



## Effect of Sponge Thickness on Septic Tank Effluent Quality for Dairy Wastewater Treatment

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### الملخص العربي :

تعتبر صناعة الألبان بشكل عام من أكبر الصناعات الغذائية. من أهم خصائص مياه الصرف الناتجة عن هذه الصناعة بارتفاع نسبة الأكسجين الحيوي الممتص، الأكسجين الكيميائي الممتص وكذلك ارتفاع نسبة المواد الصلبة المعلقة. تم في هذه الدراسة استخدام الاسفنج الصناعي بسمكات مختلفة كوسط ترشيحي بعد خزان التحليل. وحققت استخدام الاسفنج الصناعي نسب إزالة جيدة للمواد الصلبة المعلقة والأكسجين الحيوي الممتص والأكسجين الكيميائي الممتص 98.14% و 70.28% و 70.36% على الترتيب.

### Abstract

The dairy industry is generally considered to be largest source of food processing. These industries wastewater is characterized by high COD, BOD, nutrients etc. The present study is related to the possibility of using sponge as gravity filter. The thickness of sponge media layer achieved removal efficiencies 98.14%, 70.28%, 70.36% of TSS, BOD and COD respectively with constant density and constant discharge.

### 1-Introduction

Ever increasing industrialization and rapid urbanization have considerably increased the rate of water pollution. The dwindling supplies of natural resources of water have made this a serious constrain for industrial growth and for a reasonable standard of urban living. The environmental protection agencies have imposed more stringent regulatory prohibitions and they have started more strict vigil along with some non-governmental organization to protect the environment. This has made the wastewater treatment more expensive and to comply with the discharge quality standard itself which is becoming a huge burden for the industries [1]

Septic tank one of the on-site decentralized systems are commonly used in rural areas, which has a suitable efficiency in sewage treatment. There are many septic tanks modifications procedures in order to improve its performance. The simplicity of operation, economically issues and the high removal efficiency of BOD and COD after modification with sponge make the septic tank one of systems can be used in industrial wastewater treatment of industries that have high load of BOD [2].

## **2-Research Significance and Previous Work**

The highly variable nature of milk wastewater in terms of volumes and flow rates (depending on factory size and operation shifts) pH and suspended solid (SS) content (mainly the result of choosing the cleaning strategy used) makes it difficult to choose an effective wastewater treatment scheme. Since milk wastewater is highly biodegradable, it can be treated effectively with biological wastewater treatment systems, but it can also pose a potential environmental hazard if not properly treated [3].

Fixed Film and Fixed Bed Anaerobic Reactor have been studied for treating Dairy Waste Water and found that COD is reduced by 80.88% for a varying influent COD from 1500 to 4700 mg/liter. [4].

Up flow Anaerobic Sludge-Fixed Film (UASFF) bioreactor have been used for the treatment of dairy wastewater. UASFF bioreactor was developed with tubular flow behavior in order to shorten the start-up period of UASB reactor at low HRT. In this treatment; the column was randomly packed with seashell and at HRT 48 h and temperature 36°C found that, the COD removal rate and lactose conversion of 97.5 and 98 percent respectively [5].

## **3-Methodology**

The pilot plant operation aims to study the effect of sponge as a gravity filter layer media thickness. Two runs are held and some characters were examined BOD, COD, total suspended solids (TSS) and pH to study the pilot plant removal efficiency for dairy wastewater treatment as shown in table (1).The pilot plant shown in figure (1) simulate conventional septic tank followed by modified gravity filter. The pilot unit divided to two compartments one of them simulate conventional septic tank and the other compartment used as modified septic tank which consist of conventional septic tank followed by gravity filter with sponge media. The modified septic tank was erected to receive the industrial flow from small dairy factory located at El Sharkia Governorate.



