Testing a New Material - The Agriculture Waste – As a Replacement to the Synthetic Fibers in Waste Water Treatment using the ABR

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Abstract: ***Achieving high efficiencies in anaerobic baffled reactor (ABR) for reducing chemical oxygen demand (COD) has always been an outstanding challenge for most researchers as most experiments focus on using fibers in ABR to reduce COD. In this paper a new material was introduced as a replacement for fibers which is the agricultural waste such as palm fibers and ficus trees. The Effect of using agricultural wastes on the performance of the (ABR) in reducing COD was tested for four different stages (start-up, steady state, shock and final). Both palm fibersand ficus trees samples achieved higher COD removal efficacies as compared to previous studies. The palm fiber samples achieved the highest COD removal efficiency in the four stages as compared to the ficus tree samples.The COD removal efficiency of palm fiber sample reached an average value of 93.07% and a pH value ranging between 6.99 to 7.15 where the ficus tree samples reached 88.37%and a pH value ranging between 6.9 to 7.12. The reason why palm fiber samples reached high efficiencies could be contributed to the nature and characteristics of the palms. Palms have high surface area and void ratio which allow the acidogenic bacteria to breed and replicate, which decompose the organic materials.***

Keywords: Anaerobic baffled reactor, organic load rate, Biomass, hydraulic retention time, Biodegradation

1. Introduction

It is necessary to reuse wastes and to find low-cost methods for wastewater treatment. Wastes from agriculture activities are a major problem due to the increase in food demand the potable water shortage is mainly due to the costs required for water treatment due to the area needs and operation techniques difficulties. To overcome such problems. Treatment and disposal of wastewater are presently one of the serious environmental problem contributors. Therefore, there is a need to develop reliable technologies for wastewater treatment, water resources are becoming increasingly deficient and the quality of the environment in the world is constantly becoming worse in most regions. Water protection and waste management are two important issues to world population. It has advantages as simple design, use of uncomplicated equipment, high treatment efficiency, low excess sludge production and low operating and capital cost (Saktaywin et al., 2005; Sato et al., 2006).

The high rate anaerobic processes could be achieved by the separation between the hydraulic retention time (HRT) and the solid retention time (SRT). In addition, stringent environmental is giving the impetus to developing anaerobic wastewater treatment processes due to potential economic and environmental benefits they hold over traditional aerobic techniques (Zakkour et al., 2001).

2. Literature Review

Wastewater is generally divided into domestic wastewater and industrial wastewater. Domestic comes from communities of homes, businesses, and institutions. Domestic wastewater is 99.9% water and only 0.1% solids. The solids in domestic wastewater are both dissolved and suspended solids. Therefore, it is necessary to reuse wastes and to find low-cost methods for wastewater treatment. Wastes from agriculture are a huge problem caused by the increase in food demand. These wastes contain substances which effect on the public health and the environment due to the toxicity and remediation problems.

3. Materials and Methods

The (ABR) unit used was built in the laboratory of Sanitary and Environmental Engineeringat Alexandria University Using agriculture wastes are ficus trees and palm fiber.

Preparation of the samples

Activated sludge process utilizing a synthetic wastewater was prepared by diluting with a concentrated (1-100) containing 8.8 g/l (NH4)2SO4, 48 g/l glucose and 11.65 g/lNa3PO412H2O. The synthetic wastewater was prepared with a solution has average COD concentration equals to 500 mg/L.

Processing of biomass

The experimental work was carried out by operating the activated sludge pilot plant to anaerobic sludge by anaerobic conditions in the reactor.The 38 L of biomass was divided evenly between eachof the five compartments within each reactor the sludge containsMLSS = 750 mg/l,and MLVSS = 180 mg/l.

Temperature:

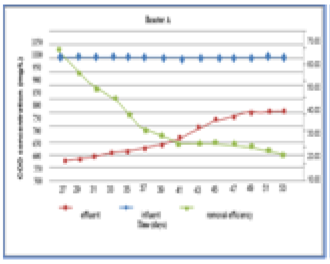
The reactor was operated with a constant temp at 35^{0}C (Metcalf & Eddy, and Ndon, et al).

