PERFORMANCE OF BLENDED CEMENT CONCRETE BY USING PALM OIL SHELLS AS COARSE AGGREGAT

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PERFORMANCE OF BLENDED CEMENT CONCRETE BY USING PALM OIL SHELLS AS COARSE AGGREGATE

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A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Civil-Structure)

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I dedicate this work

To my dear parents

Father. Prof.Dr.Noori Alhashimi and great Mother. Suad Kamal

Whose love, kindness, patience and prayer have brought me this far

For their love, understanding and support through my endeavors

To my beloved brothers

Whose presence fills my life with joy and success

Never forget to dedicate my full appreciation for my

beloved country that is dear to my heart in every step forward in my life

(Iraq)

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ABSTRACT

The construction industry has an effect on social, economic and environment. Considering the materials used, such impacts depend on the production of concrete, since it is the most consumed material and its properties are associated with the consumption of Portland cement, which represents a significant part of CO_2 emissions from this sector. In relation to that the use of waste materials in concrete production is beneficial. This research studied the potential use of palm oil shell (POS) as coarse aggregate to produce concrete with the purpose of replacing the coarse aggregate by using the waste materials to get more economical structure and achieving satisfactory strength reaching up to 30 MPa. In this study the effect of ground granulated blastfurnace slag as partial cement replacement was also studied. Laboratory work was conducted to determine the performance of the control sample, concrete with using palm oil shell (POS) and concrete with slag. The performance of these types of concrete were determined by the workability test, compressive strength test, ultrasonic pulse velocity test, shrinkage and expansion test, and flexural strength test of reinforced concrete beams. The workability of concrete was determined using slump test. Concrete cubes, prisms and reinforced concrete beams with the size of 100x120x2200 mm were cast and tested. The cubes tested at the ages of 7, 28 and 40 days. The results of the slump test show that POS concrete has lower slump value than normal and blended cement concrete. The compressive strength of POS concrete was lower than control sample. Results of reinforced concrete beam test show that the flexural behaviour of the control concrete and blended cement concrete were better than POS concrete. The other test results indicated that the quality of POS concrete was lower than the quality of control and blended cement concrete.

ABSTRAK

Industri pembinaan mempunyai kesan terhadap sosial, ekonomi dan persekitaran. yang luas. Dengan mengambil kira bahan yang digunakan, kesan tersebut bergantung kepada penghasilan konkrit kerana konkrit adalah bahan yang paling banyak digunakan dan sifat-sifatnya berkaitan dengan penggunaan simen Portland yang merupakan bahagian paling banyak mengeluarkan CO_2 daripada sektor ini. Sehubungan itu, penggunaan bahan-bahan buangan dalam pengeluaran konkrit adalah berfaedah. Penyelidikan ini mengkaji potensi penggunaan tempurung kelapa sawit (POS) sebagai agregat kasar untuk menghasilkan konkrit dengan tujuan menggantikan agregat kasar dengan menggunakan bahan-bahan buangan untuk mendapatkan struktur lebih ekonomi dan mencapai kekuatan memuaskan sehingga 30 MPa. Dalam kajian ini kesan sanga relau bagas berbutir halus sebagai pengganti sebahagian simen juga dikaji. Kerja-kerja makmal dijalankan untuk menentukan prestasi sampel kawalan. Prestasi ketiga-tiga jenis konkrit ini ditentukan melalui ujian kebolehkerjaan, ujian kekuatan mampatan, ujian halaju denyut ultrasonik, ujian kekuatan lenturan, ujian pengecutan dan pengembangan bagi rasuk konkrit tetulang. Kebolehkerjaan konkrit ditentukan menggunakan ujian penurunan. Sementara itu, ujian kekuatan mampatan dilakukan untuk menentukan kekuatan konkrit. Kiub konkrit, prisma dan rasuk konkrit bertetluang dengan saiz 100 x 200 x 2200 mm dibuat dan diuji. Kiub-kiub tersebut diuji pada hari ke 7, 28, dan 40. Keputusan bagi ujian penurunan menunjukkan bahawa konkrit POS mempunyai nilai penurunan yang rendah berbanding konkrit biasa dan konkrit simen teradun. Keputusan bagi ujian rasuk konkrit tetulang menunjukkan kelakuan lenturan konkrit kawalan dan konkrit simen treradun adalah lebih baik berbanding konkrit POS. Keputusan ujian-ujian lain pula menunjukkan kualiti konkrit POS lebih rendah daripada kualiti konkrit kawalan dan konkrit simen teradun.

