

THE DURABILITY STUDY OF QUARRY DUST AS SAND REPLACEMENT  
IN CONCRETE

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## ABSTRACT

The growth in the construction industry has increased the used of concrete. Thus, the demand on the sand resources is also increased. The high demand on the natural sand lead to the collapse of river bank and also landscape destruction. An alternative to the sand is required to solve the problem and quarry dust is very suitable to be used as an alternative due to it similar physical and chemical properties to the natural sand. Durability of quarry dust concrete was studied in this research and it was compared with the durability of conventional concrete. Besides, the applicable of quarry dust in the concrete was studied to reduce the dependency on the natural sand in concrete production. Quarry dust concrete is a type of concrete where 50% of the sand was replaced by the quarry dust and produce a new concrete mix. The durability of both of the concretes were determined in five durability tests. There were acid resistance test, sulphate resistance test, chloride resistance test, sorptivity test and water absorption test. The sample used for test was design as M30 concrete with the size 100x100x100mm. All the sample cubes were placed in water curing for 28 days until it reach maximum strength. The change in weight and compressive strength of the concrete were determined and their durability properties was discussed and compared. The results show that conventional concrete is more durable than quarry dust concrete in the chemical tests. The reduction in compressive strength for quarry dust concrete after 90 days of the chemical test are in range of 34.1% to 78.8%. Whereas, the compressive strength of conventional concrete was reduced from 25.2% to 60.5%. In term of sorptivity, conventional concrete has a sorptivity value about 0.054 while quarry dust concrete was about 0.066. The durability of the concrete was related to their porosity and permeability of the concrete toward the solution. Concrete with better compaction and density was better in chemical resistance and reduce the permeability of the solution into the concrete and caused matrix destruction. These explained that conventional concrete has better durability than quarry dust concrete. However, the durability of quarry dust is still acceptable and the used of quarry dust as partial replacement to the sand can reduce the dependency on the natural materials in the concrete production.

## ABSTRAK

Pertumbuhan industri pembinaan telah meningkat penggunaan konkrit. Hasilnya, permintaan terhadap sumber pasir juga semakin meningkat. Permintaan yang tinggi terhadap pasir semulajadi telah menyebabkan keruntuhan tebing sungai dan kerosakan landskap. Penggunaan terhadap pasir perlu digantikan untuk menyelesaikan masalah ini, dan kuari habuk adalah sangat sesuai untuk digunakan sebagai pegantian kerana ia sama sifat fizikal dan kimia dengan pasir semula jadi. Dalam kajian ini, ketahanan konkrit kuari telah dikaji dan dibandingkan dengan ketahanan konkrit konvensional. Di samping itu, kesesuaian debu kuari konkrit dikaji untuk mengurangkan pergantungan kepada pasir semulajadi dalam pengeluaran konkrit. Konkrit kuari ialah konkrit di mana 50% pasirnya digantikan dengan debu dari kuari dan campuran konkrit baru dihasilkan. Ketahanan kedua-dua jenis konkrit telah diperhatikan dalam lima ujian ketahanan iaitu ujian rintangan asid, ujian rintangan sulfat, ujian rintangan klorida, ujian kuantiti dan ujian penyerapan air. Sampel yang digunakan dalam ujian adalah M30 konkrit dengan saiz 100 x 100 x 100 mm. Semua kiub sampel telah diletakkan dalam air selama 28 hari sehingga kekuatan maksimum dicapai. Berat dan kekuatan mampatan konkrit telah ditentukan dan ketahanan mereka telah dibincangkan dan dibandingkan. Keputusan menunjukkan bahawa konkrit konvensional dalam ujian kimia adalah lebih tahan lama daripada konkrit kuari. Kekuatan mampatan konkrit kuari telah menurun sebanyak 34.1% hingga 78.8% selepas 90 hari ujian kimia. Manakala kekuatan mampatan konkrit konvensional berkurangan sebanyak 25.2% hingga 60.5%. Dalam ujian penyerapan air, konkrit konvensional mencapai nilai penyerapan konkrit iaitu 0.054, manakala nilai penyerapan konkrit kuari adalah 0.066. Ketahanan konkrit berkait rapat dengan keliangan dan kebolehtelapan konkrit terhadap air. Konkrit dengan pepadatan dan kepadatan yang baik mempunyai rintangan yang tinggi terhadap kimia dan boleh mengurangkan penembusan bahan kimia ke dalam konkrit dan menyebabkan kerosakan matriks. Ini telah menjelaskan bahawa konkrit konvensional mempunyai ketahanan yang lebih baik daripada konkrit kuari. Walau bagaimanapun, ketahanan debu kuari masih boleh diterima dan penggunaan kuari sebagai sebahagian pasir ganti boleh mengurangkan pergantungan kepada bahan semula jadi dalam pengeluaran konkrit.