

Stoneware body strength using industrial sludge to conceptually proposed for ceramic artworks

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Abstract- The enhancement of ceramic strength can play a significant role in artwork. In this study we proposed to eliminate some limitations of stoneware body in aspect of strength by creating some changes in ceramic body by addition of an industrial waste. In this work we conceptually proposed the used of palm oil sludge which has been left unused from the edible oil industry. The sludge will be used as an additive material to the stoneware body thus improved the ceramic artworks.

Keywords- stoneware; palm oil sludge; strength; waste management

I. INTRODUCTION

Ceramist and ceramic artists always goes to the limit of their creativity in producing an avant-garde art work. In doing this, artist sometime challenged the law of physics. This will lead them to the investigation towards improvement of existing ceramic bodies. This improvement or enhancement will lead to the best materials for the best artwork. Initial ceramic body comes with its own limitation where the expected characteristics wanted by the artist are not viable. Therefore some modification on the main ceramic body formulation can be done to produce the desired body in ceramic artwork. In addition with enhancement or reduction of some parts of the main formulation, the ideal result can be achieved closely [1]. In this framework, the artist also inspired by the environmental concern such as industrial by product or also known as industrial waste such as palm oil sludge. A treated waste of the sludge will be used in stoneware body in aspect of its strength before and after firing. Hypothetically it will increase the stoneware body and will become source materials for ceramic artist. In serving the artist, the framework of study is proposed in this paper.

II. OVERVIEW

World development currently is based on industries to serve the human daily needs. The development came with a high price of waste material. It becomes a major issue all over the world. The world then opted the easiest solution of this issue by blaming the poor countries for its inefficient management in waste materials. The poor countries took very simple action by burying it waste in the ground or leave it in the flowing water like rivers. However, nowadays the recycling phenomenon and

the application of waste material as raw material for relevant industries or even as a replacement or enhancement of production flow in irrelevant industries have caught the care of majority of countries all over the world [2]. Meanwhile, the waste utilization process can be considered in two different points of view. Firstly, the costs for the waste material elimination can be eradicated by obtaining a suitable basis to reuse the waste material. Afterwards, the waste material can be utilized as raw material for manufacturing or even as a mean to improve the ultimate product's quality [3-6]. With respect to the other researches that have been done on the different composition of ceramic body either industrial or non-industrial, the achieved results have had a desirable effect on the ceramic production flow. To emphasize, it is clear that the ceramic as art-industry is capable to accumulate suitable potential for waste material applications [7].

Recently Malaysia as one of the biggest producers of the edible oil from the palm oil has become a producer of a large extent of palm oil waste due to the oil production. In particular, this project attempted to apply palm oil waste material as a contributory agent to upgrade the strength of the existing typical stoneware body. Consequently, with the obtained demanded result in palm oil waste application in stoneware body not only the costs for the palm oil waste elimination will be decrease but it can be brought forward as an enhancement agent to improve the stoneware body strength significantly.

III. CERAMIC BODY

As a matter of fact, varieties of ceramic bodies have been utilized by the ceramists. Meanwhile, some of them are natural clay which is found directly in the nature and the other group of the clay which is the result of the composition process and has to be made. The filler component of a typical ceramic body which normally to be silica will be the main modified ceramic body components in this proposed framework. Stoneware body that usually high fired is most favourable for the ceramist in their artwork pieces. The body strength is one of the factors that ceramic artists focus in their artwork production process. In this research, the palm oil sludge as a contributory agent will be utilized to increase the stoneware body strength. Silica, as mention earlier to be one the ceramic body components which is the main role is to give the structure or "form" to the body in term of strength. Thus it is expected that palm oil sludge as a silica based waste can have an effective role in ceramic body strength enhancement.

In fact, ceramists have to research about their desired ceramic formula to achieve the ideal body that matched with their factors to obtain the best result [8]. Afterwards, the new formula which is closest to the ultimate result will be tested. Namely, to test the ceramic body a sort of matters should be deliberated such as ceramic surface quality, plasticity, shrinkage, porosity, strength and mature firing temperature.

IV. INDUSTRIAL WASTE MANAGEMENT

In recent years the word of recycling and waste management are not unknown words for the people all over the world. Almost the majority of people are familiar with the simple meaning of recycling through the mass media but perhaps all of them don't have a correct imagination of real effect and function of the recycling on their lives and future generation. Primarily the governments and other companies and institutions as follower intend to make the society closer to this phenomenon and use it as one of the practical solutions more effectively in human healthy life [9]. Of course its noteworthy that the recycling concept is not a new phenomenon and its history refers to 400 B.C. There are some evidences shows that in Turkey and Rome people recycled glass and metal such as Bronze and Gold and used them for new purposes [10]. In fact they realized that recycling or reuse of used materials was far easier and cheaper than using raw materials for production. Starting from the 19th century and the beginning of World War II, recycling had been propagated due to financial constraints and lack of wide spread raw material and later while industrialization and economic reasons kept going. Different countries in the 19th century buried both industrial and non-industrial wastes mainly due to the high rate of industrialization and lack of adequate research on their waste recycling phenomenon. By a glance to what was mentioned earlier, it can be achieved to convert the waste materials (industrial and non-industrial or hazardous and non-hazardous) to basic elements in recycling process to produce the same product or as a part of a new product. If recycled material could be used in appropriate places and of course if the demands would be increased, recycling phenomenon will extend so people and governments can derive its undeniable benefits.