Figure (1) Pilot unit in site

Table (1) pilot scale sponge runs

Action	Run no.	Type of material	Operation period		Remarks
			from	To	
Filtration action	(1)	Industrial sponge	11/2/2019	3/3/2019	Thickness 5.0 cm with density 33 gm/cm <sup>3</sup>
	(2)		11/2/2019	3/3/2019	Thickness 10.0 cm with density 33 gm/cm <sup>3</sup>
		Conventional septic tank	11/2/2019	21/4/2019	

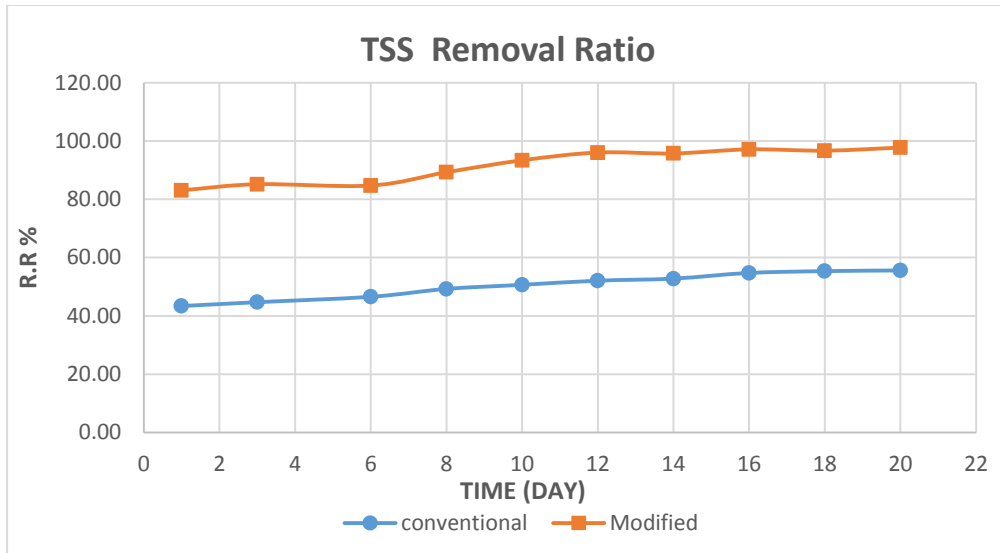
#### 4-Experimental Results & discussion

Sponge runs divided to two runs for filtration action. The removal efficiencies of these runs and the efficiency of conventional septic tank in each run are shown below:

##### 4-1 Removal efficiencies of run (1)

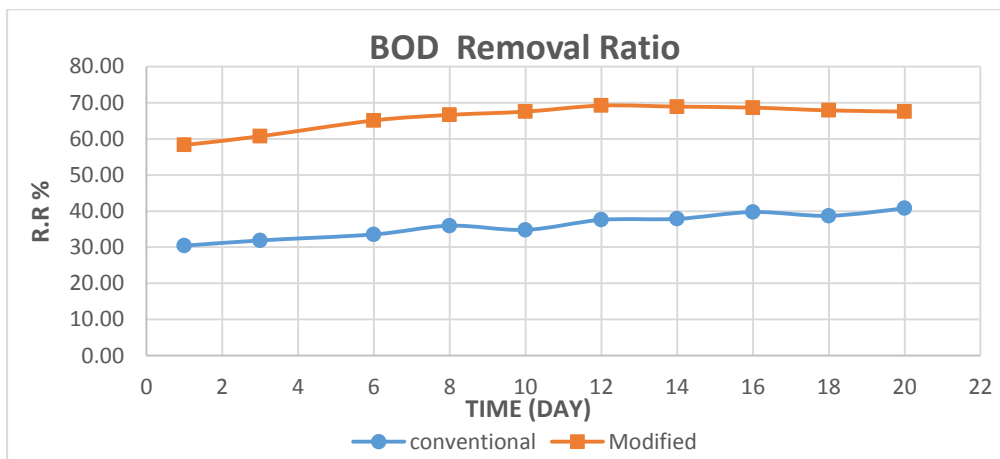
This run was applied with flow rate 9 lit/hr for 20 day of operation for filtration action with one plain layer of filter media (sponge) density 33 gm/cm<sup>3</sup> with thickness 5 cm and conventional septic tank. Data has been recorded and repeated every two days. Two samples were taken in each time.

**Figure (2)** shows that the filtration action gives the highest removal ratio of TSS 97.77% which is higher than TSS removal ratio of septic tank by 42.17% after 20 days.



