PROPOSED SANITATION FOR A TIMBER HOUSE CONSTRUCTED ON WATER

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ABSTRACT

One of the problems causing a threat to public health is the sanitation system of timber houses built in water. The sanitation systems of these houses unfortunately dispose wastes directly into the natural water bodies, since the houses are not actually equipped with the proper sanitation system for disposing wastes from the toilets. The centralization of the waste disposal system is not used widely at tourist areas constructed on water due to technical and financial difficulties. This research requires gathering relevant data from various sources. Moreover, this project will utilize qualitative data collection tools, but is rooted in a qualitative epistemological position that signifies the importance of locating the research within a particular social and cultural house settlement. This paper surveys the literature on problems that arise from raw sewerage disposed into natural water bodies before any sanitation is proposed to solve the problem and how an individual sewage treatment plant can be installed and solve this problem. A sustainable potential solution through making use of a new individual sewage treatment plant for Timber houses is presented in this proposal. The results would lead to the development of affordable waste management systems, as well as, improvement of water quality surrounding the Timber houses while maintaining the social and cultural values of indigenous people living in them. In this study, a sanitation system is proposed to be used in the timber houses constructed in water and the system was tested and showed that it is effective in wastewater treatment.

Keywords: Timber houses, water sanitation, sanitation system, disposed

1. INTRODUCTION

Indigenous houses are made of wood and foliage and have a simple structure. These houses can be built everywhere; some of them are built on the water at the beach and some of them on the ground. Due to the need of indigenous people living along the water, these houses can be found on the surrounding waters (Akinnifesi et al. 2008). It is estimated that there are about 370 million of indigenous people located in 70 countries all over the world. On the other hand, their social, cultural, economic, and political characteristics are different compared with the dominant society in which they live (Godoy et al. 2010).

Today, indigenous houses are found in all parts of the world and many indigenous people still live in these homes. Due to the variety of geographic location and climates in different countries, the structures of these houses are consistent with the surrounding area (Nasrolah et al. 2014). So the houses are different in shapes and materials in different parts of the world (Richmond & Ross 2009). More advanced timber framing system allows easy production and ease the assembly (SIVA. JAGANATHAN 2011).

As mentioned earlier, due to the simple structure of these types of houses, they only have the primary features and basic amenities. For example, most indigenous houses are without toilets to control wastewater. Indigenous people, whose homes do not have sanitation system, prefer to use the nature water for washing. On the other hand, the indigenous houses that have the basic facilities such as toilets linked to a sewer system and treatment plant, the wastewater is transferred into the natural water directly (Struthers & Eschiti 2005).

Because of the lack of proper basic facilities, indigenous people build their houses along the natural water. Finding food is another privilege of living near natural water (Bromley 2009). The governments provide other basic facilities such as electricity and water supply that help the indigenous people to have a normal life. The existence of indigenous housing on the water is causing problems to the environment and humans (Lohmann 2009).

The domestic wastewater coming from kitchens and bathrooms of indigenous houses is also termed as sewage or gray water. In areas of high population density, wastewater can pose a serious public health threat (Barber et al. 2007). Good sanitation system for domestic wastewater includes treatment and disposal of solid and light wastewater (Gu 2000). All these wastes have negative effects on the environment and transfer the disease to human and animals. Wastewater from growing population is disposed into the environment and pollutes natural, environmental bodies. Therefore, sewages or wastewater and managing them play an important part in people's life (Nicolella et al. 2000). Today, the toilet filtering system is the best way for managing and controlling the sewages in the houses. Two types of toilet filtering system are used in the world; the traditional way and the central system of toilet filtering (Su et al. 2011).

Malaysia is one of the countries that have a large number of tourists and timber houses can accommodate tourists. In Malaysia, more than 1.5 million timber houses were constructed on the water and they are mainly used for tourist attraction purposes. Due to the growing number of timber house close to water, there is an increasing need for a proper sanitation system for these houses in order to control environment pollution (Wang et al. 2007).

