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EFFECT OF FIXED FILAMENTOUS MEDIA ON WASTEWATER TREATMENT

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Abstract – Adequate treatment of wastewater is important for the protection of the environment. In many countries, the existing conventional biological wastewater treatment systems are unable to meet the required standards. Therefore, present research focused on the improvement of aerobic wastewater treatment plant by adding readily available cheap media. Plastic filamentous media was used due to the non-biodegradable property. The media length was 5 meter but it was rolled into spiral shape. The average removal of TDS and COD, without the media, was about 35% and 70%. After the media has been added, the removal efficiency improved to 55% and 95%, respectively. The experimental results demonstrated that the use of filamentous media is capable of improving the quality of effluents in wastewater treatment towards a better quality of effluent to be discharged to nature.

INTRODUCTION

Malaysia produces over 6 million cubic meter of sewage sludge annually which needs to be treated before being discharged into rivers, lake and ocean (IWK, 2007). High levels of organic matters especially phosphate and nitrate found in untreated wastewater can trigger algal blooms that can affect water turbidity and reduce the recreational value of a local waterway (Hammouda *et al.,* 1995). With increased human populations and trends towards centralization of modern societies, most regions now require that wastewater be treated prior to discharge to a local water system. Therefore, it is very important to treat the wastewater up to the required standard.

In sewage treatment process, separation of solids, fats, oils, and greases is critical as it eliminates portions of the waste that cannot be easily broken down by bacteria living in the system. Incorporation of a biofiltration media consisting of artificial compounds like textiles, plastics or ground glass can be packed inside a reactor on which layers of microbes can form (Sherman, 2006). Systems packed with compact units such as plastic media as filter that has wide surface area canreduce the waste load entering the sewer (Khatoon *et al.,* 2014; Parveen *et al*., 2008).In addition, filteras media can serve as a surface for bacteria to colonize and for biochemical and physical treatment processes to occur which would be helpful in achieving better level of purity at low operational cost and environmental damage (Fang and Yeong, 1993; Parveen *et al.,* 2008; Rupani *et al.,* 2010; Vinod and Mahalingegowda, 2012).

Although numerous investigations were carried out using synthetic materials as filter in the wastewater treatment, no efforts have been made using polymeric plastic material such as nylon mosquito net. Commercially available mosquito net is very cheap, non-biodegradable, highly resistant to moisture and above all has high specific surface area which can be considered as a better choice for increased microbial support and treatment efficiency. In addition, such material has the

additional ability to withstand sudden shock for any wastewater treatment operations (Parveen *et al*., 2008; Vinod and Mahalingegowda, 2012). Previously, polymer fiber geotextiles have been established to support biofilm development and also augment the biodegradation rate (Korkut, 2003). Therefore, in the present study emphasis has been given for reliable and cost-effective technology by introducing commercially available nylon net for sewage treatment.

MATERIALS AND METHOD

Reactor and filamentous media

An aerobic digester was used in the present study and the filamentous media (net) made from nylon was placed inside. The net was constructed as the shape of spiral with a 1 inch space. Aerators placed at the bottom of the aerobic reactor produced bubbles to homogenize and to control the Dissolved Oxygen (DO) of the sludge in the reactor tank.

Laboratory tests

Wastewater from the cafeteria of Engineering Faculty of International Islamic University of Malaysia, Kuala Lumpur, Malaysia, was used as the wastewater. The characteristics of the wastewater was analyzed using established and standard methods used (APHA, 2005). The chemical oxygen demand (COD) was determined following the HACH DR-5000 Spectrophotometer Manual (HACH, 2008).

Process startup and monitoring

The operation mode of the reactor was continuous. The reactor was operated every day with continuous feed and continuous effluent were collected daily. Initially the aerobic digester plant was operated without media. During this phase, the feed (wastewater) were pumped at the rate of 2 L/day. In the second phase, the filamentous media (net) was incorporated in the aerobic digester. Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Total Dissolved Solid (TDS), pH, and Temperature were determined every day.

