

INCREASING CHEMICAL OXYGEN DEMAND REMOVAL TO ENHANCE BIOGAS OF DISTILLERY SLOPS WASH

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Abstract

Study on optimization of COD removal to increase biogas from wastewater has been conducted using different COD concentrations in 6 L bioreactor. The organic loading rates (OLR) was set to be ranged from 3.5 to 4.7 kg.COD/m³-day. The experiment was conducted in anaerobic conditions by diluting wastewater to obtain COD from 25,000 to 35,000 mg/l. COD removal efficiency increased to be 70% and enhanced biogas production. The COD of 25,687.2 mg/l, 27,633.2 mg /l and 29,579.2 mg/l had optimum biogas or methane (CH₄) production up to 52.5%, 55.5%, and 51.0% with minimum CH₄ production 2%, 3.5% and 3% respectively. COD removal efficiencies were 78.12, 67.79 and 81.83% respectively. The highest methane yield was 0.144 m³/kg-COD.

1. INTRODUCTION

Wastewater from distillery slops process in fermented alcohols and yeasts has concentrated dark brown liquid with high organic content (Mohan, 2007). This study was conducted by diluting wastewater with wastewater to obtain specific amount of COD. Moreover, COD values were ranged from 25,000- 35,000 mg/l with pH ranging from 6 to 10. In order for the OLR to be in the range from 3.5 to 4.7 kg.COD/m³-day. This method resulted an increase of COD removal efficiency to be 70%. The objective of this study was to investigate the wastewater concentration of concentrated wastewater to improve COD removal efficiency by at least 70% and to identify the amount of gases such as CH₄, CO₂ and H₂S for the optimum rate of wastewater dilution.

2. MATERIALS AND METHODS

This study had conducted with the following steps: (1) Sample collection and analysis of wastewater properties (APHA,2005), (2) Analysis by standard methods for the examination of water and wastewater, and (3) Biogas composition analysis using 5000 Geotech portable biogas analyzer.

3. RESULTS AND DISCUSSION

Microbial seed was obtained from Korat flour industry Co., Ltd. with MLVSS 9,380 mg/l. The experiment was conducted in shifting experiment. The volume of the reactor was 6 L with capture time between 30 and 60 days. F/M ratio in the reactor was maintained to be 0.5. The OLR for the control system was in the range of 3-5 kg.COD/m³-day in diluted wastewater. The concentrations of COD were 16,800.00, 23,283.36, 25,687.20, 27,633.20, 29,579.20, 35,952.00, 41,328.00 and 75,600.00 mg/l and OLR is 3.5, 4.44, 3.96, 4.01, 4.05, 4, 4.1 and 4.2 kg.COD/m³-day revealed.

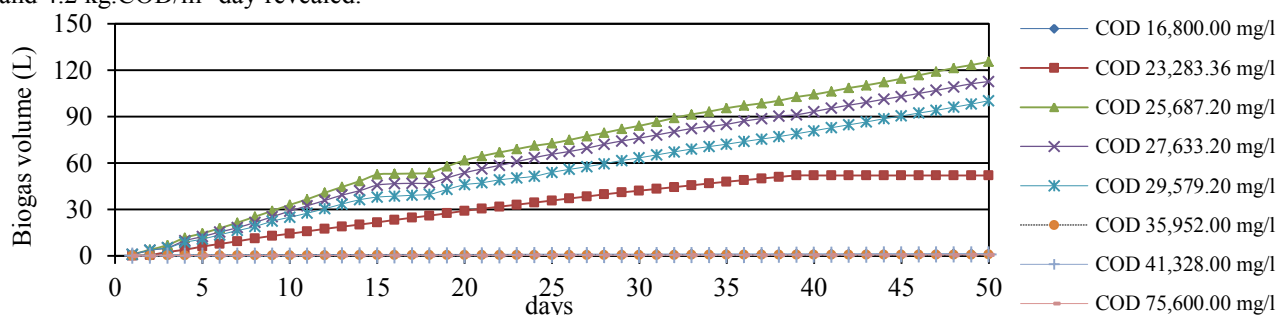


Figure 1. Biogas volume (L)