2. MATERIALS AND METHODS

This research is an experimental research in which the value of one variable is systematically changed by using small treatment plant (septic tank). The data source is of utmost importance in this research since the data needs to be helpful. Thus, the sources of data are divided into two groups according to the types of data, namely, direct observations and indirect observations. In this research, the information that is mainly used for designing the model is taken from literature review (books, articles, and internet). The new design of septic tank is divided into two parts and each part is doing separate function. The media that had been used in septic tanks is the proposed design system treatment. Wastewater treatment can be achieved through two stages without any connection. The septic tank technology uses the physical treatment (sedimentation) for making separation of suspended solid from the wastewater (Radićet al. 2010). In fact, the septic tank is a wastewater treatment tank that can remove suspended solids by physical method or sedimentation (Grisey et al. 2010). However, due to timber housing settlement with septic tanks of direct contact with water, BOD5 must be reduced to the standard acceptable level. Therefore, adding the media to the structure of septic tank can help to reduce water contamination; a new proposed design of septic tank will include this new technology in chamber.

The new design can be divided into three parts; the function of first part is to remove the suspended solid from wastewater in the shortest possible time and the second part removes bacteria from wastewater. Both reactions help to reduced water contamination in the shortest possible time.

A septic tank is required to be designed based on a set of data, information and computation to follow the standard size of septic tanks. Septic tank size depends mainly on the number of households.

As mentioned in Malaysian sewerage industry Guidelines (MS 1228), the standard of Malaysian volume of the septic tank is 2000 liters/day. This capacity can support 5 to 9 persons per day. On the other hand, according to the standard of water consumption of each person on a daily basis in each country, the United States has the highest consumption, but 2000 liters/day is the minimum volume according to Malaysian sewerage industry guidelines. This minimum capacity can support the indigenous houses with five persons.

According to Malaysian sewerage industry guidelines, the Working Volume and Accumulated Sludge Volume have different standard sizes of septic tanks. For example, working volume of the septic tank is 1,125 liters/day which is enough for 5 persons in 24 hours, and hence, the indigenous houses in the resort that are on the water with more than five people cannot live in these houses. The Minimum capacity of 1,125 liters/ day is useful for the new design of septic tank.

In fact, the timber houses built on the water can be used as resorts and residential complexes. Therefore, the new design of the septic tank must have the lowest volume. On the other hand, according to media technology, the treatment time will be reduced from 24 to 12 hours.

In addition, timber houses can accommodate 2 to 5 persons for the short period of time or vacation time. So, if the septic tank volume is 600 liters, it can be divided into two or three chambers. The idea of dividing the volume of the septic into three chambers will allow using the media in the second chamber. These two processes are different from each other and they are not used in the same chamber. Thus, the interior volume of the septic tank needs

to be divided. The interior space can be divided into two or three stages of treatment. The first and the third stages are designed for sedimentation and the middle stage for media. For this purpose, the tank is divided into two chambers, but the treatments will not be done perfectly. Consequently, the interior space is divided into three chambers.

The suspended solids are separated in the first chamber and the second chamber does the aeration. The last part can polish chamber or primary chamber for sedimentation. One of the important points in the design of septic tank is the time which is required for treatment. In fact, the treatment time can play an important role in the design of chambers.

3. RESULTS & DISCUSSION

For understanding the quality of wastewater discharged, it is required to collect data from this prototype at different times. All samples were analyzed in the laboratory to determine their quality. There were several parameters for analysis and these parameters are as follows:

1. BOD5 (Biochemical Oxygen Demand Five Days)
2. COD (Chemical Oxygen Demand)
3. TSS (Total Suspended Solid)
4. AN (Ammonia Nitrate)
5. PH (Hiring Potential)

This tests can show to the quality of wastewater discharged from the septic to a great extent, but it should be noted that the data will be collected in various circumstances to which it refers.

