SURVEY ON THE ABILITY OF COD AND SS TREATMENT OF AQUATIC WASTE WATER BY AEROBIC BIOLOGICAL TECHNOLOGY WITH BAGASSE SUBSTRATE

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Abstract

Bagasse is a cheap material and the collection of bagasse is easy from sugarcane shops. This survey used cane bagasse as a substrate for aerobic biological modeling to treat aquatic waste water, bringing about economic, technical and environmental benefits. This study was conducted at three different loads: 1.2kg COD/m^3.day; 2.4kg COD/m^3.day; 3.6kg COD/m^3.day. The results showed that COD removal efficiency was 99.15%, the optimum load of the research model was 2.4kg COD/m^3.day for the SS removal efficiency reaching 92.49%.

Keywords: *aquatic waste water, bagasse, loads, removal efficiency*

INTRODUCTION

The aquatic processing industry is one of the key industries of our country, according to the General Statistics Office of Vietnam (2014), by 2013 there will be 570 aquatic processing establishments on an industrial scale and thousands of small processing units, handcrafted households with a processing capacity of about 2.5 million tons per year. In addition to the economic benefits that this industry brings, waste water from processing establishments polluting the environment, as most of them are concentrated on some locations such as downstream rivers with high density and large processing capacity. And with raw processing technology, for exporters of raw materials, only about 60% for export, the rest is thrown out or used inefficiently polluting the environment (Le Hoang Viet, 2015).

At some aquatic processing plants, wastewater is mainly generated during the process of washing and processing raw materials. Due to the diversity of types and forms of processing, the components in the wastewater of the fisheries sector are extremely complex and contain a lot of waste and are itself a threat to the aquatic environment because aquatic waste water has a very high organic content, COD ranges from 1000 to 1200 mg/l, BOD_5 from 600 to 950 mg/l (Lam Minh Triet, 2014).

Apart from the enterprises operating in the concentrated industrial zones, there are many small processing establishments located in the residential areas also contributing to pollution. These

facilities are often not invested in machinery and technology, and are often found to be discharged directly into the environment.

And in practice, the application of various technologies and methods for treating fishpond wastewater meets the emission standards is a difficult issue. With the aim of diversifying treatment methods and more options for wastewater treatment, the project "Survey on the ability of COD and SS treatment of aquatic waste water by aerobic biological technology with bagasse substrate" with the expectation that it can be applied in practice to treat wastewater for craft villages, small and medium aquatic producers as well as to solve some current environmental pollution situation.

MATERIALS AND METHODS

Materials

Modeling

Table 1. *Parameters of aerobic biological tank size.*

No	Parameter	Unit	Value
1	Length	cm	30
2	Width	cm	35
3	Height	cm	45

Notes:

1. Waste water input
2. Aerobic tank with filter material
3. Waste water output
4. Quantitative wastewater pump
5. Valve
6. Coil
7. Bagasse substrate
8. Waste water

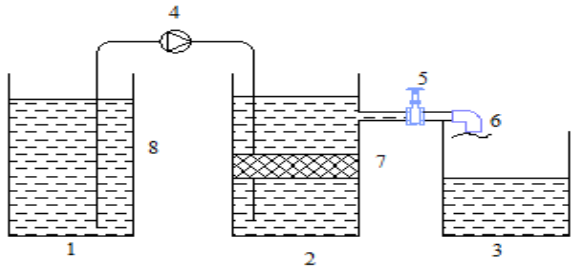

Figure 1. *Research model*

Research waste water: This study was conducted with artificial aquatic wastewater to evaluate the treatment effect at different loads. The composition and characteristics of wastewater are shown in the following table:

Table 2. *Characteristics of research aquatic waste water*

No	Parameter	Unit	Value
1	pH	-	7,5 (6,5 – 8,5)
2	COD	mgO_2/L	1300 (400 – 2200)
3	TSS	mg/l	1400 (1100 – 1700)
4	NH_4^+	mg/l	250 (100 – 400)
5	NO_2^-	mg/l	4 (1,2 – 6,4)
6	NO_3^-	mg/l	14,9 (1,3 – 28,4)

Activated sludge: Activated sludge was taken from the settling tank II of Viet Huong I Industrial Park wastewater treatment plant. Every day, add aquatic waste water to feed the microorganism to adapt and develop (by removing the water layer above and adding waste water).

