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THE INFLUENCE OF MICROWAVE-INCINERATED RICE  
HUSK ASH (MIRHA) ON INTERFACIAL ZONE  
CHARACTERISTIC AND CONCRETE PROPERTIES

I NUR LIYANA MOHD KAMAL

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UNIVERSITI TEKNOLOGI PETRONAS

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by

NUR LIYANA MOHD KAMAL

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(MIRHA) ON INTERFACIAL ZONE CHARACTERISTIC AND CONCRETE  
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by

NUR LIYANA MOHD KAMAL

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DECLARATION OF THESIS

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## ABSTRACT

Researchers have discovered that, rice husk ash (RHA), rich in silica can be utilized as cement replacement material (CRM) in the construction industries. Burning procedure to obtain RHA that is highly reactive and the optimum percentage replacement of OPC need to be identified. Improper burning with regards to procedures and maximum combustion temperature may result sub-standard RHA being produced. This research was carried out to investigate the effects of replacing 5%, 10%, 15% and 20% of cement in concrete by open burning RHA and microwave incinerated rice husk ash (MIRHA). The RHA was collected from two rice milling processes and both were using uncontrolled burning method meanwhile MIRHA was obtained using UTP Microwave Incinerator (UTPMI) in controlled temperatures of 600°C, 700°C and 800°C. X-Ray Diffraction (XRD) analysis was carried out to analyze the crystalline properties to detect the presence of crystal system of SiO<sub>2</sub> and X-Ray Fluorescence (XRF) analysis was performed to determine the content of various chemical oxides in both samples. This research compared the performance of MIRHA, RHA and control OPC concretes with reference to their compressive strength, porosity and Interfacial Transition Zone (ITZ) characteristic. The strength developments of the various concrete mixes were monitored at ages 3, 7, 28 and 56 days. In general, it showed that 5% replacement of MIRHA burnt at 800°C provided good acceleration in compressive strength development and the lowest porosity at 28 days. The push-out test at 28 days curing revealed that 5% inclusion of MIRHA at 800°C burning temperature provided good interfacial bond strength of aggregate/mortar. Scanning Electron Microscopy (SEM) test disclosed that the replacement of this pozzolanic material could affect the ITZ between aggregate and cement paste by modifying the micropore structure within the concrete matrix.

Keywords: Microwave Incinerator Rice Husk Ash (MIRHA), Rice Husk Ash (RHA), Interfacial Transition Zone (ITZ).



## ABSTRAK

Kajian menunjukkan abu sekam padi (ASP) yang kaya dengan silika boleh digunakan sebagai bahan pengganti simen (BPS) di dalam industri pembinaan. Oleh itu, prosedur pembakaran yang dapat menghasilkan ASP dengan kereaktifan tinggi dan peratus penggantian simen optimum perlu dikenalpasti. Pembakaran yang tidak sempurna dan suhu pembakaran yang maksimum akan menghasilkan ASP berkualiti rendah. Kajian ini dijalankan untuk mengkaji kesan penggantian 5%, 10%, 15% dan 20% simen di dalam konkrit dengan ASP daripada pembakaran terbuka dan pembakar gelombang mikro. ASP yang di ambil dari dua kilang padi telah melalui proses pembakaran tidak dikawal manakala ASP pembakaran gelombang mikro (ASPPGM) adalah hasil daripada pembakaran terkawal pada suhu 600°C, 700°C dan 800°C menggunakan UTP Microwave Incinerator (UTPMI). Ujian Belauan Sinar-x dijalankan bagi mengkaji kehadiran sistem dan ciri-ciri kristal iaitu SiO<sub>2</sub> manakala analisis pendarkilau sinar-x dijalankan bagi menganalisis komposisi kimia sampel. Kajian ini membandingkan prestasi ASPPGM, ASP dan konkrit kawalan merujuk pada kekuatan mampatan, keporosan dan ciri zon peralihan antara muka (ZPAM). Kekuatan mampatan pelbagai jenis konkrit diawasi terhadap kadar pembangunannya pada umur 3, 7, 28 dan 56 hari. Secara keseluruhannya, ia menunjukkan 5% penggantian ASPPGM pada suhu 800°C menunjukkan kadar pecutan yang baik dalam pembangunan kekuatan mampatan dan nilai keporosan yang rendah dibandingkan dengan jenis bancuhan konkrit yang lain. Ujian tolakan keluar pada 28 hari pemulihan mendedahkan 5% penggantian ASPPGM pada suhu pembakaran 800°C menghasilkan kekuatan ikatan antara muka batu/mortar yang baik. Ujian Mikroskop Elektron Pengimbasan (MEP) mendedahkan, penggantian bahan pozzolan dapat memperbaiki ZPAM batu/simen dengan memperbaiki mikroliang struktur dalam matriks konkrit.

Kata kunci: Abu Sekam Padi Pembakaran Gelombang Mikro (ASPPGM), Abu Sekam Padi (ASP), Zon Peralihan Antara Muka (ZPAM).



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