# CERAMIC MEMBRANE PREPARATION FROM WASTE : EFFECT OF ADDITIVE

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***Abstract*** *– Ceramic support is the most basic layer of a ceramic membrane. A ceramic membrane plays a vital role in filtration especially. Usually ceramic membrane is artificial and its made up of inorganic materials such as alumina, titania, zirconia oxides, silicon carbide or some glassy materials. In this experiment, ceramic waste from Top Glove Sdn Bhd is obtained and crushed to become tiny particles. The crushed ceramic is then sieved to obtain a diameter range of less than 180 microns. Using compression method, these materials are prepared to produced circular pellets in which characterization will be tested based on the composition structure of the materials upon adding different composition of additives,* $MoO_3$ and $AlF_3$.

## INTRODUCTION

Lately, ceramic gained many interest due to their flexible usage. Ceramic are usually used as membrane, absorbent, kiln furniture, catalytic converter insulation, and others. Due to its amazing properties in which they have low density, low thermal conductivity, high temperature stability and high resistance to chemical attack. Ceramic membrane comes with different shapes and sizes. In this study, the ceramic membrane that will be produced would be tubular in shape. Tubular shape would provide mechanical strength to the intermediate layer and membrane layer that will stand against the stress produced by the pressure during compression. Ceramic membrane consisted of support, intermediate layer (catalyst support) and membrane layer (catalyst). As alumina and silica are expensive, so an alternative method is chosen in which ceramic waste is produced. Besides that, sanitary waste is also used as raw material. The parameter that will be observed in the study is porosity and. This paper will focus on the influence of adding additives to the analysis of the ceramic support using Fourier Transform Infrared Spectroscopy (FTIR). FTIR is a device used to observe the distribution of different chemical species in a sample to be seen. (Wikipedia, FTIR)

## METHODOLOGY

Experimental procedures

**Starting materials for membrane support**

Ceramic (Top Glove Corporation Berhad) are used as starting material. Ceramic waste is crushed and grinded to become ceramic powder. The ceramic powder is in various size and shapes. Then, the ceramic powder is taken to be sieve. Sieve machine is used to sieve powder to obtain the desired diameter. Using sieve tube of 180 microns diameter, the obtained powder that is sieved is then will be used as the starting material.

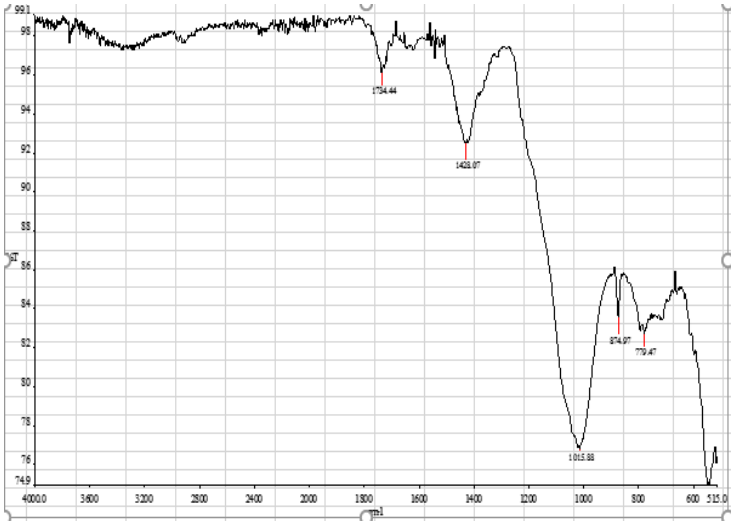
For the preparation of ceramic support, the materials used are ceramic powder, Polyvinyl Alcohol – PVA is used as organic binder, and mixture of $MoO_3$ - $AlF_3$ as additives used as the factor influencing the properties the ceramic support.

Three samples will be prepared and labelled with M0, M5 and M10 respectively. MO is the sample without any addition of $MoO_3$ - $AlF_3$ and only PVA is added as an organic binder. Where M5 and M10 samples are added with 4wt% of $AlF_3$ and 5wt% $MoO_3$ and the other one is added with 4wt% of $AlF_3$ and 10wt% $MoO_3$ respectively. After adding solutions into the ceramic powder, materials are mixed uniformly with PVA- fully hydrolysed (5.0 wt.%solution) in a container. After that, the mixed powders are pressed at a pressure of 150-190 MPa using a compressor to form pellets.

