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A Preliminary Study on Gum Arabic as a Binder in Preparation of Starch Based Edible Plastic

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***Abstract*— This research emphasizes on synthesizing edible plastic using a one pot method by adding starch, gum Arabic as the binder and sugar (sorbitol and glycerol). In order to get the right composition, the ratio of each ingredient was varied. The FTIR spectroscopy was used to characterize the structure and composition of the sample produced.**

***Keywords*— Edible Plastic; Starch; Sorbitol; Glycerol.**

INTRODUCTION

Gum arabic has been widely used in food industry because of its high water solubility, low solution viscosity and low interfacial activity. These properties made gum arabic very useful in many applications especially in the food industry. For example, it widely used as flavor encapsulator and also stabilizer of citrus emulsion in soft drinks [1]. Furthermore, gum arabic is the best emulsifier in oil-in-water emulsion systems which very important in pharmaceutical industries [1,2].

As far as our concerned, there was no literature discussed on the utilization of gum Arabic as a binder for making edible plastic. Therefore, the aim of this work is to carry out a preliminary study on the preparation of edible plastic by using potato starch with the additional of gum arabic, glycerol, and sorbitol at different ratios. The temperature is varied between 40 °C to 70 °C. The samples were analyzed by Fourier Transform Infrared spectroscopy (FTIR).

II. METHODOLOGY

In a beaker, gum Arabic was dissolved with distilled water and heated for 60 minutes at 40 °C and labeled as sample A. Meanwhile, potato starch, glycerol and sorbitol was mixed with different ratio and labeled as sample B. Both samples were mixed together, stirred and heated for 30 minutes at 70 °C. The mixture was then placed in a petri dish and left in the oven for 24 hours at 50 °C.

III. RESULT AND DISCUSSION

A. Edible plastic texture

The experiment showed that the best ratio to prepare a good edible plastic was 20:20:10 wt% (gum Arabic: starch : glucose). Further experiment was made to determine the best ratio of glucose by adjusting the sorbitol and glycerol. As reported previously, the sorbitol was able to act as plasticizer, where it gave the hardness and made it less flexible. Whereas, the glycerol gave softness to the plastic structure. It was found 0.1 wt% of sorbitol and 0.2 wt% of glycerol gave the best texture of the edible plastic. A transparent plastic was obtained without sticky or brittle. This texture is important the food coating purposes (Fig. 1)

Fig. 1: A transparent edible plastic with a ratio of 20:20:10 wt% (gum Arabic: starch: glucose)

It was also found that the amount of gum Arabic used was also important for edible plastic preparation. Only 0.1g was needed, otherwise the plastic texture became jelly-like with less gum Arabic while the product unpeel-able if the amount of gum Arabic excessed (Figure 2).

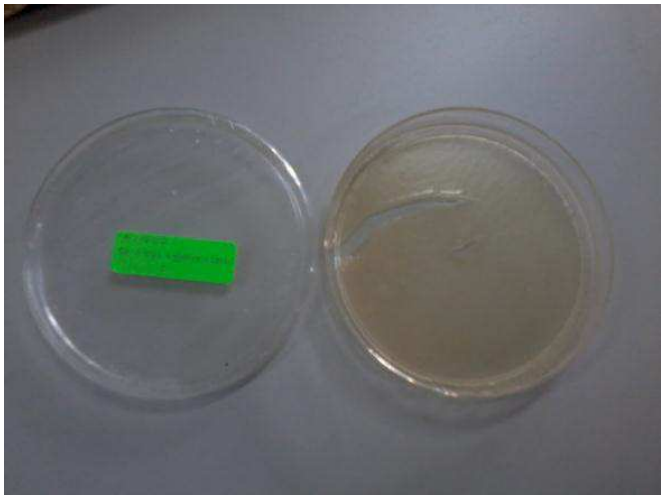

Fig. 2: Starch based edible plastic with excess gum Arabic

The heating and drying process was important due to the starch was sensitive to any temperature changes. If sample was heated over 50 °C caused the plastic burned and the color turned to be brownish. Also, the edge of the plastic became hard and brittle (Fig. 3)