Using 50-day measurement time, the optimum range using the COD value from the concentration of 16,800.00-75,600 mg/l (Figure 1). Furthermore, in such concentration of COD, the period after 28th day showed a significant increase of methane (CH₄) concentration (Figure 2). The COD concentration at 25,687.2, 27,633.2 and 29,579.2 mg/l revealed. OLR 3.96, 4.01 and 4.05 kg.COD/m³-day revealed. The highest amount of methane content as much as 52.5%, 55.5%, and 51.0% with the lowest concentration at 2%, 3.5%, and 3.0%, respectively. The experiment batch scale showed that the amount of tank size 5-6 liters (Iqbal, 2013). The amount of biogas from the experiment will be more than other studies but the study found that when the tank size increased. The amount of biogas increases as well (Valéria, 2018, L.M.L.González, 2017). However, the obtained results showed that the high efficiency amount were higher than most of the studies reported before (Table 1).

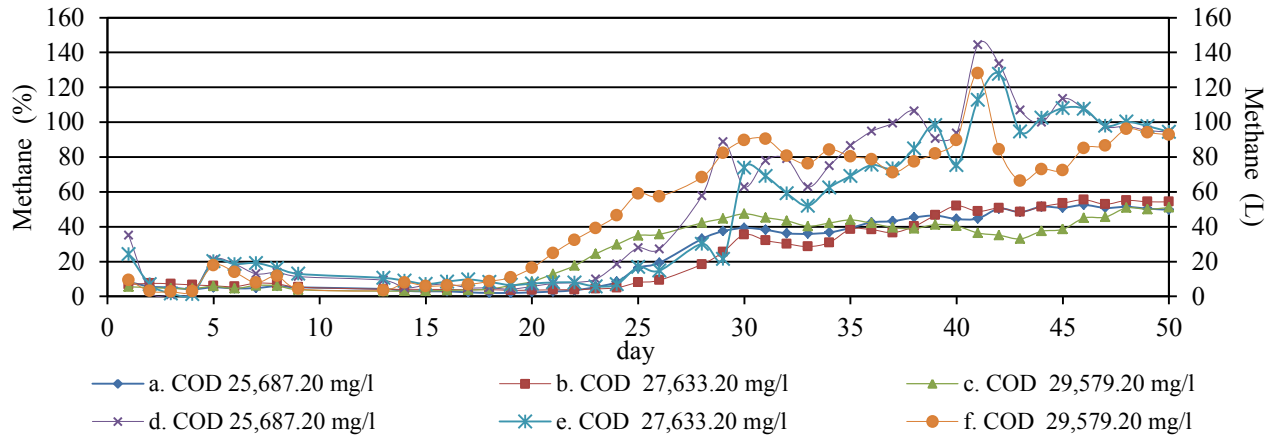


Figure 2. a, b and c Methane proportion in Biogas product (%), d, e and f Methane yield from wastewater (L)

Table 1. Comparison of biogas from distillery slops

Researcher	Experiment type	Tank volume (L)	Duration (days)	COD (mg/l)	Organic loading rate (kg.COD/m ³ -day)	Cumulative Gas (m ³ /kg.COD)	COD removal efficiency (%)
1. This Study	Batch	6	60	25,687.2	3.96	0.144	78.12
2. This Study	Batch	6	60	27,633.2	4.01	0.130	67.79
3. This Study	Batch	6	60	29,579.2	4.05	0.119	81.83
4. Valéria, (2018)	continuous	60	700	19,220	32.4	0.229	76.4
5. L.M.L.González, (2017)	continuous	50	29	284.5	2.2	0.365	64
6. Valciney, (2016)	continuous	40.5	140	15,344	6.25	0.185	81
7. B.S. Moraes, (2015)	Batch	20	100	421.6	2.00	0.2674	-
8. Iqbal, (2013)	Batch	5	60	268,647	-	0.139	38.088

4. CONCLUSION

This study found that the peak concentration for biogas production from wastewater was in the range 3 to 5 kg.COD/m³-day of organic loading rate with COD values were ranged from 25,000-30,000 mg/l at COD concentration of 25,687.2 mg/l at 50 days Organic loading rate 3.96 kg.COD/m³-day. Using exact values, this experiment also achieved COD removal rate at 3.96 kg.COD/m³-day and COD removal efficiency was up to 78.12%. The highest methane content was obtained at 144.381 L/kg.COD.

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