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# Evaluation Biofilm Sewage Treatment Plant

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***Abstract*—**The research study is carried out to determine the efficiency of the Biofilm sewage treatment plant which is located at the Engineering Complex's. Wastewater analyses have been carried out at the Environmental Engineering laboratory to study the six parameters: Biochemical Oxygen Demand BOD, Chemical Oxygen Demand COD l, and Total Suspended Solids TSS, Ammoniac Nitrogen NH3-N and Phosphorous P which have been selected to determine the wastewater quality. The plant was designed to treat 750 Pe (population equivalent) at hydraulic retention time of 5 hours in the aerobic zone. The results show that Biofilm wastewater treatment plant was able to treat sewage successfully at different flow condition. The discharge has fulfilled the Malaysia Environmental of Standard A water quality. The achieved BOD removal is more than 85%, COD is more than 80%, TSS is more than 80%, NH3-N is more than 70%, and P was more than 70%. The Biofilm system provides a very efficient process for sewage treatment and it is compact in structure thus minimizes the required land area**.**

***Keywords*—**Sewage, Bio film, Cosmo-Ball, Activated sludge

## I. INTRODUCTION

SEWAGE can be defined as wastewater, which is discharged from domestic sources such as homes, restaurant, industries and agricultural plants etc. The wastewater contain substance like human waste, food scraps, oil, soaps and chemicals. Generally the sewage flows through an extensive network of underground pipes to wastewater treatment plant where the polluted water is treated using various methods to remove the pollutants. If the polluted water is fed directly in to the rivers lead water contamination. The statistical account of polluted rivers in Malaysia remained at 14 as in the previous years which are Dondang, Sg. Jurn and Sg. Jejawi in Penang; Sg.Deralik and Sg. Raja Hitam in Perak; Sg. Kelang, Sg. Buloh and Sg. Sepang in Selangor; Sg. Tukang Batu, Sg. Pasir Gudang, Sg. Sedili Kecil, Sg. Kempas, Sg. Pontian Kechil and Sg. Rambahbah in Johor [ 1].Some of the Malaysia rivers are heavily polluted with mean BOD levels nearly six times the international standard. The higher level of BOD-related water pollution is due to the residential pollution, followed by agriculture and industries. Of the 119 rivers monitored for wastewater pollution, 34 rivers exceeded the standards. The numbers of affected rivers were nine in Johor, seven in Selangor, six in Sarawak, three in Terengganu, two each in Melaka, Pahang, Perak and Sabah and one in Negeri Sembilan.

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The reasons behind the sewage treatment are the scarce in natural water resources and the higher demand of clean water supply. Moreover the higher volume of wastewater back to natural water resources deteriorates quality of water in receiving bodies. These matters have emphasized technological development in water industry to provide innovative yet proven technical solution.

The main goal of any sewage treatment plant is to reduce or remove organic matters, solids, nutrients, disease-causing organisms and other pollutants from wastewater.

Sewage treatment plants go through several steps in a treatment process in order to safely treat large quantities of wastewater. In addition to that each sewage treatment plant must hold a permit listing the allowable levels of $BOD_5$, suspended solids, and other pollutants. Currently the systems like septic tank, activated sludge, oxidation ponds and aerated lagoon are used to treat the polluted wastewater. These wastewater treatment plants are not very efficient in treating sewage.

The BioFilm wastewater treatment system is more effective than conventional wastewater treatment system.

## II. METHODS

### *A. Experimental Procedure*

The sewage analyses are carried out in the Environmental Engineering Laboratory near to the Engineering Complex's sewage treatment plant. Sewage sample are taken from different sampling points and are analyzed immediately. The four samples are taken from grease trap, balancing tank, clarifier tank and discharge end. The parameters analyzed are Biochemical Oxygen Demand ( BOD), Chemical Oxygen Demand ( COD), Total suspend Solid (TSS), PH value, Ammonia Nitrogen and Total Phosphate. The experiments are repeated several times to obtain average results. The sample analyses are carried by using the standard examination method called Hach Spectrophotometric. The experiments are carried out by taking samples at influent, effluent and intermediate points.

### *B. Cosmo- Ball Filter Media*

The Cosmo-ball media is suitable for both aerobic and anaerobic situations. It is light in weight, floats in water and therefore easy to remove or clean whenever it is required. The Cosmo-ball is made of strong polyethylene plastics which will resist even highly corrosive or hazardous effluent. The innovative design of cosmo-balls makes it less prone clogging as the void spaces provided is in excess of 85%. [ 2].

BioFilm system offers many advantages which are needed for sustainable wastewater treatment plants, the most important features are:

1. Effective treatment within short retention time, thus save space and also capital costs.

2. It needs less air for aeration (special characteristic of BioFilm processes).
3. Modular in construction (which can be upgraded to fit increased population).
4. Effective for both BOD and nitrogen removal.
5. No objectionable odor release.
6. Quick restarting especially during power failure.
7. Small land area requirement

The most important feature of BioFil system is in terms of 40% land saving and increase buffer distance (50%) to nearby residential premise, as show below.

