Treatment of wastewater from animal glue manufacturing

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REACHING THE UNREACHED: CHALLENGES FOR THE 21ST CENTURY

Treatment of waterwater from animal glue manufacturing

K. Karthikeyan and K. Gopalakrishna**, India*

THE ROTATING BIOLOGICAL contactor process is a low cost treatment system and has become very popular all over the world due to advantages like relatively low reactor volume with large microbial population in the attached media, ease of separation of sludge and comparatively low power consumption and no odour nuisance.

A laboratory model of rotating biological contactor was fabricated with discs made up of Asbestos. The discs had a diameter of 0.28 m and a submergence of about 40 per cent in the waste water.

Composite wastewater generated from an Animal Glue manufacturing unit located near Madras wasused for the studies. The real field condition, was created by procuring daily the fresh waste watergenerated from the industry.

As the BOD of the waste water is very high in the range of 2000-3000 mg/l, to simulate this condition the waste water was diluted to 1:1 ratio before feeding to RBC under assumption that it hasachieved 50 per cent BOD removal anerobic treatment.

The dimensions of the rotating biological contactor is given below.

To develop the biomass 10 per cent cowdung slurry was fed into the unit initially. Necessary nutrients like Lactose, Magnesium chloride, calcium chloride were added in small amounts and the discs were rotated at a nominal RPM till a substantial biofilm was observed. A good biofilm of about 2mm average thickness was seen at the end of 10 days. After formation of biofilm acclimatisation was carried out by gradual feeding the waste water collected from the glue industry and the experiments were conducted for varying hydraulic loading rates, organic loading rates, and rotational speeds. The parameters ofstudy included 5-day BOD, COD, Total dissolved solids and pH. Tests were carried out as per standard methods of analysis.

The experiment were conducted for three different hydraulic loading rates with three different rotational speeds of the bio discs. At 5 RPM, and with the hydraulic loading rates varied as 0.026$m^3/m^2/day$, 0.039 $m^3/m^2/day$ and 0.068 $m^3/m^2/day$, the BOD removals were found to be 97 percent, 92 percent, 75 percent respectively. The COD removals were 92.9, 79.8, 67.4 percent respectively.

When the rpm of the biodisc was increased to 14 rpm and the hydraulic loading rates maintained at 0.026 $m^3/m^2/day$ 0.039 $m^3/m^2/day$, 0.068 $m^3/m^2/day$, the BOD removal efficiencies were found to be 97.6; 93.4, 77.2 percent respectively and the COD removal efficiencies were 93.5, 81.7, 69.1 percent.

The rpm was further increased to 18 rpm and similar hydraulic loading rates were repeated. The BOD removal efficiences were observed as 98, 95.5, 79 percent respectively. The COD removal efficiencies were 95.1, 83.2, 71.2 percent.

The effect of varying organic loading was studied and the results were reported. When the organic load was 20.3g m^2/day with the rotational speed of 5 rpm, the BOD removal was found to be 97 per cent. An effective removal of 93.4 percent was observed when the organic load rate was increased to 32 $g/m^2/day$ and further reduced to a 75.6 percent to a loading rate of 75.6$g/m^2/day$.

When the rotational speed of the bio-discs were increased to 14 rpm the BOD removal efficiency increased to 97.6 percent for the organic loading rate 20.3 g BOD/m^2/day and 94.4 percent and 77.2 respectively for the organic loading rate of 32 $g/m^2/day$ and 71g $d/m^2/day$. Similarly for the rotational speed of 18 rpm, the BOD removal efficiencies were observed to be 98 perent, 95.5 percent and 79 percent repetitively for similar organic loading rates.

Table 1. Dimensions of the rotationg biological contactor laboratory unit

Number of Discs	14
Diameter of the discs, m	0.28
Spacing between the discs, m	0.02
% submergence of the disc,	40
Surface area of the discs, m2	1.742
Rotational speed	5 rpm - 18 rpm

Table 2. Characteristics of composite waste water

SNo.	*Parameter*	*Value*
1.	pH	6.5 - 7.50
2.	Total suspended solids, mg/l	200 - 800
3.	Total dissolved solids, mg/l	2000 - 8000
4.	Bio-chemical oxygen demand mg/l as BOD	2000 - 3800
5.	Chemical oxygen demand, mg/l	2500 - 4200
6.	Oil and grease, mg/l	10 - 20
7.	Sulphates, mg/l	1000 - 1500
8.	Sulphides, mg/l	10 - 60
9.	Percent sodium (%)	5 - 72
10.	Chlorides, mg/1	1200 - 3800

