PERSISTENCE AND OCCURRENCES OF BACTERIA ON WASTEWATER IN SELECTED TREATMENT PLANT OF UITM PAHANG BRANCH, JENGKA CAMPUS

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Abstract

Coliform bacteria are present in the environment and feces of all warm-blooded animals and humans. Fecal coliform bacteria are a subgroup of total coliform bacteria. They exist in the intestines and feces of people and animals. E. coli is a subgroup of the fecal coliform group. Human or animal feces infected with E. coli sometimes get into lakes, pools, and water supplies. This research is conducted to identify the occurrence of the bacteria in influent and effluent of wastewater discharged from selected treatment plant in Universiti Teknologi MARA (UiTM) Pahang. The samples were taken and preserved before further analysis. The method used in this experiment is presumptive total coliform test using m-Endo broth (MF). MF Method is a fast and simple way to estimate bacterial populations by passing an appropriate sample volume through a membrane filter (0.45 microns) small enough to retain the bacteria present. Several samples were tested and the result showed that the bacteria (total coliform bacteria) are persistence in the sample and further discussion have been done by referring to the Water Quality Index from Department of Environment, Malaysia.

Keyword: Coliform bacteria, Malaysia, m-Endo broth, Occurrences, Wastewater

Introduction

A man or other animal are the source of the presence of fecal coliform bacteria in aquatic environments. It will be trigger factor for the water source to be contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A (Jumat et al., 2017). The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. As a result of the overflow of domestic sewage or nonpoint sources of human and animal waste, the Fecal coliform bacteria may occur in ambient water.

As reported by Borrego et al., 1997, the main cause of faecal pollution in natural aquatic environments is the discharges of wastewater. Domestic wastewaters are the main source of pathogens in receiving natural waters, thus indicator microorganisms must be monitored to prevent outbreaks of enteric diseases. Previously it is just used to detect the presence of specific pathogens. Residual water contains millions of bacteria per millilitre of water. Protozoan, fungi and virus are also abundant is these waters (Pelczar et al., 1993). Treatment of wastewater is essential, for further uses, such as irrigation. The purposes of wastewater treatment plants are to remove organic and inorganic substances, nutrients and microorganisms from residual waters. This is important to prevent the degradation of the receiving aquatic systems and problems related with public health (Ndulini et al., 2018). The

focus of this study is to identify the performance and the quality of an effluent discharged from the selected wastewater treatment plant. It is important to identify the performance of the treatment provided because the effluent will flow into the nearest river which will expose to aquatic life and ecosystem thereafter.

Treatment used in the plant

The selected wastewater treatment is a plant located in one of the students' residential. The treatment process is started with primary screening where large-scale rubbish will be blocked from continuously entering and subsequently the effluent will undergo secondary screening where the size of screen is smaller so that the small size of the rubbish will be stuck and prevented from entering to the next process. This wastewater will then go through the process of grit removal and oil and grease removal. Oil and grease will float on the surface of the water while clean water will be removed through the bottom of the tank and flow into the aeration tank. In the aeration tank, the wastewater will be supplied to the air to promotes the microbial growth and increase the efficiency of sludge sedimentation process. After the aeration process, the wastewater will enter the clarifier tank. In the clarifier tank, once again the wastewater containing suspended solid will be filtered before entering the next process, namely the disinfection tank. In disinfection tanks, chlorine will be mixed with treated water before being released or known as effluent. This effluent will drain into the nearby river. **Figure 1** below shows the schematic diagram of treatment used in the plant.

