

UTILIZATION OF OLEO CHEMICAL
WASTE AS A PARTIAL CEMENT
REPLACEMENT IN CEMENT BRICK

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Kajian ini membentangkan penggunaan sisa kimia Oleo dalam pengeluaran bata dengan berat penggantian simen sebahagiannya. Pengeluaran bata dengan menggunakan simen, air, pasir dan sisa bergantung pada kadar penggantian. Kadar penggantian yang digunakan untuk penyelidikan ini ialah 0%, 5% dan 10%. Sisa kimia Oleo dikumpulkan dari Industri Kimia Oleo yang memproses minyak sawit. Industri Kimia Oleo menghasilkan banyak produk seperti sabun, detergen, syampu dan lain-lain. Di samping kertas ini, penyediaan sisa kimia Oleo perlu dilakukan sebelum pencampuran. Sisa kimia Oleo perlu kering di dalam ketuhar selama 24 jam, gulung dan ayakan. Jumlah spesimen bata ialah 45 sampel. Makalah ini akan menyiasat potensi sisa dalam tiga ujian yang berbeza iaitu Ujian kekuatan mampatan, ujian kekuatan Flexural dan ujian Penyerapan Air selama 7 dan 28 hari. Kaedah pengawetan yang digunakan dalam kajian ini adalah kaedah pengawetan air. Keputusan menunjukkan kekuatan lebih rendah daripada bata kawalan. Batu bata simen juga menyerap air rendah apabila menambah lebih banyak Oleo Chemical Sludge dalam keadaan kering. Penyelidikan ini amat penting bagi negara kita kerana permintaan bahan binaan dan sisa kitar semula lebih tinggi disebabkan pertumbuhan dari segi pembangunan negara. Ini mewujudkan keperluan bagi bahan pembangunan dengan penggunaan sisa yang sesuai. Walau bagaimanapun, dalam masa yang sama, ia juga menghasilkan banyak sisa. Semua sisa buangan akan dibuang ke tapak pelupusan. Dalam tempoh yang panjang, sisa akan menyebabkan pencemaran. Walau bagaimanapun, punca-punca pencemaran bukan sahaja disebabkan oleh sisa, tetapi pengeluaran simen dalam pembuatan simen juga merupakan satu lagi faktor pencemaran. Malaysia mempunyai Dasar Kebangsaan mengenai Alam Sekitar (DASN) untuk memastikan kehidupan yang berkualiti. Objektif Persekitaran Dasar Kebangsaan (DASN) adalah untuk mempunyai persekitaran yang bersih, selamat, sihat dan produktif bagi kami dan generasi masa depan kami. Untuk mengelakkan masalah dan mencapai Dasar Kebangsaan Mengenai Alam Sekitar, inilah salah satu inisiatif untuk menggunakan semula sisa ini sebagai salah satu bahan binaan. Sebelum ini, tiada kajian mengenai penggunaan bahan buangan Oleo Chemical dalam bahan binaan. Oleh itu, dalam kajian ini akan meneroka penggunaan sisa Oleo Chemical sebagai pengganti simen separa dalam bata simen.

ABSTRACT

This paper presents about the utilization of Oleo chemical waste in production of brick by replacement weight of cement partially. The production of brick by using cement, water, sand and waste depends on the rates of replacement. The rates of replacement used for this research are 0%, 5% and 10%. Oleo Chemical waste is collected from Oleo Chemical Industry that processing Palm oil. Oleo Chemical Industry produce a lot of product such as soap, detergent, shampoo and others. In addition of this paper, the preparation of Oleo chemical waste must be done before mixing. The Oleo chemical waste need to be dry in oven for 24 hours, grind and sieve. The total specimen of brick are 45 samples. This paper will investigate the potential of waste in three different test which are Compressive strength test, Flexural strength test and Water Absorption test for 7th and 28th days of curing. The method of curing used in this research is water curing method. The results shows that the strength is lower than the control brick. The cement brick also absorb low water when add more Oleo Chemical Sludge in dry condition. This research is very important to our country due to the demand of construction material and recycling waste was higher due to the growth in terms of development country. This created a need for the development material with a suitable utilization of waste. However, in a same time, it also produces a lot of waste. All the waste will be thrown away to the landfill. In a long time period, the waste will cause a pollution. However, the causes of pollution not only come by waste, but the production of cement in cement manufacturing is also another factor of pollution. Malaysia have a National Policy on the Environment (DASN) is to ensure the quality life. The objectives of the National Policy Environment (DASN) are to have a clean, safe, healthy and productive environment for us and our future generation. In order to prevent the problems and to achieve the National Policy on Environment, this in one of the initiative to reuse this waste as a one of the construction material. Before this, there is no research about utilization of Oleo Chemical waste in construction materials. Thus, in this research will explore the utilization of Oleo Chemical waste as a partial cement replacement in cement brick.