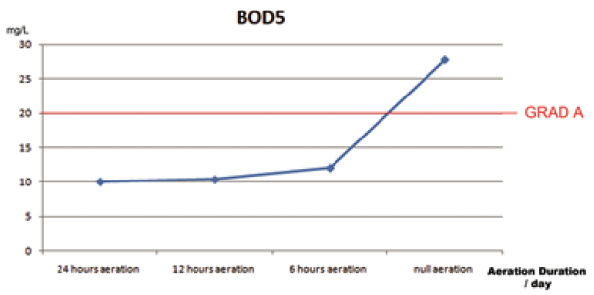

Figure 1: BOD5 Results

Generally, the samples are collected five times, four times of which are done before the upgrading process and once after upgrading the septic tank. According to the Malaysian industry sewerage guideline, the BOD5 of domestic raw sewage is around 300 mg/L, so the test was performed again to verify. As the chart shows, BOD5 of 24 hours aeration is lower than other experiences, but 6 hours aeration is under the Grad A that is acceptable. Other results have been shown in the following chart.

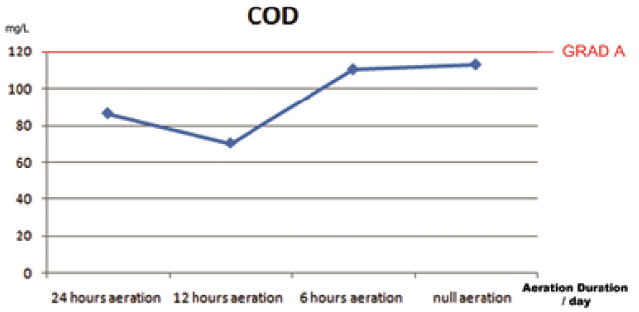

Figure 2: COD Results

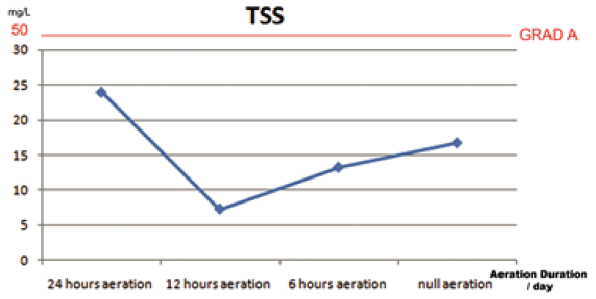

Figure 3: TSS Results

The chart of TSS shows that septic tank has worked better after upgrading. The next chart illustrates the PH results showing that all the experiments follow the Grad A.

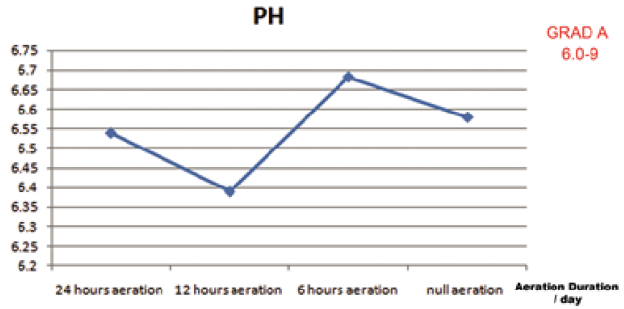

Figure 4: PH Results

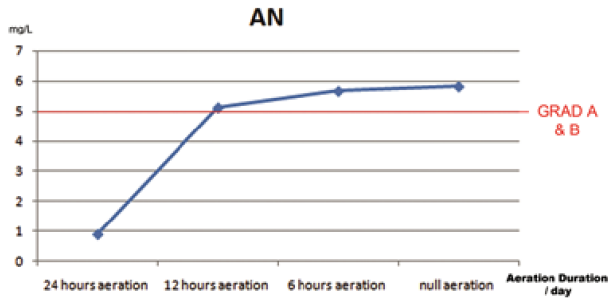

Figure 5: AN Results

The last test is ammonia that is the one with the best result. The ammonia result of septic tank shows that 24 hours aeration has best result.

4. CONCLUSION

The most important parameter in this study is the size of the septic tank that is very important to the timber houses constructed in water due to its small volume and weight. In case of applying the standard size of septic tank, the weight and size can be problematic for timber houses. Given the low weight and size to half the size of new septic tank, the study recommends its usage in the timber houses. Future researches are recommended to reduce the size of septic tank. To conclude, this research recommends reducing the size of a conventional sewage treatment plant domestic wastewater.

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