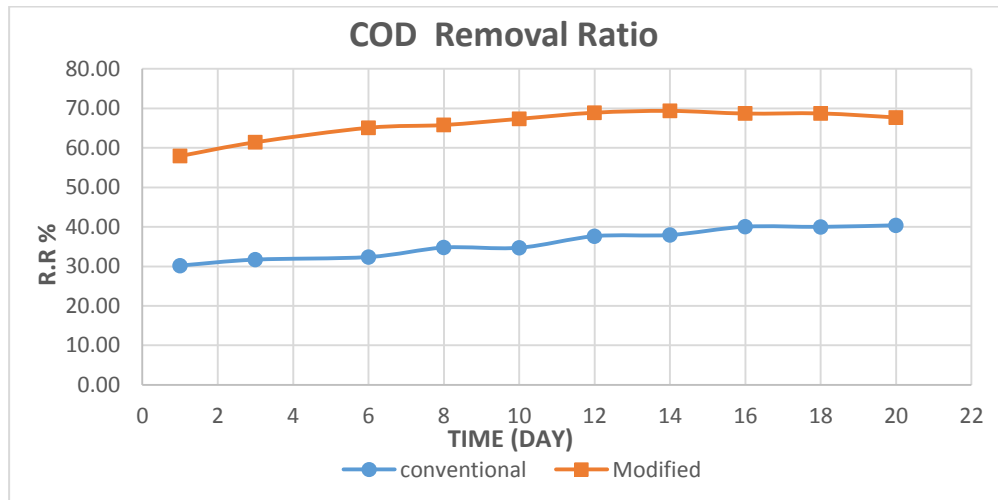
**Figure (2) TSS removal ratio of run (1)**

**Figure (3)** shows filtration effect that increase by 28.9% for BOD removal ratio.



**Figure (3) BOD removal ratio of run (1)**

**Figure (4)** shows filtration effect that increase COD removal ratio by 29.32%.

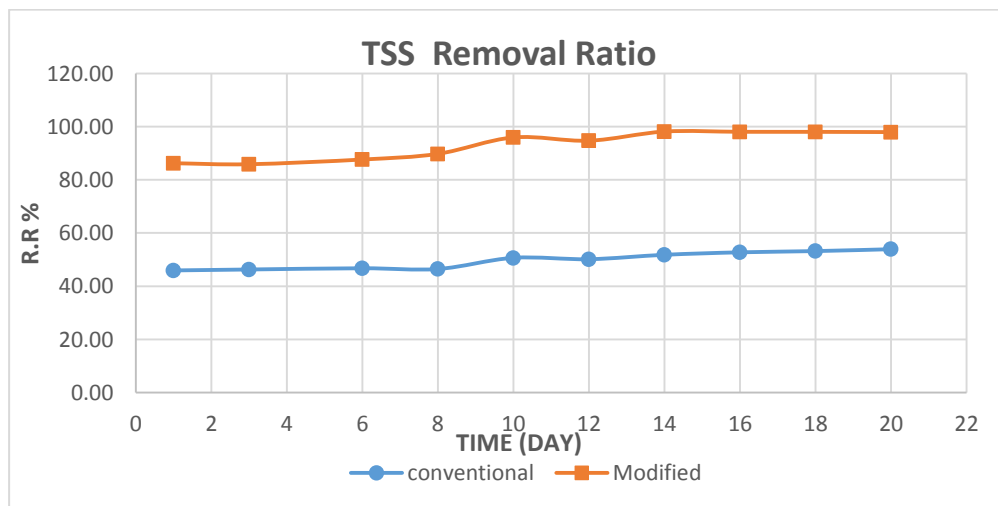


**Figure (4) COD removal ratio of run (1)**

#### 4-2 Removal efficiencies of run (2)

This run was applied with flow rate 9 lit/hr/m<sup>2</sup> for 20 day at filtration of one plain layer of filter media (sponge) density 33 gm/cm<sup>3</sup> with thickness 10 cm and conventional septic tank. Data has been recorded and repeated every two days. Two samples were taken in each time.

**The figure (5)** shows filtration effect which is increase by 44.24% for TSS removal ratio.



**Figure (5) TSS removal ratio of run (2)**

The figure (6) shows filtration effect which is increase by 28.19%.for BOD removal ratio.