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LIST OF ABBREVIATIONS

DASN	National policy of Environment
FAME	Fatty Acids Methyl Ester
Al ₂ O ₃	Aluminium Oxide
Fe ₂ O ₃	Ferric Oxide
WSG	Water Glass Sludge
JKR	Jabatan Kerja Raya
OPC	Ordinary Portland Cement
CaO	Calcium Oxide
SiO ₂	Silicon Dioxide
CSH	Calcium Silicate Hydrate
PSI	Pound Square Inch
SO ₃	Sulfur Trioxide
W _s	Saturated Weight of Sample
W _d	Dry Weight of Sample
Pa	Pascal

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Brick is one of the main sources for building. It is a small unit that very useful to building material. Brick are used in order to make walls or other construction and help in order to ensure the stability of the building. Concrete brick, sand lime brick, common burnt clay brick, fly ash clay brick and engineering brick are 5 common types of brick. The main sources to produce a brick are sand, cement and water. However, in order to produce cement, hydration process is needed but this process will release a lot of carbon dioxide. Carbon dioxide is colourless gas that can effect as a heat-trapping greenhouse gas. Furthermore, in a long term period, the resources of cement will be very limited since the demand of material building is very high.

Oleo chemical Industry is an industry that process palm oil to produce fatty acids methyl ester (FAME) and glycerine. The formation from Oleo chemical can produce a lot of product and in the same time, it also produced wastes. Normally, disposal of material will be thrown away to the landfill area but in a long term period, the waste will cause a pollution. It is because the volume of waste at the land filling is become higher. Furthermore, wastewater that release from oleo chemical Industry and flow into water also can cause a water pollution (Ismail *et al.*, 2017). Therefore, it is important to come out with an idea on how to minimize the wastes. The functional idea for this problem is by recycling the waste and use it for other purpose such as for construction building.

There have a lot of research and studies about the potential of waste as a cement replacement. One of the example is using waste glass sludge (WGS). The result show that waste glass sludge (WGS) improved the strength at the later ages (28th days)(Kim, Yi and Zi, 2015). University of Jean also have done a research about the replacement of cement in the mixture of brick (Martínez, Cotes and Corpas, 2012). The existing of waste in the brick will supply the energy because of the organic material content (Martínez, Cotes and Corpas, 2012).

1.2 Problem Statement

Carbon dioxide is one of substance that can harm our environment. Production of cement and the utilization of cement in construction industry cause carbon dioxide emission. Carbon dioxide that release from the manufacturing of cement will change the climate and global. Furthermore, it also can cause air pollution. Air pollution will effect to our health. The health problems are caused by smoke, gas and dust. Cement also contain an alkaline compound such as calcium oxide that a very dangerous because it can cause damage to human tissue. In order to produce cement, the limestone is needed but the preparation of limestone can destroy our ecosystem.

1.3 Objectives of the Study

The aim of this research is to investigate the potential of using Oleo Chemical waste as a partial cement replacement in brick.

The objectives for this research are listed below:

- i. To study compressive strength of cement brick by using sludge as a partial cement replacement.
- ii. To evaluate the flexural strength of cement brick by using sludge as a partial cement replacement.
- iii. To determine the water absorption of cement brick by using sludge as a partial cement replacement

1.4 Scope of the Study

The scope of this research are listed below:

- i. The sample of sludge is taken from FPG Oleo Chemical Industrial, Gebeng.
- ii. The testing that used in this research are compressive strength, flexural strength and water absorption. This testing will be conducted at Laboratory University Malaysia Pahang (UMP).
- iii. 0%, 5% and 10% replacement of sludge will be used to replace the percentage weight of the cement.
- iv. The size of mould will follow JKR Standard (2014) which is 113mm x 225mm x 75mm (W x L x H)
- v. The testing for Compressive strength and Flexural strength will be conducted at 7th days and 28th days.
- vi. The Compressive test is according to the ASTM C618 (1994).
- vii. The Water absorption test according to JKR Standard (2014).

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