L	561	91.8	539	92	600	159.2	561.4	13.1	545	36.5	597	93.5
4.	BOD	mg/L	485.3	70.3	429	67	489	124	492.4	17	438	26.5	482	72
5.	*E. coli*	MPN/100mL	394	72	377	82	326	80	420	76	387	82	340	82
6.	Faecal Coilform (FC)	MPN/100mL	165	34	174	39	169	43	194	39	174	37	179	45
7.	Total Coliform (TC)	MPN/100mL	650	90	626	95	633	85	682	50	690	65	636	80

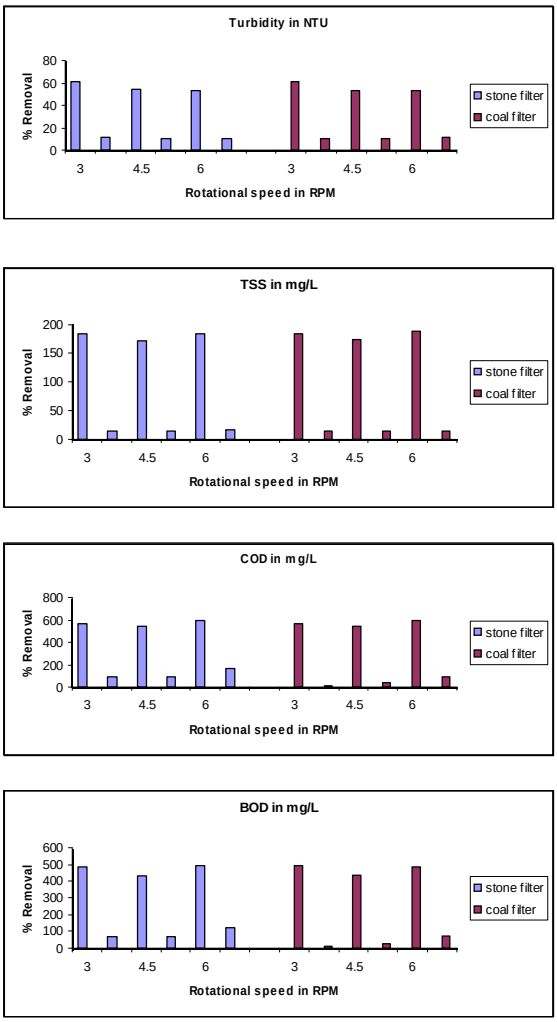


Fig. 2: Physical and chemical quality of grey water (influent and effluent) in the treatment process.

The laboratory model produced effluent of improved quality and was very efficient in TSS, turbidity and BOD removal at 92%, 83%, and 96% respectively. COD removal was 94%. Total coliform removal was 93% at a rotational speed of 3 rpm with coal as filter media. The present study shows that with proper management, grey water can be used for irrigation/gardening without any risk. Among the three rotational speeds of blades i.e., 3, 4.5, and 6 rpm, the blade rotational speed of 3 rpm was found to give better results.

CONCLUSION

Safe use of grey water can benefit a drought-stricken community. It can be concluded that there is an urgent need for more information about the characteristic of grey water in order to be able to evaluate the potential for reuse and infiltration. Reuse of grey water after treatment is urgently needed

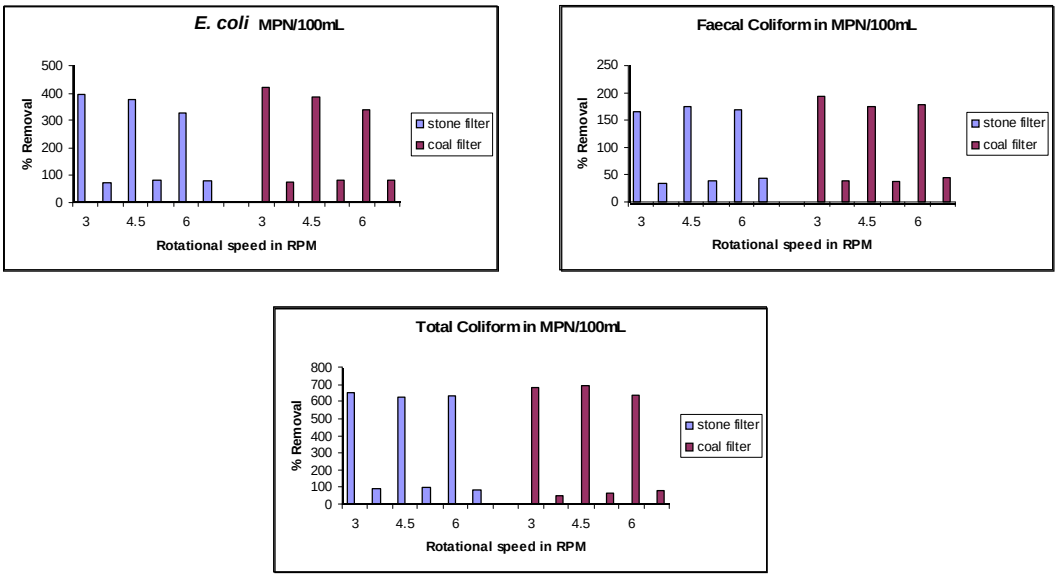


Fig. 3: Biological quality of grey water (influent and effluent) in the treatment process.

because of the general scarcity of water in India. On site reuse of treated grey water will reduce the water consumption for gardening and landscape irrigation considerably (Friedler et al. 2005). The results of grey water characteristics reveal that the concentrations of the parameters tested are acceptable. The present study on grey water treatment shows that, with proper management, grey water can be used for landscape irrigation. It is considered as a new source of water use for irrigation purposes.

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