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INTRODUCTION

1.1 Background of the Study

Concrete is a mixture of cement, aggregates and water together, with any other admixtures which may be added to modify the ultimate physical properties of concrete. The water and cement paste fills the voids between the grains of sand and these will fill the voids between the stones. After a few days the cement paste start to harden or set and at the end of four weeks it gives concrete its nominal ultimate strength, which is as good as that of some of the strongest stones (Lyons, 2004).

Concrete mixtures are "designed" by specialized laboratories and mixed in strictly controlled proportions in concrete plants from which they are carried to the site in the revolving drums of large trucks that keep mixing the concrete. Concrete samples in the shape of cylinders or cubes are taken from each truckload and tested for compressive strength after seven and twenty-eight days. The strength of concrete depends on the ratio of water to cement, and of cement to sand and stone. The finer and harder the aggregates, the stronger the concrete (Lyons, 2004).

The invention of reinforced concrete remedied this deficiency and produced a structural material that, pound per pound, is the most economical. In reinforced concrete, steel bars are embedded in the concrete so that the steel takes the tension and concrete takes the compression. For example, the bottom of a beam supported at its ends is always in tension, while its top is in compression. Steel bars set near the bottom of the beam prevent the concrete from cracking under tension and make the beam capable of resisting both kinds of stress. Reinforced concrete is the most commonly used structural material in construction industry. Combining the compressive strength of concrete and the tensile strength of steel, reinforced concrete can be poured into forms and given any shape suitable to the channeling of loads. It is economical, available almost everywhere, fire-resistant, and can be designed to be lightweight to reduce the dead load (Lyons, 2004).

Since concrete is the most important part in structural construction, the aggregate content should be in a form of good strength for structural purposes. Concrete is made up of aggregate, cement and water. Through this combination of materials, three – quarter of the mix is governed by aggregate. The aggregate itself is categorized as fine and course aggregate (Lyons, 2004).

1.2 Statement of the Problem

Recently, the construction industry is becoming large day by day; therefore, the demand to produce good industrial materials to construct tall buildings and very big projects is increasing. The construction industries are becoming more challenging than ever before. The field of engineering related to the industries has to be established. One of the areas that can be established is the used of waste material in the construction. The aim of this research is to produce concrete from waste

materials by using palm oil shell (POS) as coarse aggregate and blended cement as bending agent to satisfactory compressive strength.

1.3 Research Objectives

This study focused on the following objectives:

I. To study the properties of blended cement concrete containing palm oil shell as coarse aggregate.
II. To develop the (POS) concrete mix to have same concrete strength as control concrete by using slag and decrease W/C ratio.
III. To study the flexural behaviour of (POS) and blended cement reinforced concrete beam.

1.4 Scope of Study

In this study, the scope of research focused on the performance of the blended cement concrete by using palm oil shell (POS) as coarse aggregate. Also this research involves studying the behaviour of palm oil shell (POS) and slag and their effect on concrete and compared with ordinary concrete.

1.5 Significance of the Study

In construction industries, the use of aggregates is the most important material in composition of concrete. This research is conducted to study the behaviour of palm oil shell (POS) as coarse aggregate and blended cement in the concrete. Their engineering properties are compared with normal concrete. Other areas of application in civil engineering construction are suggested.

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