Bagasse substrate: Bagasse is a cheap material, and it is easy to collect bagasse from sugar cane juice shops. Sugarcane bagasse after harvesting will be dried because the bagasse is fresh and high moisture. After the dry bagasse, sugarcane residue was compacted into compact blocks.

METHODS

Experiment 1: *Determine the volume of the substrate*

Table 3. *Operation parameters determine the substrate weight*

Parameter	Unit	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5
Substrate Weight	g/l	10	20	30	40	50
Waste water volume	liter	3	3	3	3	3
COD	mg/l	2000	2000	2000	2000	2000
MLSS	mg/l	2500	2500	2500	2500	2500
DO	mg/l	≥2				

Substrate was stored in a 5-liter container. Measurement of COD after 1 day, 2 days, 3 days, 4 days to monitor the treatment of each batch and observe the ability of mud sticking on the substrate, the experiment was repeated 4 times to determine the suitable substrate weight for the model.

Experiment 2: *Adaptive operation*

- At the stage of adaptation, model run with organic load rate (OLR) of 0.7 kgCOD/m^3.day. - Maintaining pH in the range of 6.5 - 8.5 is optimal from 6.6 to 7.6. Check COD : N : P ratio = 150: 5: 1 (aerobic) if nutrient deficiency (N, P) is added with NH_4Cl and KH_2PO_4

Experiment 3: *Operation at OLR of 1.2kg COD/m^3.day.*

Table 4. *Parameter and value at OLR of 1.2kg COD/m^3.day*

No	Parameter	Unit	Value
1	pH	-	6 – 9
2	OLR	kg COD/m^3.day	1,2
3	COD	mg/l	831,6
4	Q	l/h	2,08
5	HRT	h	19
6	DO	mgO_2/l	Aerobic tank ≥2

Experiment 4: *Operation at OLR of 2.4kg COD/m^3.day*

Table 5. *Parameter and value at OLR of 2.4kg COD/m^3.day*

No	Chỉ tiêu	Đơn vị	Giá trị
1	pH	-	6 – 9
2	OLR	kg COD/m^3.day	2,4
3	COD	mg/l	1663
4	Q	l/h	2,08
5	HRT	h	19
6	DO	mgO_2/l	Aerobic tank ≥2

Experiment 5: *Operation at OLR of 3.6kg COD/m^3.day*

Table 6. *Parameter and value at OLR of 3.6kg COD/m^3.day*

No	Chỉ tiêu	Đơn vị	Giá trị
1	pH	-	6 – 9
2	OLR	kg COD/m^3.day	3,6
3	COD	mg/l	2494,8
4	Q	l/h	2,08
5	HRT	h	19
6	DO	mgO_2/l	Aerobic tank ≥2

RESULTS AND DISCUSSION

The result of suitable bagasse substrate weight survey for aerobic biological model.