Nowadays, in majority of the industries, the waste materials are used. Waste materials are capable to be used not only as raw material but as an agent to improve the production process. Ceramic industry is not exception from this phenomenon and not only is a producer but a consumer of the waste material. For instance, the used water in the ceramic production process can be recycled and reused in either this industry or other industry. According to the researches that have been done on different waste materials and their reuse in different parts of ceramic production process such as material, technique and form, it can be expected that, ceramic as an interaction point of art and industry, can be significant target for different waste material reuse. The application of the waste material can be used to eliminate some limitation of ceramic bodies. To exemplify, in some researches that have been done before, the reuse of waste material as a portion of ceramic body raw material could have a significant effect on new body physical and mechanical characteristics. Nevertheless, it is undeniable

that the waste material which is being used in ceramic production must be compatible with ceramic body in aspect of melting point and characteristics.

V. CONCEPTUAL FRAMEWORK

In this project firstly the palm oil waste which is obtained from an unknown company will be fired in kiln at 400 centigrade degrees to burn the remaining oil and also silica activation. Afterwards, the stoneware body will be dried at the room temperature and it will become dust. Then the characteristics of both of them will be checked in aspect of their composition [11-12]. In the next step the crashed stoneware will be divided into five groups and the palm oil dust will be added to each group in different percentage to test the effect of waste amount. In the next step every group will be mixed with water and will be dried in a shape of test bar at room temperature. Afterwards, all test bars will be fired in 800 °C and 1000 °C temperatures in oxidation kiln. After firing, the water absorption and shrinkage test should be accomplished on fired test bars. Then the strength test, modulus of rupture (MOR) will be scrutinized in two non-immersed and immersed conditions. Finally, the morphology of the modified body will be investigated by Scanning Electron Microscope (SEM) to observe the waste particles. Phase analysis will be also carried out to confirm any reaction between the stoneware body and the waste particle. Overall framework is shown in Fig. 1 below.

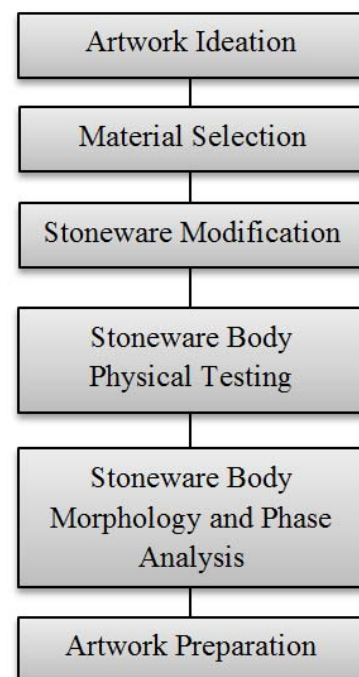


Figure 1. The conceptual framework of the study

As we know silica is one of the main materials of the stoneware bodies' composition which has a role in its strength [13]. Regarding to the palm oil characteristic which describes

the palm oil waste raw material, it is clear that the palm oil can have a significant effect on the stoneware bodies' strength due to its high amount of silica in content [14]. In this study it has tried to utilize the palm oil waste as a contributory agent to upgrade the stoneware bodies' strength because of noteworthy amount of silica in palm oil waste. Moreover, with a sort of the relevant test to deliberate the improvement of the stoneware body quality after addition of the palm oil waste in variety of amounts, the most appropriate amount of the palm oil addition to the stoneware can be achieved. On the other hand, the stoneware bodies' strength modification which has being used as one of the bodies by ceramic artists in artistic tasks has an effective role in new artistic work design and production. Nevertheless, these issues had not been practicable due to the before stoneware body strength deficiencies.

To sum up, the results which will be obtained based on this framework can be used by the artists in stoneware application significantly. In fact, by the stoneware strength modification, the artist may utilize this body to perform the artistic tasks will be able to test new ideas which not practicable with prior body without the additives. Consequently, this framework will path a way for more creative and challenging artwork. The artwork will also employing the green themes.

SUMMARY

Through many the similar research has been done, it can be seen that industrial waste as raw material or a part of raw material in same production process or different production could be utilized to eliminate some deficiencies. Meanwhile, it is not negligible that the application of industrial waste can lead to decrease the energy consumption and production costs considerably. Ceramic as part of the art-industry can be a high potential base for use of industrial waste as an alternative themes. In this study, palm oil sludge will be used as an auxiliary agent to enhance the strength of the stoneware body. Based on the characteristic of palm oil sludge, silica is main element of the waste material which can be expected to assist stoneware body to be stronger. Lastly, the final product which is stronger stoneware body can be used by ceramists in some designs that were unreachable before.

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