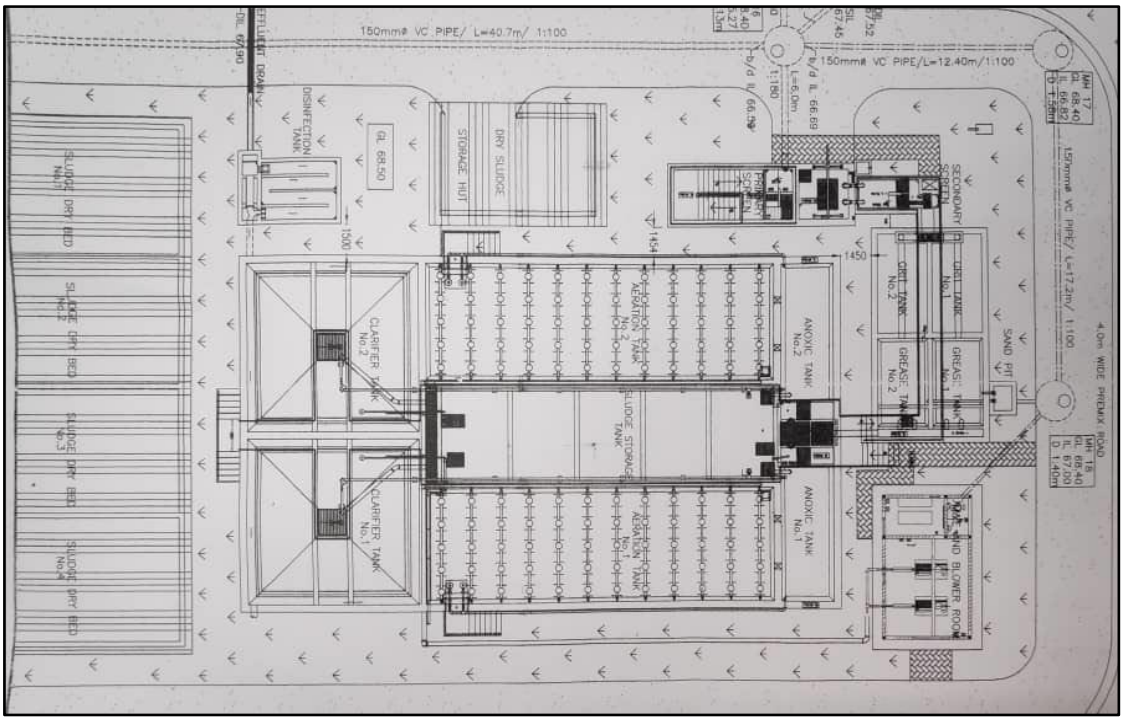

Figure 1 Schematic Diagram of the Treament Plant

Materials and Methods

Wastewater samples were taken from influent (before the screening chamber) and effluent (after disinfection tank) as much as 30 mL per sample. Sampling was conducted for 5 consecutive days i.e. from Monday to Friday. Samples taken are then stored in the 4°C container and taken to the laboratory for analysis. At the same time basic parameters of the sample also were recorded on-site such as pH, turbidity, temperature and conductivity. Sample of wastewater was tested within 24 hours because if delaying, it can cause bacteria (*E.coli*) to die and will cause the data inaccurate (Jackson et al., 2019). **Figure 2** shows fecal

coliform formed after 24 hours incubation. For the purposes of identifying the colony coliform found in the sample, the membrane filter technique was used. There are 3 commonly used methods for obtaining colony, namely Membrane filter technique, multi-tube fermentation and enzyme substrate coliform test. This study chose membrane filter technique as a research methodology because of the lack of facilities available in the environmental laboratory. The membrane filter technique procedure conducted as below (APHA, 2012).