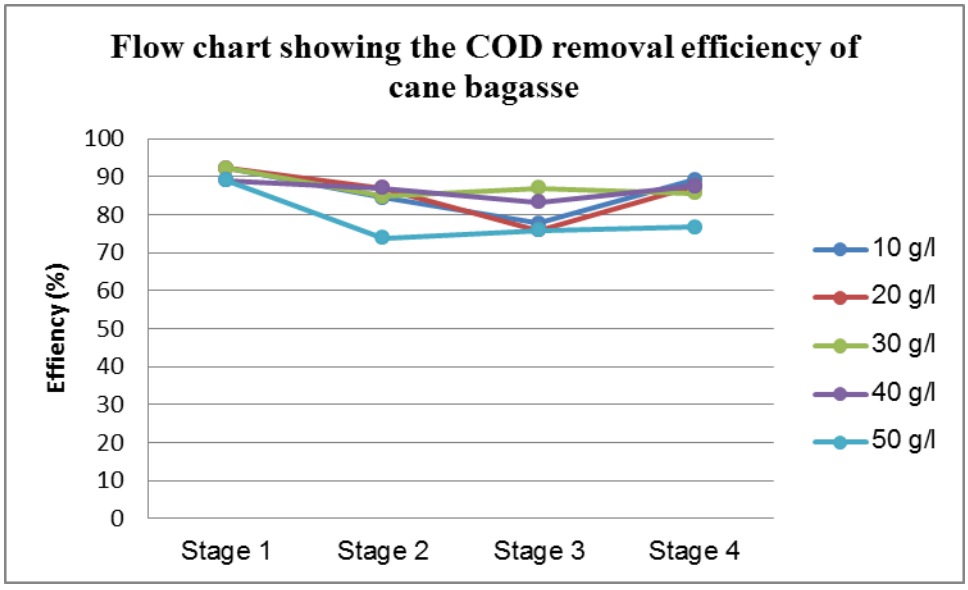

Figure 2. *Flow chart showing the COD removal efficiency of bagasse substrate*

From the above chart it could be seen that during the first stage of the survey, models with low bagasse at 10g/l, 20g/l and 30g/l gave the best treatment about COD, and 40g/l and 50g/l for lower processing efficiency. And after the run time of the 3 replicate stages, we could see 20g/l and 30g/l on the 3 stages of the survey for poor COD efficiency. The average of 10 g/l over the next three surveys was the best COD removal efficiency. So we chose 10 g/l as the bagasse substrate had the optimal volume.

COD removal efficiency

From the chart above, the process of treating COD concentration through three OLR as follows: At the OLR of 1.2kg COD/m^3.day, the COD was well treated during the day with the highest efficiency of 95.71%. At the OLR of 2.4kg COD/m^3.day, the COD was well treated during the day with the highest efficiency of 97.86%. And at the OLR of 3.6kg COD/m^3.day, the COD was well treated during the day with the highest efficiency of 90.95%. Thus, at a OLR of 2.4kg COD/m^3.day, COD concentration is best treated with a yield of 97.86%.