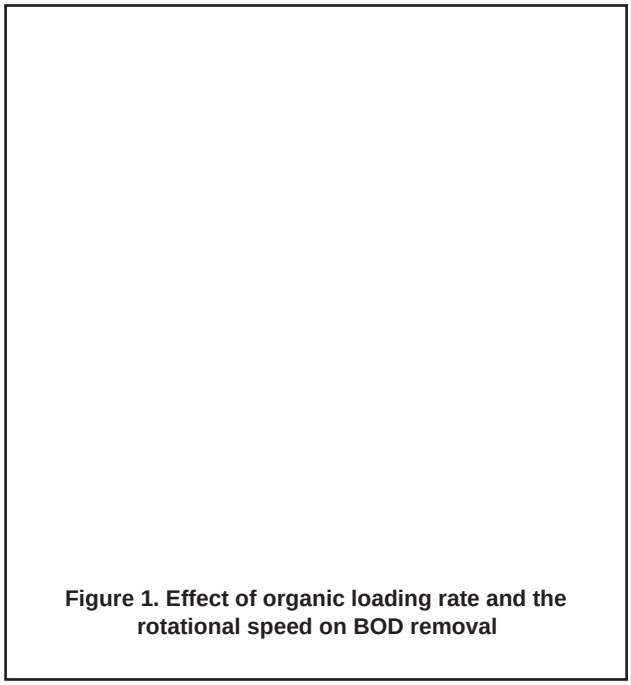

Figure 1. Effect of organic loading rate and the rotational speed on BOD removal

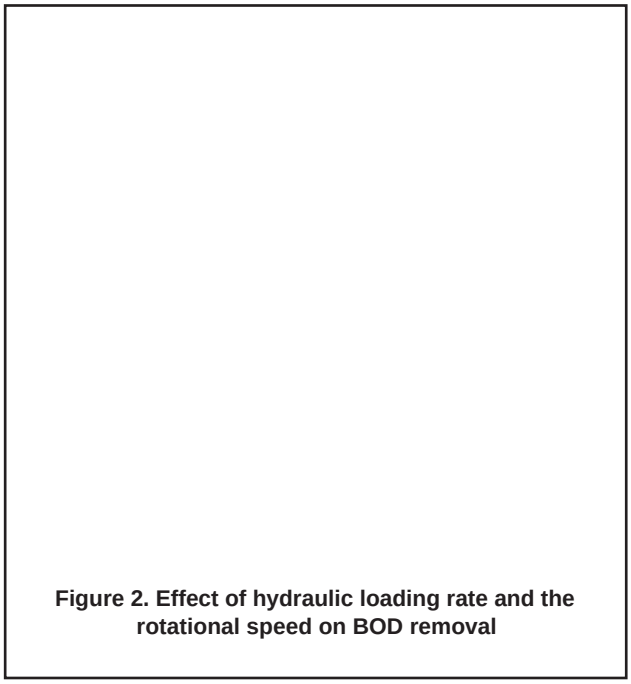

Figure 2. Effect of hydraulic loading rate and the rotational speed on BOD removal

Effect of pH

During the acclimatization period, the pH was varying from 6.5 to 8. The pH increased to 7.8 to 8 on reaching steady state condition. The maximum efficiencies on BOD removal and COD removal were obtained at this steady state conditions at a pH of 7.8 to 8.

Conclusions

1. The animal glue waste water can be effectively treated using rotating biological contactor as a follow up treatment after initial anaerobic treatment. As the BOD of the composite waste waters is in the range of 2000-3000 mg/l, Prior anaerobic treatment is necessary before feeding to RBC with the assumption that 50 per cent BOD removal is possible under anaerobic treatment.
2. The efficiency of BOD and COD removals in the RBC were found to be decreasing with increased hydraulic loading rates owing to the reduced effective detention periods for biofilm formations.
3. The BOD and COD removal efficiencies were also found to be decreasing with increasing organic loading rates.
4. The maximum BOD removal was found to be 98 percent for 20.3 g / m^2 / day of organic loading rate with a rotational speed of 18 rpm.
5. For the same BOD loading of 20.3 g / m^2 / day and rotational speeds of 5 rpm and 14 rpm the BOD removal efficiencies were 97 per cent and 97.6 per cent this shows that there was no significant improvement in the BOD removal rates with increased speeds.
6. The pH in the range 6.5-8 was found suitable for the organic removal process in RBC to treat the effluent from the animal glue manufacturing unit. However steady state condition for maximum removal effeciencies were observed in the pH range of 7.8 to 8.

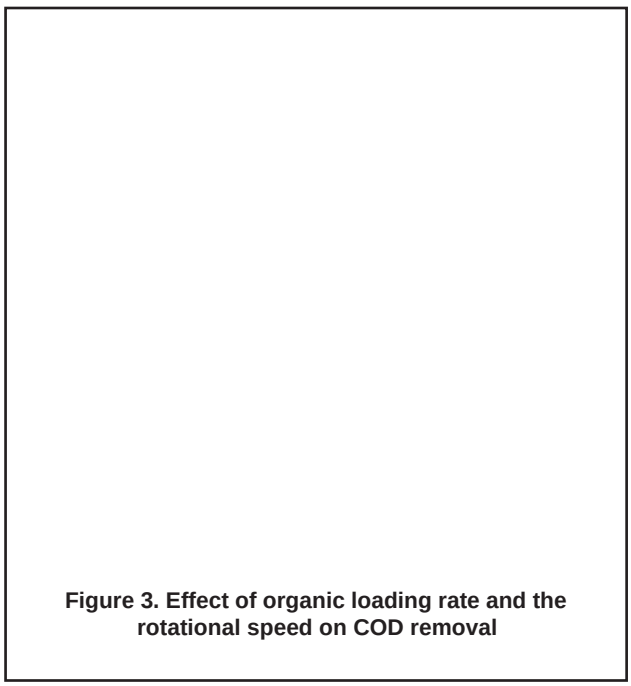

Figure 3. Effect of organic loading rate and the rotational speed on COD removal

References

Assistant Environmental Engineer, Tamilnadu Pollution Control Board, Tirunelveli.

Asst.Professor.Environmental Engg. Dept.of Civil Engg.I.I.T Madras.

* Assistant Environmental Engineer, Tamil nadu pollution control board, Tirunelveli.

** Assistant Professor Environmental Engineering. Department of Civil Engineering, Madras.