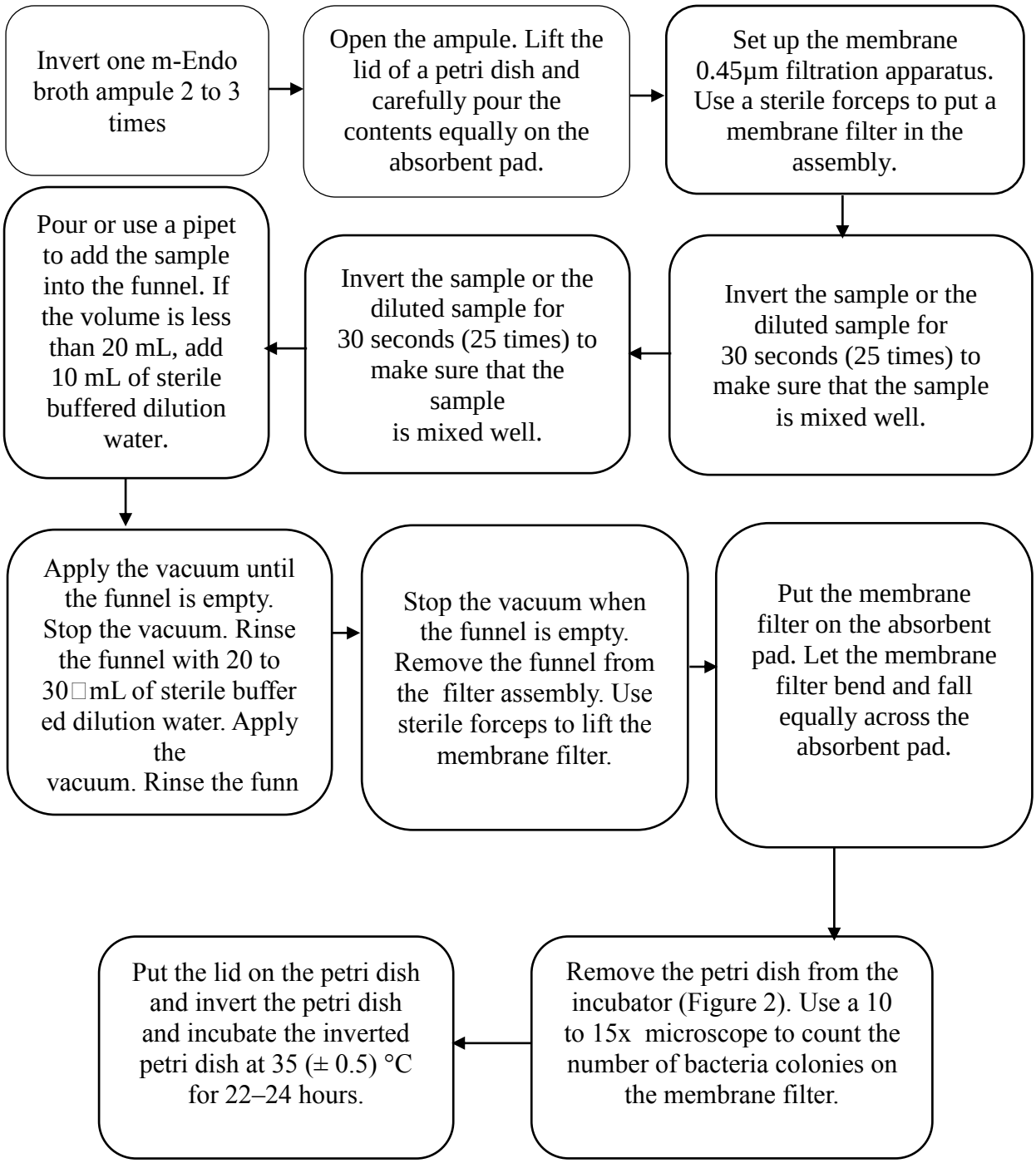

Figure 2 Fecal Coliform formed after 24 hours incubation

The counted coliform then calculated using following equation:
E.coli / 100 mL = [Numbers of E.Coli colonies / Volume of sample filtered (mL)] x 100
The result obtained are compared with the National Water Quality Standard (WEPA, 2006).

Result and Discussion

After the sample was tested and analyzed, it was found that the sample on Day 1 (Monday) showed the removal percentage of Coliform was the highest compared to other days. This is because the contractor who manages the plant adds chlorine on weekly basis which is on Monday. It is also showed that the percentage of removal of coliform was the lowest on Friday, only 32.3% of the coliform removed. Overall, the percentage of removal obtained was between 31% - 61% and after the calculation of E.coli colony in 100 mL was made, it was found that the colony E.coli range was between 150-300 count / 100mL. In National Water Quality Standard for Malaysia stated that the level of coliform under level 4 (irrigation) must lower than 5000 count/100mL, since the result obtain indicate the value only between 150 to 300 count/100mL so the effluent of the coliform treated in this treatment is sufficient enough. **Figure 3** shows the comparison between influent and effluent obtained during the study, while **Figure 4** shows the percentage of removal of coliform for 5 consecutive days.