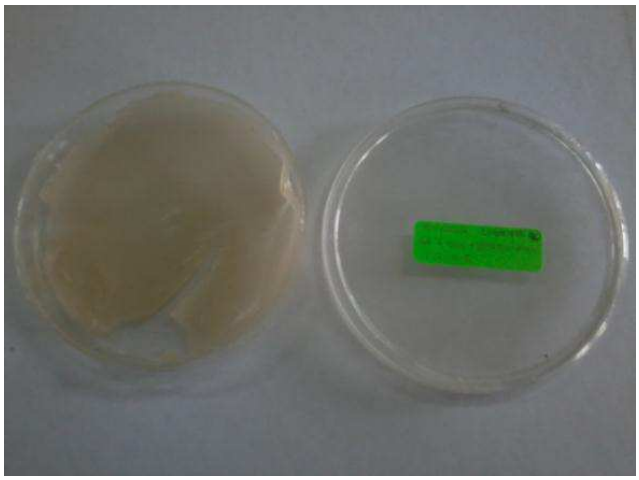

Fig. 3 Brittle and hard sample of edible plastic sample at overheated temperature

B. FTIR analysis

Figure 4 shows an infrared spectrum control sample which contains gum Arabic, glycerol and sorbitol. A typical stretching of hydroxyl (OH), the double bond (C=C) and carbonyl (C=O) group at 3321 cm-1, 1637 cm-1cm-1 and 1040 cm-1 respectively. A broad peak is observed at 3321 cm-1 due to unreacted alcohol solvent. The peak at 1040 cm-1 represents (C-O) primary, secondary or tertiary alcohol [3-5]

A similar trend of spectrum can be seen for the edible plastic sample (Figure 5). The broadband of OH (3282 cm-1) is contributed by the glycerol and sorbitol that being used in the sample. Three significant peaks 2928, 1638, and 1338 cm-1demonstrates the stretching of C-H bond [6,7].

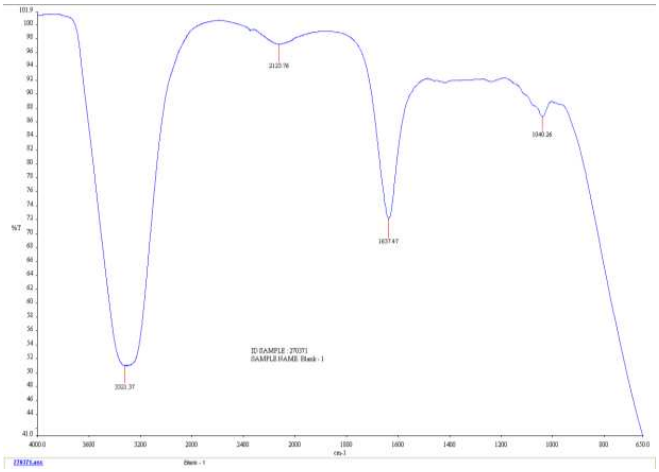

Fig. 4 FTIR spectroscopy for a control sample

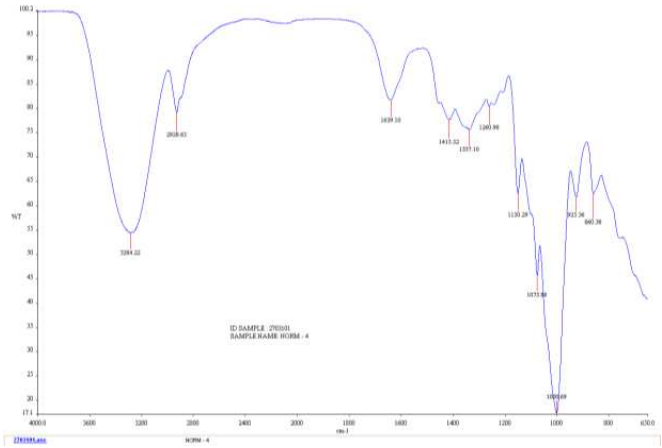

Fig 5. FTIR spectroscopy for edible plastic sample

IV. CONCLUSIONS

Starch based edible plastic was successfully prepared by using a mixture of starch, gum Arabic and glucose. The experiment showed that the best ratio to prepare a good edible plastic was 20:20:10 wt% (gum Arabic: starch: glucose). It was found 0.1 wt% of sorbitol and 0.2 wt% of glycerol and 0.1g gum Arabic with a temperature of 50 °C gave the best texture of the edible plastic, Fourier Transform Infrared spectroscopy (FTIR) was used to determine the functional groups of the edible plastic.

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