SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering (Hons.).

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Date : 11 January 2017

THE EFFECTIVENESS OF EFFECTIVE MICROORGANISMS IN TREATING WASTEWATER

NAVANITHARUBAN A/L BATUMALAI

Thesis submitted in fulfillment of the requirements

for the award of the degree of

Bachelor of Civil Engineering (Hons.)

Faculty of Civil Engineering & Earth Resources

UNIVERSITI MALAYSIA PAHANG

JANUARY 2017

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries, which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature : _____

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Date : 11 January 2017

Special dedication to:

My beloved mother Menachi Sivaraman

My UMP lecturers

And to my friends Shankar, Shan and others…

Thank you for everything…

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℃	Degree Celsius
%	Percentage

LIST OF ABBREVIATIONS

AN	Ammoniacal Nitrogen
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
ed	Edition
EM	Effective Microorganisms
EQA	Environmental Quality Act
FKASA	Fakulti Kejuruteraan Awam dan Sumber Alam
g	gram
HM	Heavy Metals
mg/l	milligram/litre
ml	mililitre
mm	milimeter
NGO	Non-Governmental Organization
NI	Nickel
NTU	Nephelometric Turbidity Unit
O&G	Oil and Grease
TSS	Total Suspended Solids
UMP	Universiti Malaysia Pahang
ZN	Zinc

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ABSTRACT

This paper present the studies on the effectiveness of using effective microorganisms (EM) in treating wastewater by using molasses, honey and sugar as a solution on activating it. It also determined the removal efficiency and also compared the three types of EM solutions in removing pollutants from the wastewater sample. EM is a group of 250 bacteria mainly consist of three types of microbes that are yeast, lactic acid, and photosynthetic bacteria. It is widely used for the purpose of wastewater treatment and purification that contribute to the significant of reduction on the water quality parameters such as chemical oxygen demand (COD), pH value, biological oxygen demand (BOD), total suspended solids, turbidity, ammoniacal nitrogen, oil & grease, and heavy metals. The EM was produced accurately and was activated by using sugar, honey and molasses. The sample of the wastewater was collected from morning market of Taman Tas, Kuantan. The data showed by using activated EM with molasses, the percentage of BOD removal was 43.64%, COD removal was 84.01%, TSS removal was 55.17%, zinc removal was 72.5%, and nickel removal was 90.28%. Furthermore, the data also showed by using activated EM with honey, the percentage of BOD removal was 38.37%, COD removal was 81.95%, TSS removal was 62.07%, zinc removal was 67.5%, and nickel removal was 84.72%. On the other hand, it also showed by using activated EM with sugar, the percentage of BOD removal was 30.93%, COD removal was 78.73%, TSS removal was 72.41%, zinc removal was 62.5%, and nickel removal was 81.9%. Moreover, all of the activated effective microorganisms removed 100% the oil & grease, and ammoniacal nitrogen from the wastewater. The results showed that the removal efficiency of the three types of activated effective microorganisms were successful. The study indicated that the treatment process using EM was effective.

ABSTRAK

Kertas kerja ini membentangkan kajian mengenai keberkesanan penggunaan efektif mikroorganisma (EM) dalam merawat air sisa dengan menggunakan pelbagai jenis bahan larutan seperti sirap pekat, madu dan gula untuk mengaktifkan EM tersebut. Ia menentukan kecekapan penyingkiran dan membandingkan tiga larutan EM yang berbeza dalam menghapuskan bahan pencemar dari air sisa. EM adalah sekumpulan 250 bakteria terutamanya terdiri daripada tiga jenis mikrob iaitu yis, asid laktik dan bakteria photosynthetik yang digunakan secara meluas untuk tujuan rawatan air sisa dan pembersihan yang menyumbang kepada pengurangan yang ketara pada parameter kualiti air seperti COD, pH, BOD, TSS, kekeruhan, nitrat ammoniacal, minyak & gris, dan logam berat. EM tersebut telah dihasilkan dengan terperinci dan ia telah diaktifkan dengan menggunakan gula, madu dan sirap pekat. Sampel air sisa dikumpulkan dari pasar pagi di Taman Tas, Kuantan. Hasil kajian menunjukkan dengan menggunakan sirap pekat sebagai bahan pengaktif EM, peratusan penyingkiran BOD adalah 43.64%, penyingkiran COD adalah 84.01%, penyingkiran TSS adalah 55.17%, penyingkiran zink adalah 72.5% dan penyingkiran nikel adalah 90.28%. Hasil kajian menunjukkan dengan menggunakan madu sebagai bahan pengaktif EM, peratusan penyingkiran BOD adalah 38.37%, penyingkiran COD adalah 81.95%, penyingkiran TSS adalah 62.07%, penyingkiran zink adalah 67.5% dan penyingkiran nikel adalah 84.72%. Hasil kajian menunjukkan dengan menggunakan gula sebagai bahan pengaktif EM, peratusan penyingkiran BOD adalah 30.93%, penyingkiran COD adalah 78.73%, penyingkiran TSS adalah 72.41%, penyingkiran zink adalah 62.5% dan penyingkiran nikel adalah 81.9%. Selain itu, kesemua jenis EM telah menyingkirkan 100% minyak & gris, dan nitrat ammonikal daripada sampel air sisa. Keputusan data menunjukkan peratusan penyingkiran ketiga-tiga jenis EM adalah Berjaya. Keputusan menunjukkan bahawa proses rawatan menggunakan EM berkesan dan berjaya.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Water is a source of life on earth that is very important for humans, animals, plants and other living things. They all need water to live. Without water, all the life on earth will die and all the activities that require the usage of water will be interrupted. There are various uses of water in everyday life such as for the purpose of drinking, cooking, washing, agriculture, and many others. As for that, clean water is very important for all because water that has contaminated is very dangerous for all and could cause harm to humans (Singh and Sharma, 2014). Treated water is related to the quality of wastewater discharged from the water treatment plant. As if the treated wastewater does not meet the water quality standards, the process for treating water after that can be more difficult and resulted in the increase of the cost of treatment.

