STUDY ON COMBINATION OF ADSORPTION AND BIODEGRADATION FOR TREATING TEXTILE DYE EFFLUENT

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Abstract -The objective of this study was to investigate the feasibility of using a Granular activated carbon-biofilm configured anaerobic fluidized bed reactor for treating textile dye effluent Textile dye effluent may include many types of dyes, detergents, insecticides, pesticides, grease ,oils, sulphide compounds, solvents, heavy metals, inorganic salts, and fibers. In amounts depending on the processing regime. Color removal of effluent from the textile dyeing and finishing operation is becoming important because of environmental concerns. Various physico-chemical, biological processes and usually a combination of processes are applied to treat them to meet regulatory discharge limits. In this study combination of adsorption and biodegradation of textile dye effluent in anaerobic fluidized bed reactor was tried to study the performance of the designed reactor for treating textile dye effluent.

Keywords: Colour, Decolourisation, Adsorption, Biodegradation, Fluidized Bed Reactor, COD, HRT

1. Introduction

The textile dyeing waste water contains dyes of various intense colours. The coloured wastewater of dyeing processes is not merely aesthetically objectionable. colour can interrupt photosynthesis and lower the dissolved oxygen content of receiving water bodies, which may lead to killing of fish. Color removal of effluent from the various physico-chemical advanced oxidation, biological processes, and usually a combination of processes are applied to treat them to meet regulatory discharge limits (Banat *et al*., 1996). Anaerobic digestion of textile wastewater is a promising technique becauseit is cost-effective and environmentally safe. dyes decompose under anaerobic condition due to the cleavage of the bond remove the color of the wastewater. The reduction products (aromatic amines) should then be further treated using aerobic biological treatment methods (Chung *et al*., 1978; Ong *et al*., 2005; Luangdilok and Panswad, 2000; Bromley-Challenor *et al*., 2000; Kudlich *et al*., 1996). Color removal under anaerobic condition by biodegradation of dyestuff by azoreductase activity (Idaka *et al*., 1987; Dubin and Wrigth, 1975) and nonenzymatic azo reduction of dyestuff (Chung *et al*., 1992; Carliell *et al*., 1995; Flores *et al*., 1997). In recent years, immobilization of microbial cells has received increasing interest in the field of wastewater treatment. the immobilized microbial systems greatly improve bioreactor efficiency. For instance, increasing process stability and tolerance to shock loadings, allowing higher treatment capacity per unit biomass and generating relatively less biological sludge. Immobilized cells systems have the potential to degrade toxic chemicals faster than conventional wastewater treatment systems (Yang *et al*., 1995; Zhou and Christopher *et al*., 2002; Ong *et al*., 2007). The objective of this study was to investigate the feasibility of using granular activated carbon (GAC)-biofilm configured.Anaerobic fluidized bed reactor treating textile dye effluent

2. Materials and Methods

2.1. Experimental Set Up

The experimental setup consists of a fixed film anaerobic fluidized bed reactor having an effective volume of 0.02m3. The specification of the experimental set up is given in Table.1. And schematic is shown in **fig1**

2. 2. Start-up Process

The experiment was initiated with the feeding of domestic wastewater for the acclimatization process. After attaining the steady state condition within 30 days.Real textile dye effluent was fed into the reactor for further acclimatization for the real time run After attaining 80% efficiency with the real textile effluent of COD concentration of 1110 mg/l synthetic textile effluent was fed with various concentration

2.3. Experimental Run

The operational parameters were the HRT and COD. The experiment was run for five different COD concentrations of 1000mg/L, 1250mg/L, 1500mg/L and 2000mg/L. The operational parameters HRT were varied as 24 hrs, 18 hrs, 12 hrs and 6 hrs for each COD concentration subsequently. With respect to the COD concentrations Samples were collected regularly according to the HRT varying period from inlet and outlet for the analysis. The evaluation is based on the %COD removal

2.4Analytical Methods

Samples were collected from the inlet and outlet of the reactor at 24hrs, 18hrs, 12 hrs and 6 hrs for each COD concentrations of 1000 mg/L, 1250 mg/.L, 1500mg/L and 2000mg/L for the analysis. COD was measured by the closed reflux method