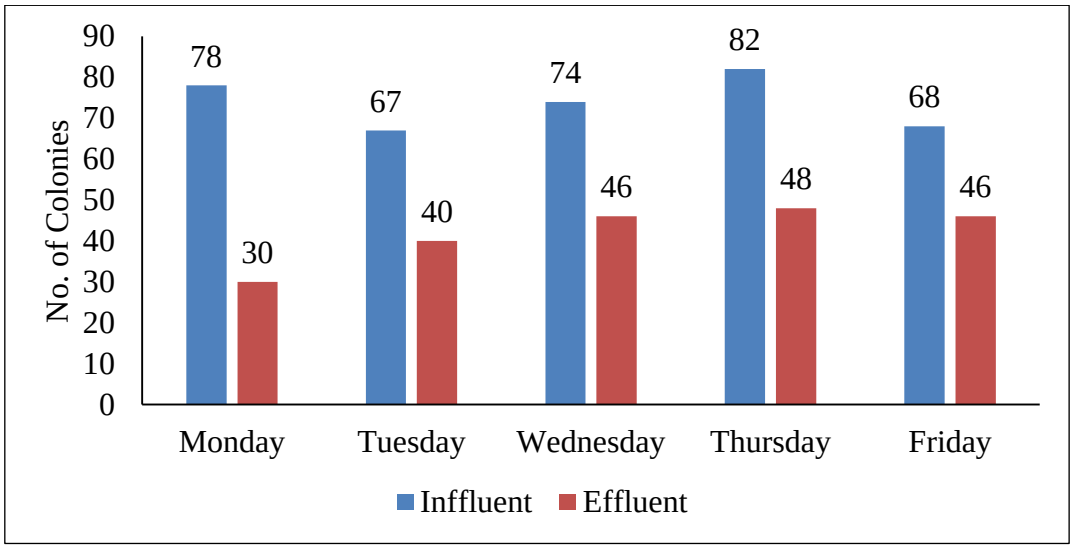

Figure 3 Comparison of influent and effluent removal on coliform

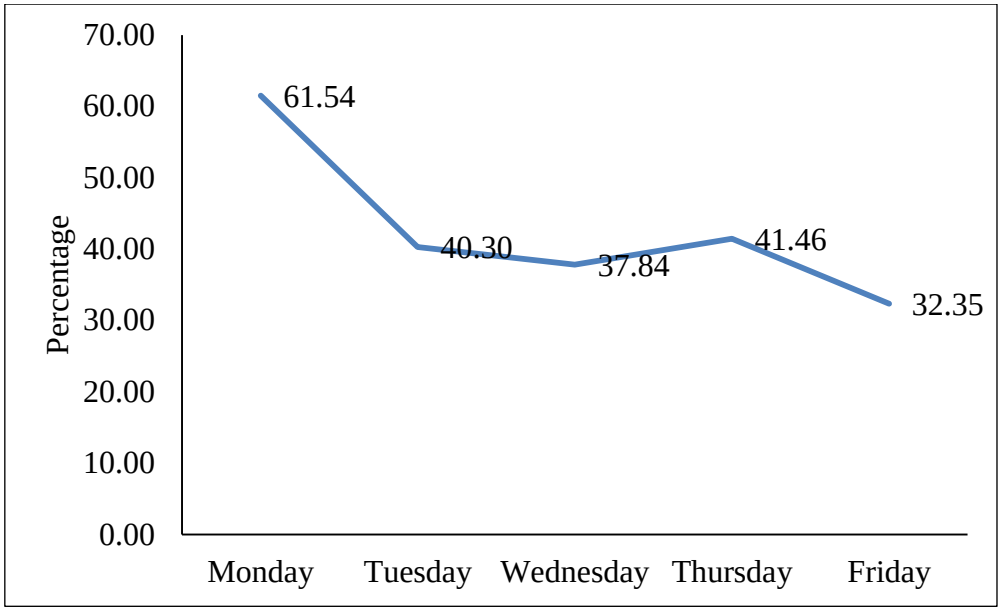

Figure 4 Percentage of removal for coliform

Conclusion

After the study was carried out for 5 consecutive days, it found that the selected treatment plant capacity was satisfactory and the volume of colony E.coli was between 150-300 count / 100mL and fulfil the National Water Quality Standard for Malaysia as discussed in the previous section. However, there are some limitation on this study as stated below:

i) This study was done only for 5 consecutive days.
ii) The rainfall data was not considered in this study.
iii) The quantity of chlorine added in the treatment process are not measured.

As suggestion for future study, the duration of the sampling process may be extended for few weeks or months. Besides, the rainfall data and quantity of chlorine must measure because the factor could affect the persistence of bacteria.

Acknowledgement

Many thanks to all the team members in the sampling processes, run the experiments, analysis and subsequent production of the paper.

Conflict of interests

Author hereby declares that there is no conflict of interests with any organization or financial body for supporting this research.

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