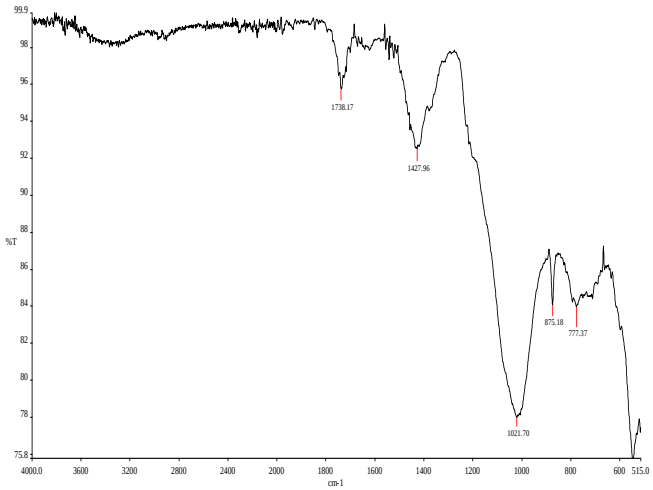
After compression, the pellets are taken to be dry for a while. The characterization that will be focused in this study is the composition of chemicals in the sample using FTIR machine which will be discussed in the discussion below.

## RESULTS

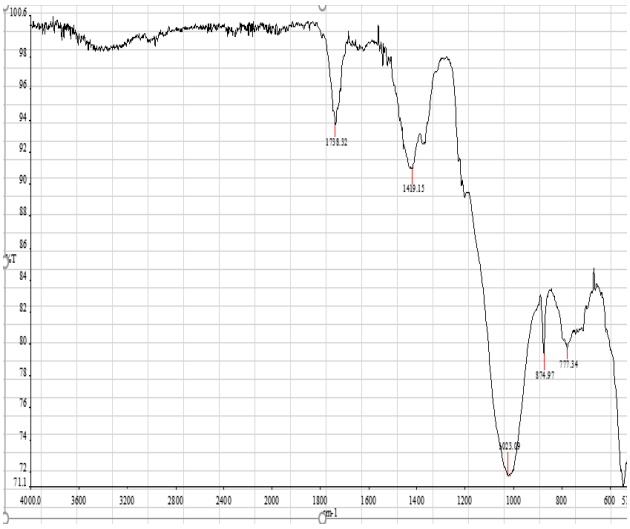
Characterisation Test




a. FTIR spectrum on the sample without adding any additives




b. FTIR spectrum upon adding 5wt% $MoO_3$




c. FTIR spectrum upon adding 10wt% $MoO_3$

## DISCUSSION

Based on the FTIR analysis that has been conducted, the three samples showed similar pattern but slightly different values at all the peaks. It can be concluded that the composition of substance in the three samples are almost the same.

At the lowest peak in the FTIR spectrum, the values are 1015.88 $cm^{-1}$, 1021.70 $cm^{-1}$ and 1023.09 $cm^{-1}$ respectively. From the lowest value, it can be seen that the sample do not contain any addition of additive. Upon increasing the concentration of additives added to the powder, the values of the peak also increases.

The second peak that would like to observe is at the last section of the spectrum. The value recorded from Figure a, b, and c are 779.47 $cm^{-1}$ 777.37 $cm^{-1}$ , and 777.34 $cm^{-1}$ respectively. As we can see the values decrease respectively. The bond between the particles have increases upon adding additive thus lowering the wavelength. At this peak angular deformation occur.

## CONCLUSION

As a conclusion of this experiment, it can be concluded that adding different compositions of $MoO_3$ – $AlF_3$ change the spectrum of the analysis. By adding these substances, the bond become stronger.

## ACKNOWLEDEMENT

I would like to thank Dr Norliza Ibrahim, my supervisor for this Research Project. I would also like to thank Ms Amira for helping me during my research project.

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