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Effect of pH on the Production of Bacterial Cellulose from Rambutan and Longkong Juice

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Abstract

The objective of this research was to study the effect of pH on the production of bacterial cellulose by using rambutan and longkong juice as a carbon source. Two fruit juice were prepared by adjusting total soluble solid (TSS) to 12 °Brix and applying $(NH_4)_2SO_4$ for 0.5% (w/v). Seven pH values of fruit juice were set at 3.0, 3.5, 4.0, 4.5, 5.0, 5.5 and 6.0. *Acetobacter xylinum* was inoculated at 10% of the prepared fruit juice volume and incubated at room temperature for 14 days. Bacterial cellulose was withdrawn every 2 days for thickness and dry weight measurement. The results showed that the optimal pH values of rambutan and longkong for bacterial cellulose production were 4.0 and 5.0, respectively. The maximum thickness and dry weight were obtained from rambutan juice at pH 4.0 and longkong juice at pH 5.0 that were significant difference ($p \leq 0.05$) from another pH values. The maximum thickness and dry weight of bacterial cellulose using rambutan juice were 1.59 cm and 80 mg. For bacterial cellulose produced from longkong juice, the maximum thickness and dry weight were 1.44 cm and 110 mg.

Keywords: *Acetobacter xylinum*, bacterial cellulose, rambutan, longkong.

1. Introduction

Rambutan (*Nephelium lappaceum* Linn.) is a common fruit in Southeast Asia (1). This fruit were planted abundantly in the East of Thailand, especially in Trat and Chanthaburi province. Rambutan is consumed as fresh, canned or processed because of its refreshing flavor and exotic appearance. Another fruit used in this study was Longkong (*Lansium domesticum* Corr.) (2). Longkong are planted in the South and the East of Thailand. After harvesting, longkong deteriorates quickly due to the pericarp browning that lead to low quality, short storage life and low marketable value.

The prices of these fruit are always decreased dramatically when the season arrives. In addition, these fruits are sold and consumed as raw. Some damaged and non-standard size fruits are sold in low price and discard in finally. It should be great if this fruit could be utilized for new products because the abundant sugar in fruit could be used as a carbon substrate for microorganism.

Bacterial cellulose (BC) is one of the products that could be produced by using some sugar in fruit (3-4). BC is a purified form of extracellular polysaccharide produced by some bacteria such as *Gluconacetobacter* (formerly *Acetobacter*), *Agrobacterium*, *Achromobacter*, *Aerobacter*, *Azotobacter*, and *Sarcina* (5). Among these genera, *G. xylinus* (*A. xylinum*) is commonly used to study BC production. BC has been reported to use in the food industry, enzyme immobilization, paper production, bio-sensing, high performance speaker and biomedical application (6-10). The production of BC depends on some factors such as carbon source, temperature and pH value of medium.

The objective of this research was to study the effect of different pH values for producing the bacterial cellulose from rambutan and longkong juice.

2. Materials and Methods

2.1 Starter culture

Acetobacter xylinum in coconut medium was bought from the Institute of Food Research and Product Development (IFRPD) Kasetsart University.

2.2 Sample preparation

Fruits were peeled and their seeds were separated from flesh. Fruit flesh was extracted by using water at the ratio of 1:1. Extracted juices were heated for 5 min and filtered. Total soluble solid (TSS) of juices were adjusted to 12 °Brix using sucrose. 0.5% (w/v) of ammonium sulfate was applied and the pH values were set at 3.0, 3.5, 4.0, 4.5, 5.0, 5.5 and 6.0 using acetic acid. 20 ml of prepared juices were filled into plastic tube size 50 ml (diameter 3.0 cm) and autoclaved at 121 °C for 15 min. 10% (v/v) of *A. xylinum* was applied to prepared juices and allowed to ferment at room temperature for 14 days. BC was withdrawn every 2 days for the thickness (cm) and dry weight (mg) measurement.