Urbanization process is the process of developing a new area. In this developed area, the process of migration of people from one area to a new area will occur. This migration process would happen in particular places that can cause population growth dramatically in that particular place (Boone and Fragkias, 2013).

Population increased on an area can trigger problem in social level, economic level and the most significant is on environmental level that could lead to environmental problems. The rate of creating residual especially high wastewater production in a specific area could give bad effects if this wastewater is not properly regulated and supervised. All of the problems occur during the flowing of the wastewater such a foul odor, wastewater collection and wastewater flow requires immediate solution in order to provide a comfortable and clean environment for human. There is a water crisis today, but the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people and the environment suffer badly (World Water Council, 2014).

Wastewater produced in a specific area will be channeled to the water treatment plant to be treated, which then will produce treated wastewater. This water will be then discharged into the drainage system or drainage ditch before it is collected and processed at the water treatment plant. Wastewater usually has high contaminants substances in it such as organic waste, or toxic chemicals (Spellman, 2014). The process for treating wastewater requires tremendous costs. This is because the government has to provide a suitable plant system for the type of wastewater that needs to be treated. If the wastewater is polluted and it consists of materials that are too dangerous, then the costs to treat that wastewater will become high too. In this development era, having to spend excessive money on the treatment of wastewater is a very critical problem to be resolved.

There are many studies have been conducted on wastewater related problems in developed areas like housing and industry. Most of the findings offer chemical and toxic methods that its outcome is feared would bring negative effects to the environment. For most towns, the concentrated wastewater will be treated and then it will be discharged through the drains, rivers and sea and eventually resulted in the pollution of the environment in all areas (Karia. and Christian, 2013).

The effect from this issue have increased the awareness among human on the importance of preserving the environment that has been rejuvenated in preparation with the goal of providing a method of maintaining the sustainability in all aspects of treatment and avoid any potential harm to the environment. Among the technology that has been used is effective microorganism technology.

Effective microorganism technology was developed in 1970 at the University of Ryukyus, Okinawa, Japan. Effective microorganism is a group of good microorganisms that have been used primarily to remove contaminants biologically (Higa, 1997). The application of effective microorganism is normally used in wastewater treatment, agriculture, fertilizer, and decomposition of organic matter, the formation of landscaping, septic tank cleaning, and controlling algae (Mathews and Gowrilekshmi, 2016). Effective microorganism was introduced to the world in an international congress in Thailand in 1989 and the benefits of it in many applications relating to the environment have been presented. As for today, EM has been widely used around the world, especially in treating wastewater (Sangakkara, 2000).

1.2 Problem Statement

EM has become famous for its solution in wastewater treatment process. EM are been used over the world now. There are also independent bodies from the governmental organizations and environmentalists that have been running campaigns to encourage usage of EM as the alternative method used in treating wastewater and conserving water. As for an example, usage of EM in Malaysia can be seen in August 2008, a total of one million EM mud balls have been thrown into the river at the Seafront of Gurney Drive on the Penang Island and in January 2010 a total of 10,000 EM mud balls have been thrown around ponds and lakes in the National Zoo as to support the campaign of conservation of water quality and the environment.

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