4. Results and Conclusions

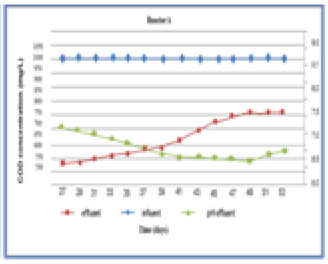
The results discussed to ABR performance along the experiment of wastewater. Three types I) convention anaerobic baffled reactorABR (A), ii) anaerobic baffled reactor with ficus trees usedABR(B), iii) anaerobic baffled reactor with palm fiber usedABR(C), where trial under different organic load rate (1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0 and 4.0 kg COD /m3 d), constant flow rate 38 l/d with initial COD concentration 500 mg/l. The ABR (C) system gave the highest COD % removal comparing with the other two systems. The figure will show the results compared between the three reactors in different cases.

Results

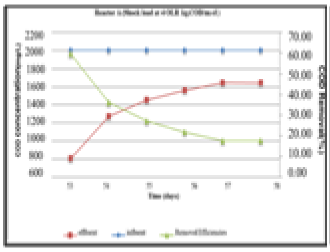
CASE (1) Conventional anaerobic baffled reactor with no media.

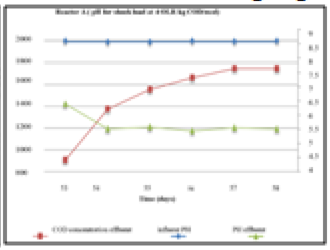


COD removal efficiency obtained until to the working stage for ABR (A).

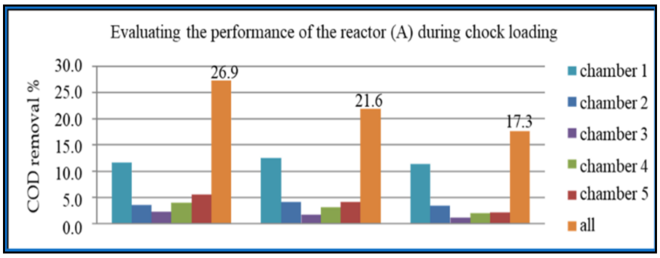


Relationship between pH and COD concentration for ABR (A) in working stage

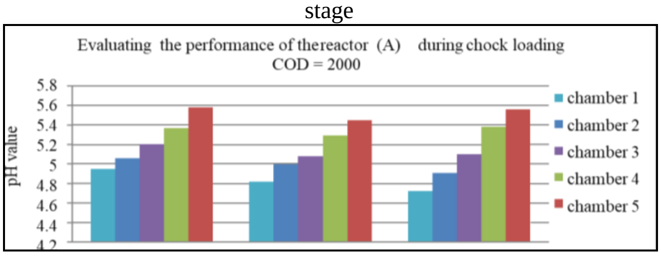




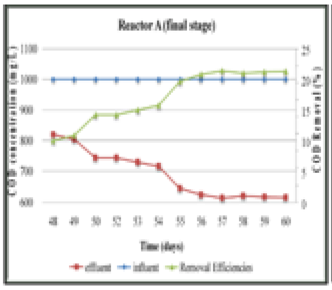
COD removal efficiency at shock pH and COD concentration in shock load stage for ABR (A).load stage for ABR (A)

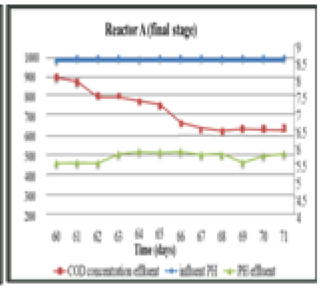


Performance of reactor (A) for each compartment in shock load stage



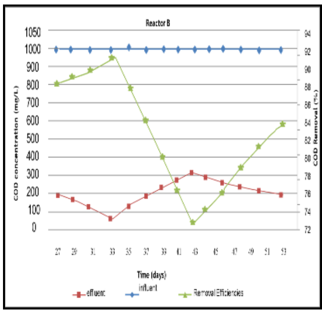
Performance of reactor (A) for each compartment in shock load stage

