UNIVERSITI TEKNOLOGI MARA

THE ROLE OF ORYZA SATIVA STRAW ASH IN CERAMIC CRYSTALLINE GLAZE

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MA

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Oryza sativa straw (rice straw) is a natural resource that has potential as a raw material in the ceramic field. Rice straw ash (RSA) contains high silica (SiO_2) after through the calcination process. The purpose of this study was to investigate on the effects of crystalline glaze using a rice straw ash as alternative substance for silica in the glaze formulation. Silica is significant material was used in the crystalline glaze to react with zinc oxide to seeding crystals as willemite (Zn_2SiO_4) in the form of spherulites during the firing process. Malaysia is distinctive of the prominent producers of paddy. It has gained 0.48 Million tonnes of rice husk with 3, 176, 593.2 tonnes production of rice straw in a year, this residue is still not fully utilized in Malaysia. RSA was different with conventional source, because SiO_2 content from sand, quartz and flint it takes a long time to replace this source again. The aims of the present study are to identify the optimum calcination temperature of rice straw ash (RSA). Next, to formulate the optimum rice straw ash addition in crystalline glaze formulation and to determine the optimum firing temperature of crystalline glaze with the addition of rice straw ash. This research uses experimental method such as the calcination of rice straw at 700°C, 800°C, 900°C and 1000°C and also X-ray fluorescence (XRF) test was performed to investigated the chemical composition in RSA followed by X-ray diffraction (XRD) test for determine the SiO_2 phases. Besides, the RSA was added in glaze formulation proportionally from 0% until 17% to identify the potential conventional silica can be replaced with RSA. All samples are fired at various of gloss temperature and involve with crystalline glaze test such as the investigation of various and crystallization temperature, glaze thickness and flowing test. The morphology of crystalline structure on the ceramic substrate body was identified using visual observation. In summary, amorphous silica derives from RSA bring the high silica content and provides a potential alternative material for silica in crystalline glaze formulation, SiO_2 content in rice straw ash bind with zinc oxide to encourage the nucleus crystal seed. From XRF test, 89.7% silica content was determined in RSA and the results also show apparent growth of crystals on the ceramic substrate samples with different effects.

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TABLE OF CONTENTS