RESULTS AND DISCUSSION

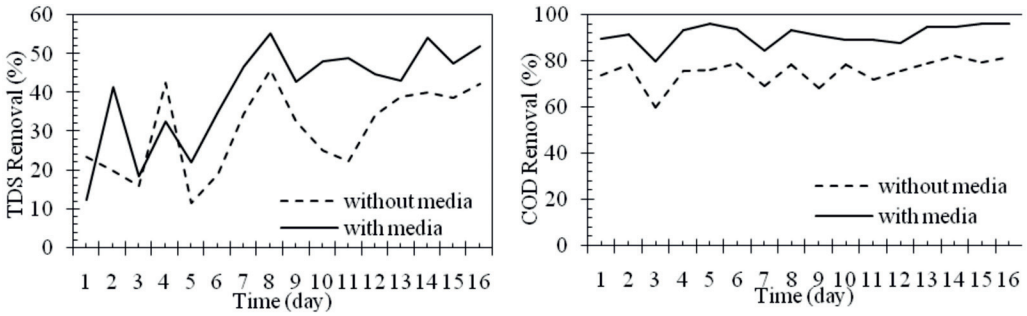
The main drawback of aerobic treatment is the production of high amount of biosolids (sludge). All sewage systems from individual septic tanks to the most sophisticated mechanical plants produce sludge. Untreated sludge is a significant environmental and public health hazard. In the present study, the use of media in the reactor resulted in substantial decrease in the amount of sludge in the effluent. Figure 1 shows the condition of the filamentous media used at the beginning and the end of the experiments.

High total suspended solid can block light from reaching submerged vegetation because the amount of light passing through is reduced. The TSS values have been reduced to as low as 50 mg/l when media was incorporated in the reactor. However, without media the lowest TSS in effluent were found to be 100 mg/L. Due to the attachment of the bacteria on the media, the value of TSS in the sludge has decreased.The TDS values were reduced to around 150 mg/L in the effluent in the experiment when no media were used. However, incorporation of the media resulted in much lower TDS values, around 85 mg/L. Almost 20% more TDS removal efficiency was observed with the addition of the media in the reactor. This proves that the media helps in reducing the TDS values and that the process can be more effective (Figure 2).

COD values in the effluent have been reduced while using media in the reactor. Media removed about 25% more COD from the effluent as compared

(a) Before the experiment b) After the experiment

Fig. 1. Arrangement of the fixed media used in the experiments



(a) Total dissolved solids (TDS) (b) Chemical oxygen demand (COD)

Fig. 2. Comparative removal efficiency of TDS and COD in the reactor.

to the reactor without media. The values met both Standard A and Standard B of Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. This once again proved the effectiveness of the media in the reactor for the treatment of sewage.

CONCLUSION

From the results observed during this study it can be concluded that the percentage removal have increased more than 20% when a filamentous media is incorporated in the reactor (Figure 2). The use of filamentous media is effective in increasing the surface area of the support media. System reliability is somewhat better than suspended package plants because of the more effective capture and control of suspended solids.In conclusion it can be said that the introduction of media in the activated sludge system can increase the effluent quality.

REFERENCES

APHA, 2005. *Standard Methods for the Examination of Water and Wastewater*. 21st edition. American Public Health Association, Washington DC, the USA.

Fang, H.H.P. and Yeong, C. L. Y. 1993. Biological wastewater treatment in reactors with fibrous packing. *Journal of Environmental Engineering.* 119 (5): 946-957.

HACH, 2008. *User Manual.* Edition 3. © *Hach*-Lange GmbH.

Hammouda, O., Gaber, A. and Abdelraouf, N. 1995. Microalgae and wastewater treatment. *Ecotoxicology and Environmental Safety*. 31 (3) : 205-210.

IWK, 2007. Corporate Sustainability Report. 1st Ed., Indah Water Konsortium, pp: 98.

Khatoon, N., Naz, I., Ali, M. I., Ali, N., Jamal, A., Hameed, A. and Ahmed, S. 2014. Bacterial succession and degradative changes by biofilm on plastic medium for wastewater treatment. *Journal of Basic Microbiology.* 54 (7) : 739-749.

Korkut, E. N. 2003. Geotextiles as biofilm attachment baffles for wastewater treatment (Doctoral dissertation, Drexel University).

Praveen, A., Sreelakshmy, P. B. and Gopan, M. 2008. Coir geotextile-packed conduits for the removal of biodegradable matter from wastewater. *Current Science*. 95 (5) : 655-658.

Rupani, P. F., Singh, R. P., Ibrahim, M. H. and Esa, N. 2010. Review of current palm oil mill effluent (POME) treatment methods: Vermicomposting as a sustainable practice. *World Applied Sciences Journal.* 11 (1) : 70–81.

Sherman, K.M. 2006. Introducing a new media for fixed-film treatment in decentralized wastewater systems. *Proceedings of the Water Environment Federation*. 2006 (8) : 4616-4624.

Vinod, A. R. and Mahalingegowda, R.M. 2012. Studies on natural fibrous materials as submerged aerated beds for wastewater treatment. *Elixir Pollution.* 51 : 10759-10762.