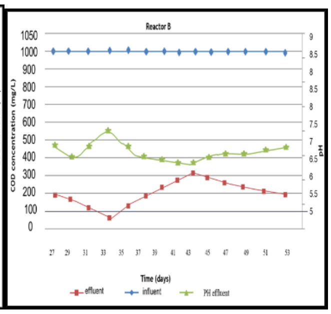




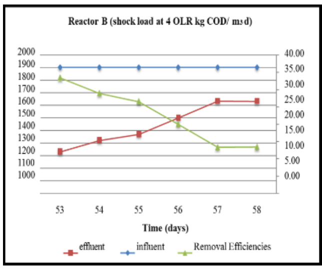
COD removal efficiency to final stage for ABR (A) pH values to final stage for ABR (A)

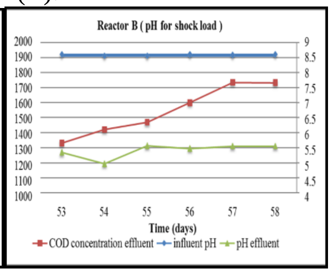
Case (2) The anaerobic baffled reactor with the ficus trees media.



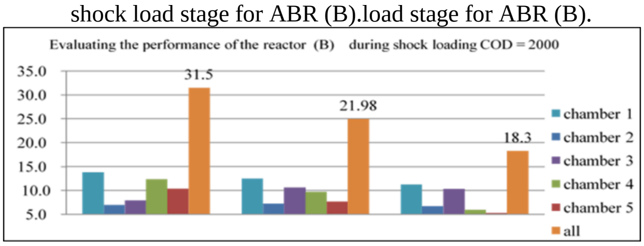


COD removal efficiency at shock pH and COD concentration in shock load stage for ABR (B).load stage for ABR (B).

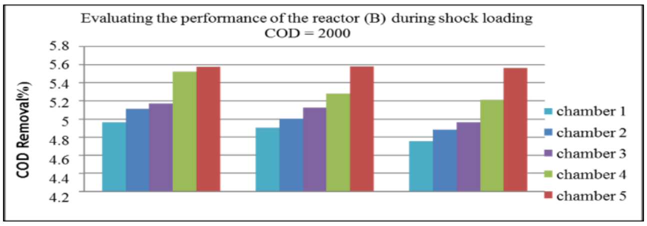




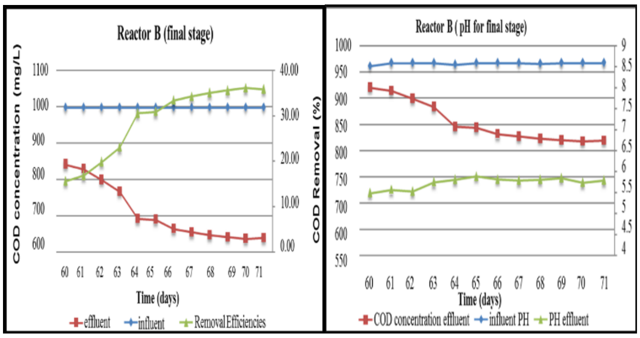
COD removal efficiency at shock pH and COD concentration in shock load stage for ABR (B).load stage for ABR (B).



Performance of reactor (B) for each compartment in shock load stage.