Fig. 1 Cosmo-Ball Media

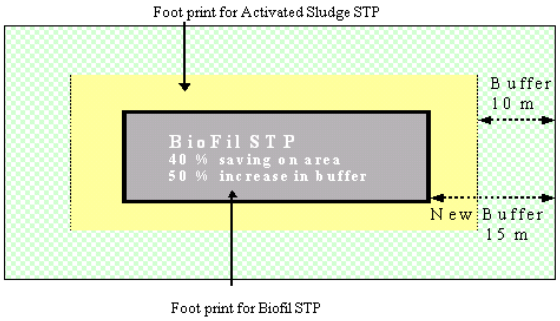


Fig. 2 Biofilm STP & Activated Sludge Foot Print

## III. Results and Discussions

The parameters in this study are given in Table(1).

### A. Flow

The flow of STP is varied from 120.50 m3/day to 154.25 m3/day shown in Fig(3). The flow of the sewage water is normal during 8.00, 11.00, 13.00 and 16.00 hours day and it reaches a maximum value of 154.25 m3/day in the afternoon. Minimum flows occur during the evening hours when water consumption is lowest.

In most cities were the low flow occur from 04 to 08 am morning but the peak flow occur from 12 to 3 p.m afternoon [3].

TABLE I
The Frequency of Parameters and Position of Sampling

| No | Parameter | Frequency | Position of sampling |
|---|---|---|---|
| 1 | *Flow rate* | *4. times per day (duration 5 days).* | *at discharging point* |
| 2 | *TSS* | | *at inlet & discharging point* |
| 3 | *BOD* | | *at inlet & discharging point* |
| 4 | *COD* | | *at inlet & discharging point* |
| 5 | *AN* | | *at inlet & discharging point* |
| 6 | *P* | | *at inlet & discharging point* |

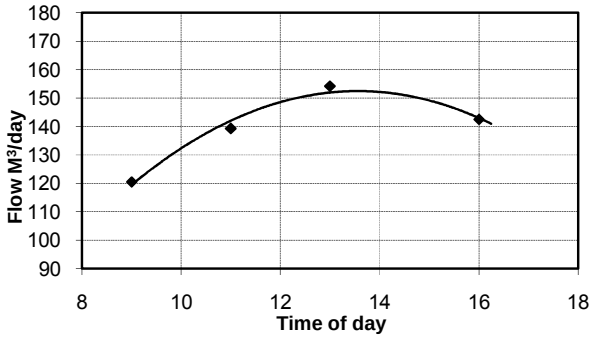


Fig. 3 Flow of sewage treatment plant per time

### B. Organic loading rate

The calculated organic load for the STP is from 0.228 kg BOD/$m^3$ dayto 0.351 kg BOD/$m^3$. day rating. From Fig (4), it can be seen that the BioFilm sewage treatment plan reduces the BOD levels.

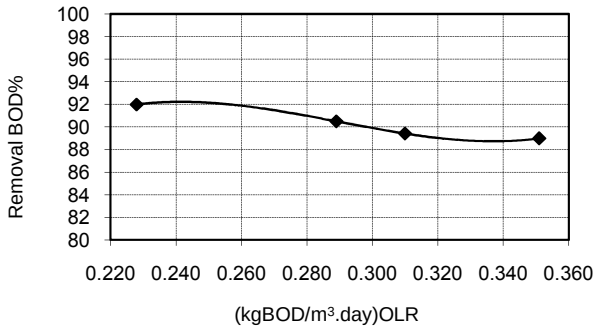


Fig. 4 BOD % removal within organic loading rate

### C. BOD Reduction

BOD is the most important parameter in water pollution control. it is used as a measure of organic pollution, as a basis for estimating the oxygen needed for biological processes, and as an indicator of process performance[ 4].

The maximum and minimum BOD level of the inlet and outlet sewage is 159.5mg/L and 11.0mg/L respectively. The achieved BOD level of treated sewage is equivalent to standard A, which is less than 20mg/L Fig(5). shows the efficiency of the BioFilm sewage treatment plant .

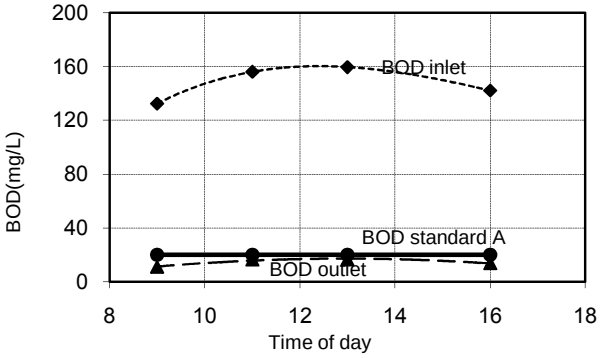


Fig. 5 Reduction of BOD concentration within the system

*D. BOD Removal*

The maximum and minimum BOD removal rates are 91.69% and 89.42% at 9.00 and 11 hour respectively which shown in Fig (6). The average BOD removal is approximately 90.31%.

