

**FIRING PROPERTIES AND MICROSTRUCTURAL CHARACTERIZATION
OF PORCELAIN STONEWARE FROM CLAY IN KIMANIS, SABAH**

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ABSTRACT

Clay harbour great deal in industrial application of economy of Malaysia. In this study, the clay sample was taken from a known natural clay deposit at the area of Southwestern area of Sabah, Daingin in Kimanis and Inuman in Beaufort. The moisture content, pH, water absorption and linear shrinkage test were carried out to physically characterize the clay. The outcome showed that the clay is porous and does not shrink at all. The clay were sieved to <125µm and flocculated in order to purify the clay sample from unwanted non-clay minerals. X-ray Fluorescence (XRF) analysis were performed on the flocculated sample. Si, Al, K and Fe were the elements which dominated the clay's chemical composition. X-ray Diffraction (XRD) analysis showed that kaolinite, quartz and illite were the dominant crystal phases present. The effect of firing on the phase evolution of the clay showed the decomposition of kaolinite and the growth of primary and secondary mullite. Batches containing the clay (50% and 70%), sodium feldspar and nepheline syenite (40% and 20%) and quartz (10%) were prepared based on dry pressing and fired over range of temperatures (900 to 1300°C). The microstructure of the batches containing different fluxes showed that the specimens contains primary and secondary mullite with presence of haematite. The different proportions of different clays used in the batches does not effect any of the presence of the crystalline phases. Quartz were seen to withstand the firing temperatures but as it goes higher, some quartz were seen to have melted. Both type of clay, Daingin and Inuman are suitable for industrial applications such as tiles production and pottery especially for production of porcelain stonewares based on the final microstructures achieved.

**SIFAT-SIFAT PEMBAKARAN DAN CIRI-CIRI MIKROSTRUKTUR TEMBIKAR PORSELIN
MENGUNAKAN LEMPUNG DARI KIMANIS, SABAH**

ABSTRAK

Lempung mempunyai aplikasi yang meluas di dalam ekonomi industri Malaysia. Dalam penyelidikan ini, sampel lempung semula jadi telah di ambil daripada kawasan barat daya Sabah iaitu Daingin di Kimanis dan Inuman di Beaufort. Kelembapan, pH, penyerapan air dan ujian pengecutan linear telah di jalankan untuk pencirian fizikal lempung. Hasil telah menunjukkan bahawa lempung adalah berliang dan tidak mengecut. Lempung di saring pada <125rpm dan di gumpal untuk menuliskan lempung daripada mineral-mineral asing. Analisis sinar X pendafluoran telah dijalankan pada sampel gumpalan. Elemen Si, Al, K dan Fe telah mendominasi komposisi lempung ini. Analisis pembelauan sinar X telah menunjukkan bahawa kaolinit, kuarza dan illit adalah fasa kristal yang dominan. Kesan pembakaran pada evolusi fasa lempung menunjukkan bahawa penguraian kaolinit dan pertumbuhan mullit kelas pertama dan kedua. Kumpulan yang mengandungi lempung (50% dan 70%), natrium feldspar dan nepheline syenite (40% dan 20%) dan kuarza (10%) telah disediakan berdasarkan tekanan kering dan pembakaran pada julat suhu (900 hingga 1300°C). Kumpulan mikrostruktur yang mengandungi pelbagai fluks menunjukkan bahawa spesimen mengandungi mullit kelas pertama dan kedua dengan kehadiran hematit. Lempung yang berbeza mempunyai bahagian yang berbeza dalam kumpulan dan ia tidak memberi kesan pada mana-mana fasa kristal. Kuarza menunjukkan ketahanan paha suhu pembakaran yang tinggi tetapi apabila suhu di tingkatkan, beberapa kuarza mula mencair. Kedua-dua lempung, Daingin dan Inuman adalah sesuai untuk di aplikasikan dalam industri seperti pembuatan jubin dan terutamanya tembikar untuk pembuatan tembikar porselin berdasarkan hasil akhir mikrostruktur.