3. Results and Discussions

The BC produced from rambutan juice at different pH values were withdrawn to examine the thickness and dry weight as shown in Figure 1 and 2. The results indicated that the BC was produced by using rambutan juice at the pH range of 3.5 to 6.0 but the optimal pH was 4.0. At the pH 4.0, the maximum thickness and dry weight of BC were around 1.59 cm and 80 mg, respectively at room temperature and 10 days fermentation. Figure 3 and 4 showed the thickness and dry weight of BC produced from longkong juice at different pH value. The results showed that the BC could be produced at the pH range of 3.5 to 5.0. The optimal pH value for producing BC was 5.0. The maximum thickness and dry weight of BC were around 1.44 cm and 110 mg, respectively that were achieved at room temperature and 14 days fermentation.

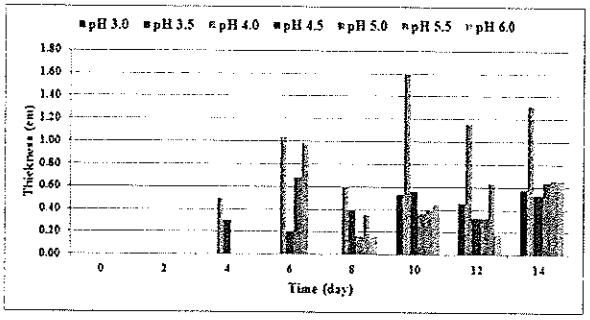

Figure 1 Thickness of BC from rambutan juice at different pH value.

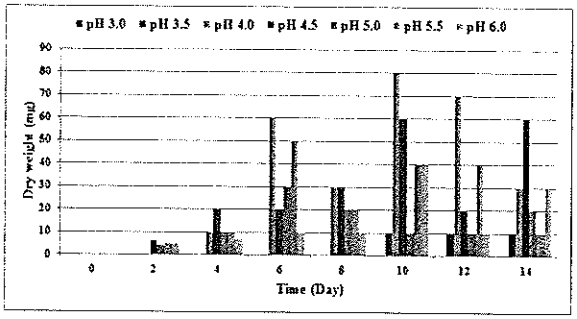

Figure 2 Dry weight of BC from rambutan juice at different pH value.

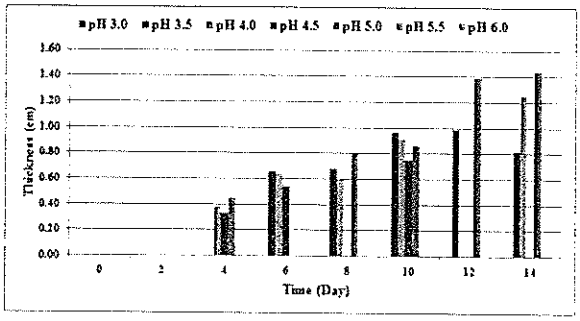

Figure 3 Thickness of BC from longkong juice at different pH value.

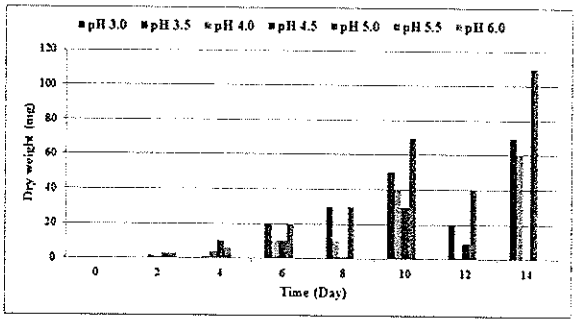

Figure 4 Dry weight of BC from longkong juice at different pH value.

The obtained results are the same as the reports that *A. xylinum* can assimilate sugar to produce BC (3-4) and the optimal pH range for cellulose production is 4 to 7 (11).

4. Conclusion

The results of this research showed the ability of *A. xylinum* to use rambutan and longkong juice as carbon substrates for BC production. This would be a choice to create value added products from fruits that are low in quality and marketable value.

5. Acknowledgement

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