% COD Removal = $\frac{A-B}{A} \chi$ **100.. (1)**

Where,

A = Inlet COD
B = Outlet COD

2.5 Fluidized bed reactor

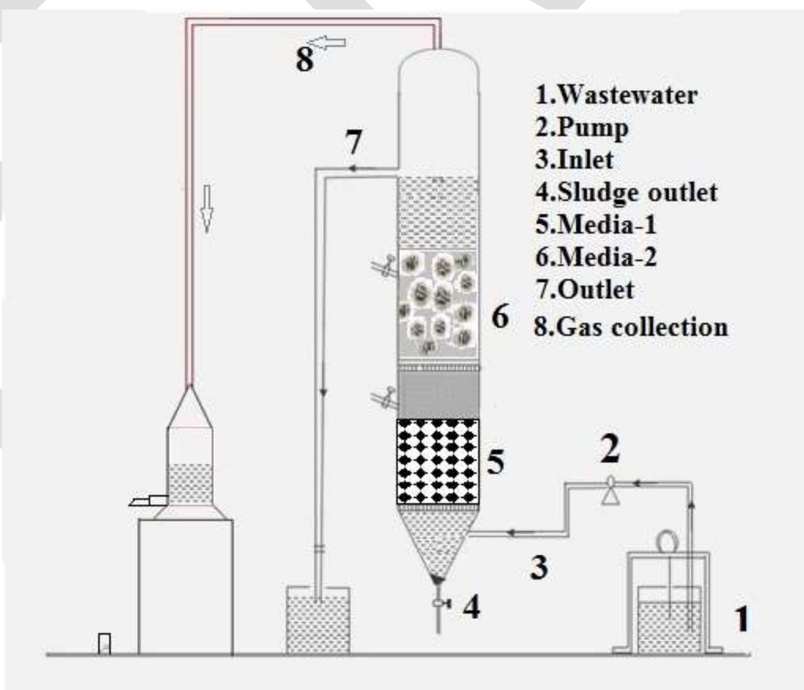


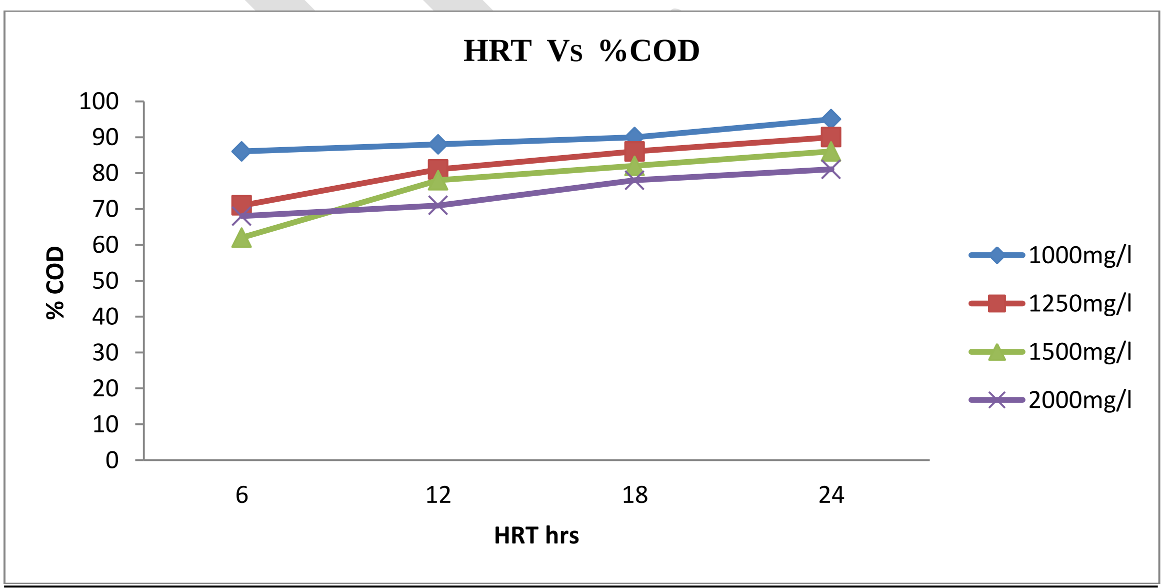
Fig 1 Schematic of fluidized bed reactor

2.6 Table 1: Physical features and process parameters

S.No	Specifications	Details
1.	Volume of Reactor	0.03m3
2.	Effective volume of Reactor	0.02 m3
3.	Diameter of Reactor	0.15 m
4.	Height of Reactor	1.42 m
5.	Effective height of Reactor	1.17 m
6.	Pump used for the influent feed	Peristaltic Pump PP-15 model (Miclin's Product).
7.	Media 1Packed, Size	Activated carbon ,4x8mm
8.	Media 2 Packed, Size	Fujino Spirals, (PVCmaterial),16 mm
9.	Specific area of filling media 1	$900m^3/g$
10.	Specific area of filling media 2	$500m^2/m^3$
11.	Void ratio of the media 1	85%
12.	Void ratio of the media 2	87%
13.	Material of the reactor	Plexi glass

3. Results and Discussion

The graph-1 shows the overall performance of the anaerobic fluidized bed reactor combined with adsorption and biodegradation the maximum COD removal of 95 %, 91%, 86%, and 81% for the COD concentrations of 1000mg/L, 1250mg/L, 1500mg/L and 2000 mg/L at 24 hrs HRT respectively. from the result it is clearly understood that the %COD reduction is directly proportional to the HRT Above 80% of COD removal is attained for the optimum 18 hrs HRT itself for the cod concentration of 1000 mg/l, 1250 mg/l and 1500 mg/l.



Graph: 1 HRT vs. %COD Removal

Conclusion

The designed Anaerobic Fluidized bed reactor combined with adsorption and biodegradation was found to be more effective in treating the textile dyeing effluent for a maximum COD removal of 95% for a COD concentration of 1000mg/L for 24 hr HRT and minimum COD removal of 68% for a COD concentration of 2000mg/L for 6 hr HRT

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