

INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

**BANANA PEELS AS AN ORGANIC ADSORBENT FOR THE
REMOVAL OF NUTRIENTS, ORGANIC MATTER AND SUSPENDED
SOLIDS FROM RIVER WATER**

**Chua Zhen Yan
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Dr. Low Wen Pei

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SUPERVISOR'S DECLARATION

This project report entitled Banana Peels as an Organic Adsorbent for the Removal of Nutrients, Organic Matter and Suspended Solids from River Water is prepared and submitted by CHUA ZHEN YAN with matrix number I13003206 as partial fulfilment of the requirement for Bachelor of Engineering (HONS) in Civil Engineering INTI International University.

APPROVED BY:

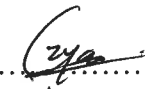


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Supervisor

7/5/18
Date:

STUDENT'S DECLARATION

I hereby declare that the final project is based on my original work except for quotations and citations, which have been duly acknowledge. I also declare that it has not been previously or concurrently submitted for any other degree at INTI International University or other institutions.

Signature	:	
Student Name	:	Chua Zhen Yan
Student ID	:	I13003206
Date	:	30/4/2018

ABSTRACT

This project presents the assessment of low operating cost and green technology way to remove the wastes from contaminated river water, Sungai Batang Labu located in Nilai, Negeri Sembilan, Malaysia. The objectives corresponding to this project are to evaluate the adsorption efficiency of banana peels and to compare the performance of banana peels in different flow rate for 5 parameters which are Phosphate, Nitrate, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD) and Total Suspended Solid (TSS) from river water. The banana peels used as adsorbents are prepared without any treatment. The experiments are distributed into 3 groups which are, control, high water flow rate and low water flow rate and each of the experiment is run for 3 days continuously. Before and after of the experiment, the quality of the water samples are analysed and classified based on Interim national Water Quality Standard (INWQS) and European Communities (Surface Water Regulations 1989). The percentages of removal also calculated to determine the efficiency of the banana peels. Based on the results, it showed that both concentration of COD and BOD are increased because of nutrients leakage. Phosphate has an average impacted in the experiment compared to the control which are 13.33% of removal in high flow rate and 20% of removal in low flow rate. Nitrate and TSS have met the expected results which are 90% and 71% of removal respectively in high flow rate, also, 87.5% and 82% of removal respectively in low flow rate. Based on the results, low flow rate has 6.67% of phosphate removal and 11% of TSS removal more than high flow rate. However, low flow rate has 2.5% of nitrate removal less than high flow rate. Therefore, this study proved that the banana peels can be one of the alternative adsorbent used for nutrients adsorption in contaminated water and it can be further used on green technology to contribute to the society.

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LIST OF ABBREVIATIONS

DO	Dissolved Oxygen
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
TSS	Total Suspended Solids
INWQS	Interim National Water Quality Standards
PO_4^{3-}	Phosphate
NO_3^-	Nitrate
EPA	Environmental Protection Agency
APHA	American Public Health Association

CHAPTER 1

INTRODUCTION

1.1 General

River plays an important role to assist the daily life of living organisms of earth in many ways. It is a main source of drinking water for all the living organisms. It provides habitats and foods for wild animals, such as otters, fishes and crocodiles. Other than this, river also is a source of water for farming and plantation purposes. According to Press Information Bureau (2017), Shri M. Venkaiah Naidu, the vice president in India claimed that the linkage of rivers with improving of irrigation of facilities is important to help the farmers to increase their production, and it's also contribute in the progress of the development of the country. (Rajendra, 2017)

Unfortunately, many rivers are being polluted starting from year 2009 due to the rapid development. This is undeniable that every activity of producing goods creates unwanted by-products as known as pollutants. For example, some harsh chemical and toxic such as mercury and lead are needed to create products during the manufacturing process. These pollutants are extremely fatal if there are not disposed in a proper way. Then, there are also overuse of pesticides or any chemical fertilizers at the farm that have effects on the soil and water contaminants for the area nearby. In fact, it was found that more than 80% of sewerage is discharged directly to the river without treated in developing countries. This causes the pollution of the river and lake especially at the discharge point (UNESCO, 2009).