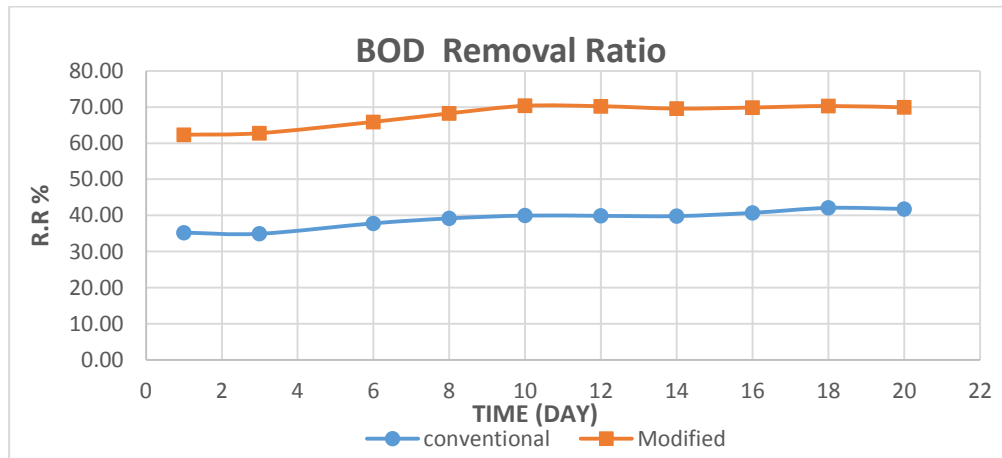


Figure (6) BOD removal ratio of run (2)

The figure (7) shows filtration effect which is increase by 27.97%.for COD removal ratio.

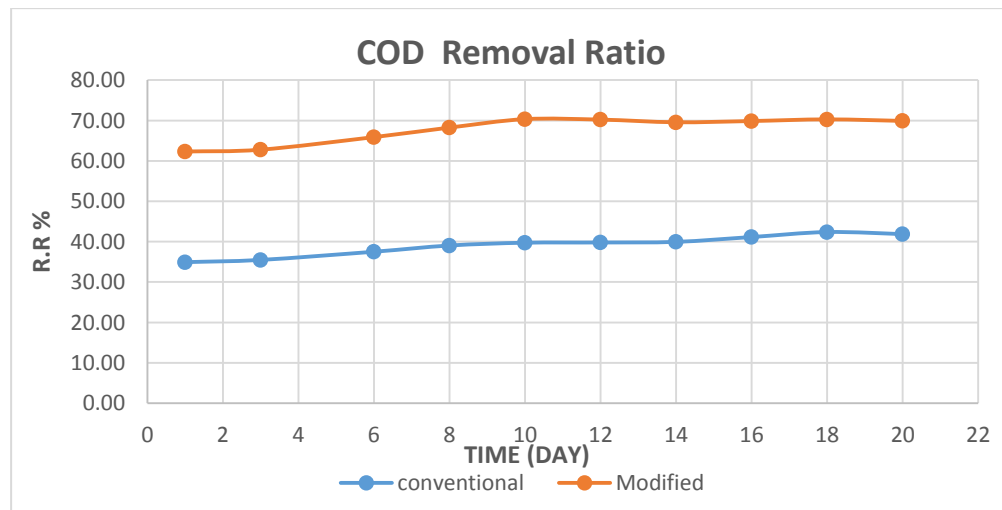


Figure (7) COD removal ratio of run (2)

## 5-Conclusions

The main target of this study is to show the effect of the thickness media using as new technique of septic tank to improve its effluent quality for dairy wastewater.

- 1- Using sponge with density  $33 \text{ gm/cm}^3$  and thickness 5.0 cm achieve removal efficiencies 97.77%, 68.64% and 96.37% of TSS, BOD and COD respectively.

- 2- Using sponge with density 33 gm/cm<sup>3</sup> and thickness 10.00 cm achieve removal efficiencies 98.14%, 70.28% and 70.36 % of TSS, BOD and COD respectively.

The pervious results shows that the sponge media with thickness 10 cm achieve the highest removal ratios.

### **References**

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