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Treatment of Distillery Spentwash in Upflow Anaerobic Contact Filter

KEYWORDS: Anaerobic treatment; distillery; spentwash; biogas; UACF; anaerobic filter

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ABSTRACT *Molasses-based distilleries are one of the most polluting industries generating an average of 8- 15 litres of spent wash per litre of alcohol produced, a huge volume of wastewater is generated. In the present study, an attempt has been made to treat the distillery spentwash by using polyurethane foam as a packing material in the upflow anaerobic contact filter (UACF). The effect of hydraulic retention time (HRT) in treatment efficiency of UACF was evaluated at different initial substrate concentrations ranging from 360mg/l to 10,000 mg/l. The COD removal percentage during the period of investigation was found to be in the range of 69 to 96%.*

1. INTRODUCTION

Production of ethyl alcohol in distilleries based on cane sugar molasses constitutes a major industry in Asia. In India, It is estimated that about 15 liters of spent wash is discharged for every liter of alcohol produced. [Rajesh Banu et al., 2007]. Distillery spent wash is one of the most recalcitrant wastes characterized by extremely high biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids (SS), low pH, strongodor and dark brown color [Central Pollution Control Board (CPCB) 1994, 2003].

The high strength of spent wash render aerobic treatment would be too expensive and physicochemical processes have met with little success [Shivayogimath and Ramanujam, 1999]. Due to their high BOD content, distillery effluents are subjected to anaerobic digestion or anaerobic lagooning and anaerobic filtration, followed by aerobic biological treatment. Anaerobic digestion is a widely used method for treatment as it removes 90%of the BOD and produces a high –calorific methane gas as a useful by-product.

Many researches have demonstrated that anaerobic process enabling recovery of biogas appears to be the most promising technology for the treatment of spent wash. Recent developments indicate that the use of hybrid reactors combining the dual advantages of up flow anaerobic sludge blanket and up flow anaerobic filter is more efficient in treating waste water [Amit kumar et al., 2008]. In this line, the present study aims at investigating the performance of upflow anaerobic contact filter treating the distillery spentwash.

2. MATERIALS & METHODS

The distillery spentwash, was collected from a brewery at Kanchipuram, Tamil Nadu, India. Cow dung slurry and sewage sludge were used as seed materials for the UACF. The sewage sludge was collected from a sewage treatment plant in Nesapakkam, Chennai, Tamil Nadu, India.

2.1. Reactor set-up

The laboratory scale of UACF reactor was fabricated with acrylic. The UACF was made of acrylic of size 12cm in diameter and 1.25m in height. The effective depth of the filter media is 80cm, filled with polyurethane foam cubes (1cm x 1cm x 1cm) media is used as packing material and to serve as a supporting media for the microorganisms in the reactor. The feed was supplied from the bottom of the reactor. The effluent pipeline was bent in U-shape to act as a gas seal. A gas head space of 1.69liters was maintained above the waste water line.

2.2. Start-up process

The upflow anaerobic contact filter was acclimatized by feeding of cow dung slurry for one week and a mixture of sewage sludge and cow dung slurry in the ratio of 1:10 (by volume) for one week. Later on the sewage sludge was increased in steps of 10% by volume till it attained 100% by volume of sewage [Vijayaraghavan,K and Ramanujam,T.K. 2000]. After the acclimization period, the reactor was operated in a continuous mode and spentwash was then gradually introduced.

2.3. Process investigation

The operating parameters under which the performance of the upflow anaerobic contact filter was monitored. The performance of the UACF was investigated for treating distillery spentwash by conducting experiments at different initial COD concentrations ranging from 360 to 10000mg/L. The effect of Hydraulic Retention Time (HRT) form 2 to 4 days, on the performance of COD removal was evaluated. The Organic Loading Rate (OLR) ranged from 0.36-10 kg of COD/ m^3/d throughout the period of investigation.

2.4. Analytical techniques

The organic strength of wastewater was determined by the COD method. The analysis were conducted in duplicate and in some cases in triplicates and the influent and effluent parameters were analyzed as per the procedure outlined in Standard Methods (APHA, 2005).

3. RESULTS AND DISCUSSION

The characteristics of raw distillery spentwash have been evaluated and presented in the Table 1. During this investigation the spentwash was diluted so as to obtain the required COD concentrations. Experiments were conducted at different initial COD concentration ranging from 360 mg/l to 10,000 mg/l for hydraulic retention time of 1- 3 days.

Table -1 Physicochemical characteristics of distillery spentwash

Parameter	Values (mg/L)
Colour	dark brown
Odour	Unpleasant smell of burnt sugar
pH	3.9
BOD	42500
COD	105100
Total solids	76800
Volatile solids	60500

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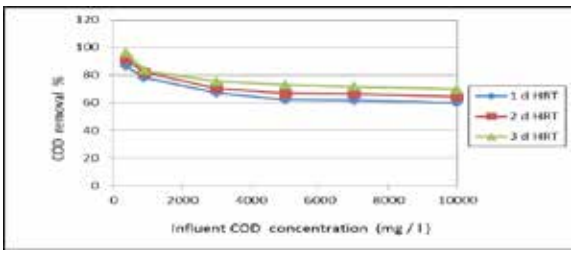
Suspended solids	610
Phosphate	5810
Chlorides	5510
Total nitrogen	1300

The effect of influent COD concentration has been studied keeping HRT as a parameter (Figure 1). It can also be absorbed that for an influent COD concentration varying from 360 mg/l to 10,000 mg/l the COD removal percentage ranges between 69 to 96%.

Figure 1: Effect of COD Concentration on COD removal at different HRTs



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