Chemicals and toxics contained in the river bring massive of negative effects to the living organisms. One of the main effects of polluted river that contained excessive nutrients is causing health issues to the living organisms. There are many serious illness infections by consuming contaminated water directly or indirectly. (Greentumble Editorial Team, 2015)

Water pollution directly affection such as drinking water and water bath. On the other hand, water pollution indirectly affection such as consuming plant foods and animal foods. From the worldwide, it has been estimated that 80% of infectious diseases are come from contaminated water, and this cause billions of cases of diarrhea and even fatal every year. Water crisis is happening around the world, there are billion humans who have not clean drinking water. (Lindastcyr, 2012) In Afghanistan, there are less than one fifth of the country has clean drinking water readily available. With the increasing of population and pollution, low cost and eco-friendly waste water treatment solutions are highly demanded.

In order to solve this issue, several solutions have been tested and applied to treat the polluted river. Advanced water treatment methods that involved advanced technologies, chemical treatment and biological treatment have been used by developed countries. In Netherlands, they introduce an advanced wastewater treatment technology which called as Nereda. Nereda using aerobic granular biomass for wastewater treatment. Nereda can purifying water consuming bacteria and produce small balls to sink, and therefore the pollutants are separated from the treated water. (Water and Wastewater International, 2017)

However, there are developing countries such as India, Laos, Africa and Afghanistan are facing issues on water treatment due to high operating cost and lack of technologies. In developing countries, the rapid urbanization is happening, but the development of waste water treatment cannot keep the pace. Therefore, an effective, simple and affordable method of water treatment to remove the pollutants is necessary to reduce the river pollution in developing countries. Recently, fruits wastes is one of the alternative materials used for wastewater treatment. A researcher has successfully removed heavy metals such as cadmium, chromium and zinc by using different type of fruit wastes. (Khairia M. Al-Qahtani, 2015) This case proved that, bio-adsorption is the new trend in low cost and eco-friendly wastewater treatment method.

According to New Straits Times (2016), There are a total of 15 thousand tonnes of foods wastes are generated by Malaysian every day. (Bernama, 2016) People has lack of awareness that instead of throwing away the fruit wastes, they can reuse the fruit wastes in useful purpose such as absorbent. Banana waste is suitable to be reused as adsorbent in wastewater treatment, because of not only it is eco-friendly, but also low cost is needed to operate the wastewater treatment. Besides, a researcher has successfully proved that, banana peel is capable of

removing of contaminants from olive mill wastewaters. (M. Achak, A. Hafidi, N. Ouazzani, S. Sayadi and L. Mandi, 2008)

1.2 Statement of the Problem

Recently, Nilai is having a massive development with all the new facilities such as, Mesa mall, Aeon Nilai which is under construction, XiaMen University and Vision City. Nilai is an ideal spot which is having attention from the investors. For example, people only need to take about 45 minutes to travel from Nilai to Seremban, Cyberjaya, Putrajaya and Kuala Lumpur. This create an advantage on transportation. Furthermore, public transport can be easily accessed by people from Nilai. There are a lot of choices of public transports such as, KTM, bus terminal, KLIA and KLIA 2. With these facilities, investors are further willing to invest on this town. (Sharen Kaur and Zaidi Isham Ismail, 2017). However, all of these development also indirectly lead to the river pollution. Sungai Batang Labu is one of the polluted river located about 8km from INTI International University as shown in Figure 1.1.



Figure 1.1: The location of the targeted river (google map, 2017)

Figure 1.2 is the condition of Sungai Batang Labu, taken during the site visit on 7th of October, 2017. The river is located nearby the residential area. From the observation, it can be seen that the colour of the river is in brownish yellow, which further proved that this river is

not under healthy condition. The river might be contained suspended solid and human wastes from residential runoff.



Figure 1.2: the condition of Sungai Batang Labu.

Then, in Malaysia, among all the fruits, banana has ranked second place of common grown fruit crop. There is about 26000 hectares of land covering with bananas and producing 530000 metric tonnes of bananas. (S. Mohan Jain and Rony Swennen, 2004) With the huge amount of banana production, it creates a huge amount of banana wastes as well. Then, banana wastes might cause unfriendly environment affection, this is because the high water content banana peels provides habitat for microorganisms. (U K Ibrahim, 2017) By reusing the banana peels for a useful purpose is better than be an environment pollutants. Furthermore, there are some compounds such as nitrogen atom, sulfur atom and carboxylic acids contained in banana peels which help in extract heavy metals from wastewater. Plus, the capable of repetitive usage and worked under high pH condition, make banana peels become an effective filter for industrial and farm runoffs. (Andrea Dumovich, 2011)

1.3 Research Objectives

The objectives are:

1. To evaluate the adsorption efficiency of banana peels for nutrients, total suspended solids (TSS), chemical oxygen demand (COD) and biochemical oxygen demand (BOD) from river water.