*E. COD Removal*

The maximum and minimum COD removal rates are 87.50% and 85.47% at 13 and 16 hour respectively and shown in Fig (6). The average COD removal is approximated 86.51%.

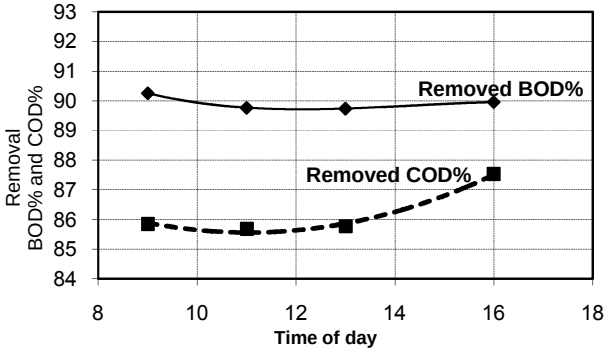


Fig. 6 BOD % and COD% removal per time

*F. COD Reduction*

The maximum and minimum BOD level of the inlet outlet sewage is 213mg/L and 21,5mg/L respectively and shown in Fig (7). The achieved COD removal is equal to standard A, which is less than 50mg/L Fig(7). This shows that the BioFilm sewage treatment plant is performing well.

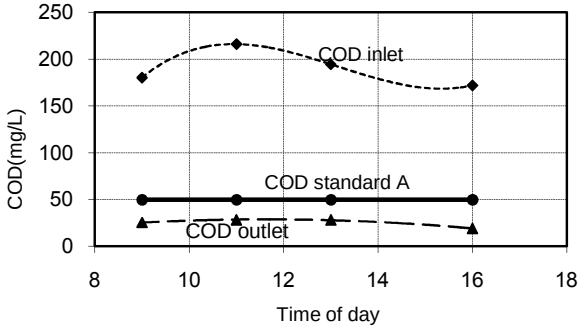


Fig. 7 Reduction of COD concentration within the system time

*G. TSS Reduction*

The maximum and minimum TSS level of the inlet and outlet sewage is 106.29mg/L and 9mg/L respectively. The achieved TSS removal is equivalent to standard A, which is less than 20mg/L and shown in Fig(8). This shows the efficiency of the BioFilm sewage water treatment plant.

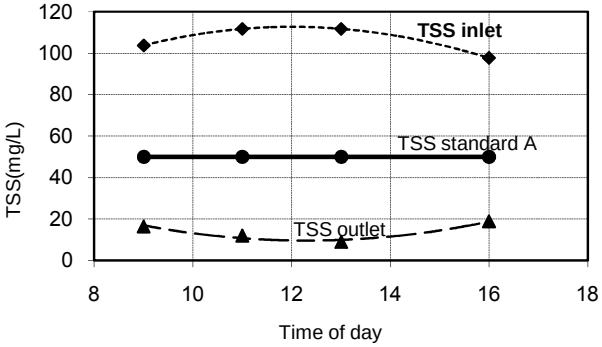


Fig. 8 Reduction of TSS concentration within the system time

*H. Reduction of $NH_3$-N and P*

The $NH_3$-N and P values are presented in Fig (9). The measured $NH_3$-N and P values are:

A. 120mg/L and 5.50 mg/L from the raw influent.
B. 1.75mg/L and 0.41 mg/L from the final discharge.

The above gradual reduction of $NH_3$-N and P values show that the BioFilm sewage treatment plant works well at various loading and operation conditions..

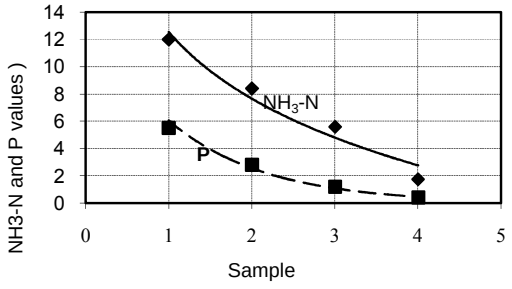


Fig. 9 Reduction of ammonia and phosphorus concentration within the system

## IV. Conclusions

From the estimated results, it can be concluded that biofilm system of the engineering complex sewage treatment plant is working well and the effectively removing the organic components from the sewage.

*The following conclusions are drawn from the experimental results.*

1- Biofilm system has shown to be very effective in removing BOD 90%, COD 86% and TSS 86% during flow conditions.
2- The ammonia nitrogen and phosphorous removal achieved in the Biofilm system are 85% and 90% respectively during flow condition.

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