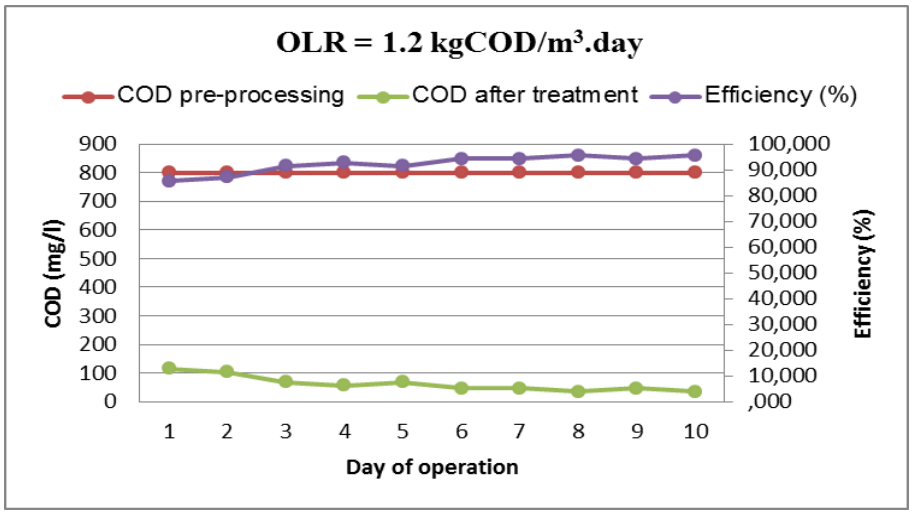

Figure 3. *COD removal efficiency at OLR of 1.2kg COD / m^3.day*

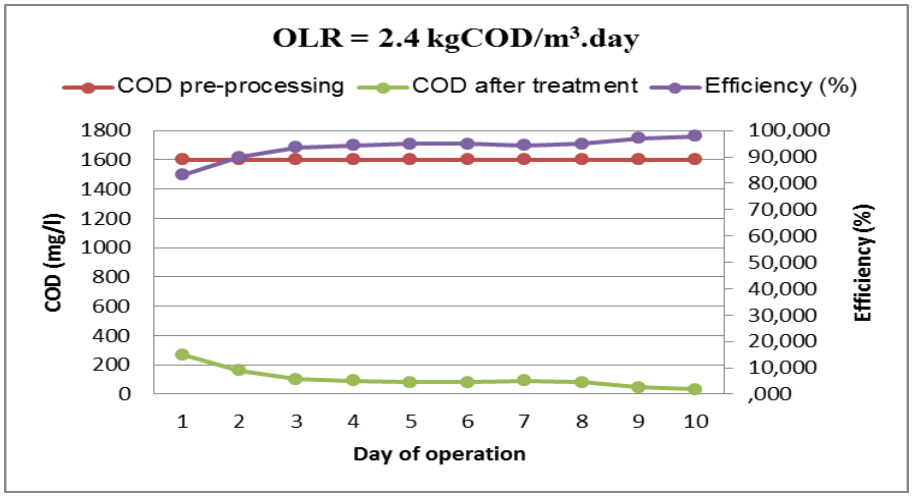

Figure 4. *COD removal efficiency at OLR of 2.4kg COD / m^3.day*

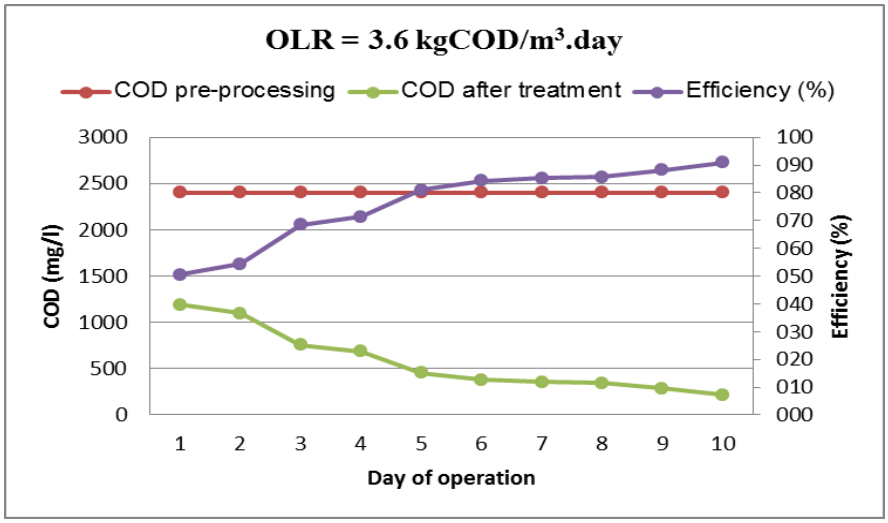

Figure 5. *COD removal efficiency at OLR of 3.6 kgCOD / m^3.day*

SS removal efficiency

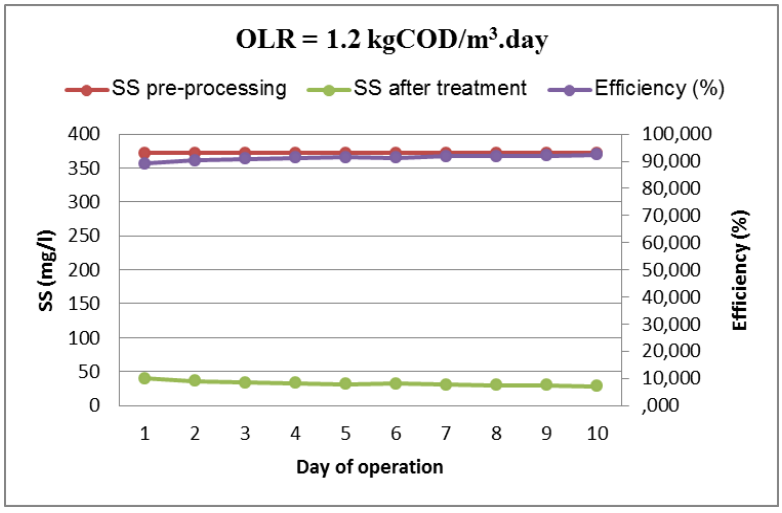

Figure 6. *SS removal efficiency at OLR of 1.2kg COD / m^3.day*

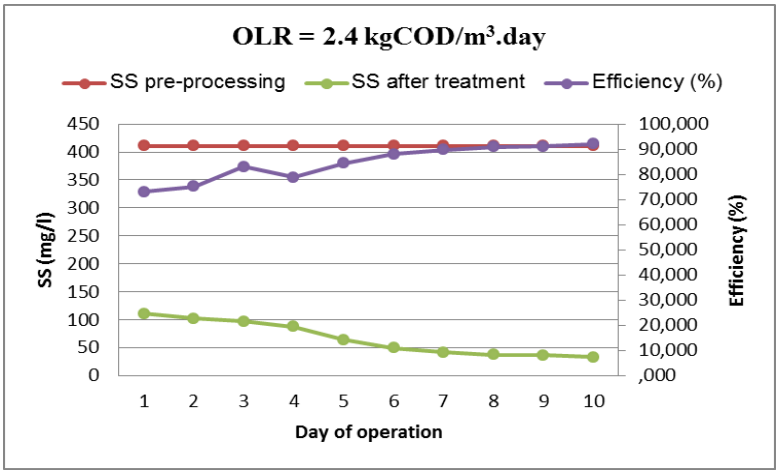

Figure 7. *SS removal efficiency at OLR of 2.4kg COD / m^3.day*

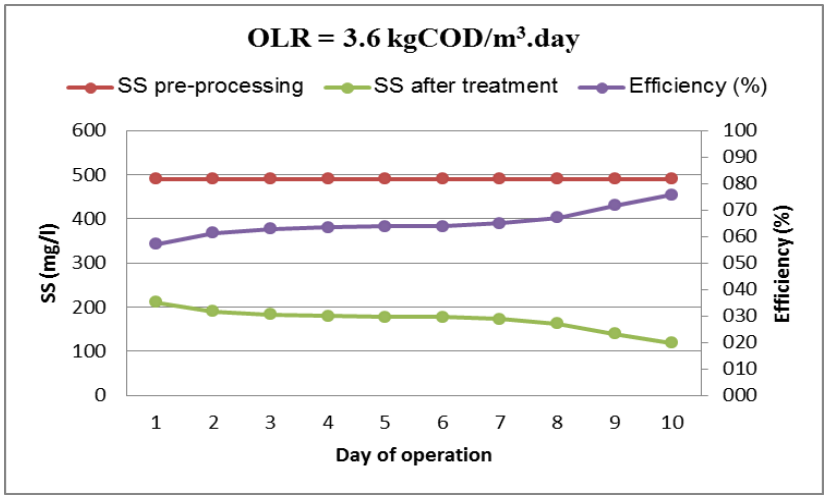

Figure 8. *SS removal efficiency at OLR of 3.6kg COD / m^3.day*

From the chart above we can see the process of processing SS concentration over three loads as follows: At the OLR of 1.2kg COD/m^3.day, the SS concentration was well treated and stable for 10 days (best treatment at 92.49% treatment efficiency). At the OLR of 2.4kg COD/m^3.day, the SS concentration was treated more and better for 10 days (best treatment at 92% efficiency). At a load of 3.6kg COD/m^3.day, the SS concentration was best treated at 75.81% and other days the SS concentration was unstable.

CONCLUSIONS

After studying the aerobic biological model with bagasse substrate for artificial aquatic waste water, the results were as follows:

- The weight of bagasse suitable for the aerobic biological model for treatment of artificial aquatic waste water was 10 g/l.

- With a bagasse of 10 grams per liter and an input COD concentration of 800-2,500 mg/l, the COD removal efficiency of the aerobic biological model was 99.15%

- The OLR of 2.4kg COD/m^3.day was the load having the best processing efficiency with the processing efficiency of SS was 92.49%.

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