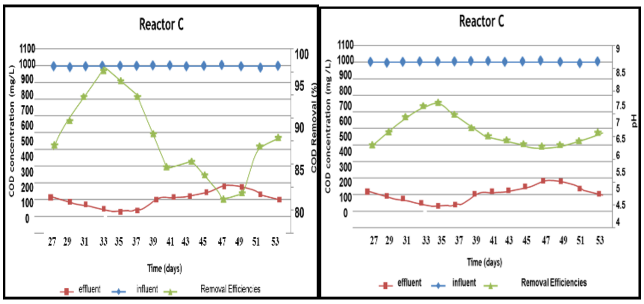


Performance of reactor (B) for each compartment in shock load stage

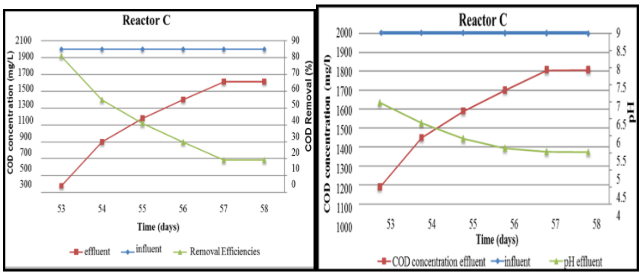


COD removal efficiency to pH values to final stage for ABR (B) final stage for ABR (B).

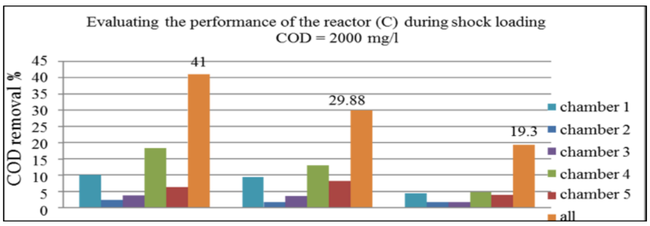
Case (3): The anaerobic baffled reactor with the palm fiber media.



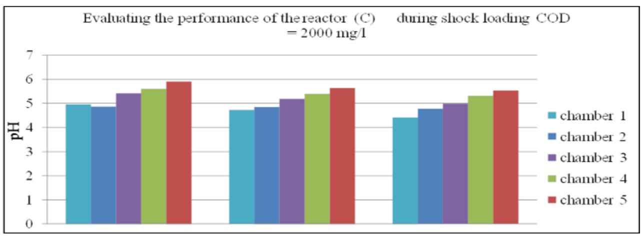
COD removal efficiency at shock pH and COD concentration in shock load stage for ABR (C).load stage for ABR (C).



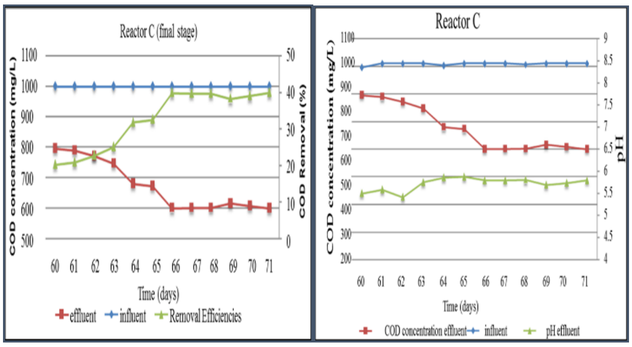
COD removal efficiency at shock pH and COD concentration in shock load stage for ABR (C).load stage for ABR (C).



Performance of reactor (C) for each compartment in shock load stage



Performance of reactor (C) for each compartment in shock load stage



COD removal efficiency to pH values to final stage for ABR (B) final stage for ABR (B)

5. Conclusion

In this paper we have reviewed different techniques for the anaerobic wastewater treatment with Using Agriculture Wastes ABR(C) system gave the highest COD% removal comparing with the other systems due to large void ratio in palm fiber media, also may be surface type for this media Creates a suitable surface for the breeding of bacteria. Palm fiber improve the removal efficiency by 28 %, while the ficus trees improves the removal efficiency of the anaerobic reactor by 22 %. pH value decreased with time which decreases the COD % removal. Must keep the characteristics of attached media (palm fiber) ABR (c) make a contact with the bacteria, void ratio and higher surface area for an order to be the highest COD % removal. Results showed that decreasing pH value had an adverse effect on treatment efficiency for all cases.

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