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Compressive Strength of Concrete Added with Cockle Shells as Sand Replacement

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ABSTRACT

Various research and study has been carried out for the advancement of knowledge about concrete technology, for example improving the quality of the concrete mixture with the replacement material. This study was carried out to investigate the effect of using cockle shells as sand replacement in concrete subjected to compressive strength. The mixes were prepared with different percentages weight (0%, 1%, and 2%) of cockle shells from the weight of fine aggregate (sand). The result analysis shows the addition of cockle shells with certain volume percentage decrease the strength of the concrete. The results indicated that the compressive strength for both 1% and 2% cockle shells added was decreased compared to the plain concrete but the strength with additions of 2% of cockle shells was increased compared to 1% of cockle shells.

1. Introduction

Due to the problems that face by concrete, there are many researches and studies have been carried out and the result is various new technology of concrete and some modern approach on concrete were established. There were many studies, researches and experimental work has been done in order to improve the properties of the concrete by putting new materials in the mix of concrete. The added material either replacing the conventional concrete material such as aggregate, sand or just as additive. Concrete with cockle shell (Figure 1) has been chose to replace the certain amount of sand by means is normal concrete that contains cement, fine and coarse aggregate, water with addition of cockle shell as replacement. From the past researcher and past experimental and practice, it has been proven that the homogeneously spreading of addition mix in cementations medium distributes stresses and enhances resistance to cracking, impact and shock loading.

Various species of cockles live in sandy sheltered beaches throughout the world. The scientific name of cockles shell is *Cerastoderma edule*. The shell is strong, compact, heart-shaped, completely symmetrical and equal sized valves. The cockle shell can be rolled over the sands and banged about without any damage to the live mollusc. Outer surface is off-white, yellowish or brownish. Growth lines are prominent. Inner surface is dull white, with a brownish or light purple stain on or about the posterior adductor muscle scar. The main element in cockle shell that usually use as an admixtures concrete is calcium (Anon, 2008).



Figure 1: Cockle Shells

Calcium chloride is a common accelerator, used to accelerate the time of set and the rate of strength gain. Excessive amounts of calcium chloride in concrete mix may result in rapid stiffening, increase in drying shrinkage and corrosion of reinforcement. In colder climates, calcium chloride should not be use as an anti-freeze. Large amount of calcium chloride is required to lower the freezing point of the concrete, which may ruin the concrete (Ramachandran, 1976).

This study is conducted to determine the effect of concrete properties using the cockle shell as a replacement to the total weight of fine aggregate in concrete mixture with difference percentages. The important of this research is also to determine the perfect percentage of cockle shell in the mixture of the concrete design. This should be an important factor in the development of construction industry to be more effective, strong and safe.

2. Methodology

In this study, the concrete design mix ratio follows DOE method. There are two different percentages of cockle shells namely 1% and 2% by weight of fine aggregate were added to concrete Grade 25. In this study, 27 cube specimens were prepared. The basic approach of this study is to evaluate the properties of concrete added with cockle shells. Water cement-ratio (w/c) of 0.59 was fixed as a

constant value. Two types of aggregate were used as a filler namely medium size aggregate with size distribution of 10mm to 20mm and mining sand that passing through 5mm sieve. In this study, the size of cockle shells is varies from 10mm to 50mm. The cockle shells were collected from restaurants sea side in Kuantan. The cockle shells should be clean and clear before drying under the sun for duration of 7 days.

LA Abrasion machine was used to crush the cockles shell to get the average size of cockles' shell of 0.7mm. Five balls in LA Abrasion machine used to crush the cockles shell. The process of crushed the cockles shell took around 4 minutes. The mixes then were poured into mould and let to harden. The hardened concrete was taken out from the mould after 24 hours after casting was cured in the curing tank for curing period of 7, 14 and 28 days for all mixes. The tests were conducted after 7, 14 and 28 days of curing period.

3. Result

The concrete were tested subjected to compressive strength and all the data tabulated in Figure 2. Concrete with 1 % and 2% cockle shells showed the decrement in its strength for all 7, 14 and 28 days compared to the control pecimen (plain concrete).

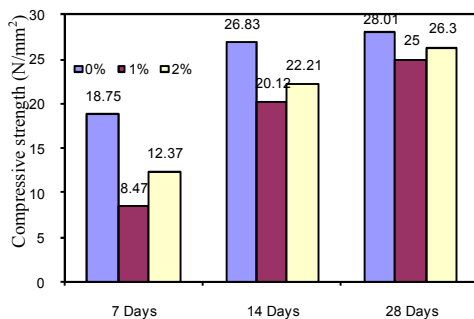


Figure 2: Compressive Strength Result with Various Percentages of Cockle Shells for 7, 14 and 28 days.

Chart in Figure 2 shows that for 1% and 2% cockle shells added, the strength is gaining according to their ages. The strength for 2% cockle shells added at 28 days is found slightly similar with the control specimen at 14 days. The increment of the strength for 2% compared to 1% cockle shells is 31% at 7 days, 9% at 14 days and 5% at 28 days. It shows that the differences for both percentages are getting smaller by days.

4. Discussion

It was revealed that, an addition of a little amount of cockle shell to concrete effect the compressive strength of concrete. The weight of cockle shell is influenced the concrete strength properties and also have possibility in interfering with other basics properties of the concrete. There is not much effect of compressive strength for concrete with 1% cockles shell because the percentage amount of the cockle shells that had been replaced as fine aggregate is too small in quantity. The replacement of 2% cockles shell from weight of fine aggregate in concrete not achieved the strength as plain concrete. The strength of concrete will be increased with an increment of percentage of cockles shell as replacement of fine aggregate. Even though the strength for both 1% and 2% is not higher or same as control specimen but their strength is still in its grade.

5. Conclusion

From this study the conclusion than can be made is the addition amount of cockle shell to concrete due to compressive strength are slightly significantly effect. The optimum content of cockle shells that gives higher strength volume for compressive strength is 2% but maybe there is optimum value. For the future study the more percentage of cockles shell must be added to know the optimum content of cockle shells which will give the higher strength for compressive strength.

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