The Development of Biodegradable and Antimicrobial Packaging Material from Bacterial Cellulose Film

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INTRODUCTION

- Nowadays in Malaysia, plastic became the third largest solid waste volume in municipal solid waste (MSW).
- The conventional petroleum-based polymer took around 400 to 500 years to biodegrade by itself.
- Even though, recycling plastic was aimed to minimize its quantity in order to avoid pollution, the process used during the recycling process still releases a heavy and toxic metal into the air and environment.
- Because of that, the best solution is to use biodegradable plastic (Bert et al., 2002).
- Additionally, greater interest in the use of bio-preservatives for antimicrobial packaging due to the health concern of consumers especially over the safety of food.
- Antimicrobial packaging is define as a packaging system that can kill or inhibit spoilage and pathogenic microorganisms that are contaminating food (Brody, 2001).
- The packaging system limits or prevents microbial growth by extending the lag period and reducing the growth rate or decreases live counts of microorganisms (Han, 2000).
- Antimicrobial function of the packaging system can be achieved by incorporating active substances into the packaging system by various ways (Han, 2003).

OBJECTIVE

- To produce bacterial cellulose (BC) by fermentation of *Acetobacter xylinum 0416* in the Henstrin-Shramm medium.
- To incorporate BC film with lauric acid (LA) at different concentration and soaking time.
- To study the properties of BC – LA film through water vapour permeability, biodegradation rate, mechanical properties and disc diffusion assay.

METHODOLOGY

Production of the bacterial cellulose (BC) film by fermentation of *Acetobacter xylium* 0416 in Hestrin-Schramm (HS) medium

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Treatment of BC film (boiling at 100˚ C, 2 hours) and preparation of BC film (drying at 40˚ C, 5 hours)

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Incorporation of BC film with antimicrobial agent (lauric acid) using soaking techniques (different soaking time and lauric acid concentration)

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Film analysis

- Testing antimicrobial effectiveness: Using the agar diffusion method (Zone Inhibition Assay).
- Water vapour permeability analysis: Using a modified American Society for Testing and Materials (ASTM) method.
- Biodegradable Test Analysis: Using soil burial and compost conditions
- Testing mechanical properties: Using the Universal Polymeric Material Testing Machine

Figure 1: Flowchart of Methodology

Figure 2: Process Flow Diagram

CONCLUSION

- Bacterial cellulose is suitable materials that can be used to substitute the usage of conventional plastic.
- Bacterial cellulose incorporated with lauric acid is an alternative material for packaging application and also can reduce the environmental pollution.
- Apart from that, addition of antimicrobial agent to bacterial cellulose film can avoid microbial growth and protect the products from microorganisms/spoilage.

RESULTS

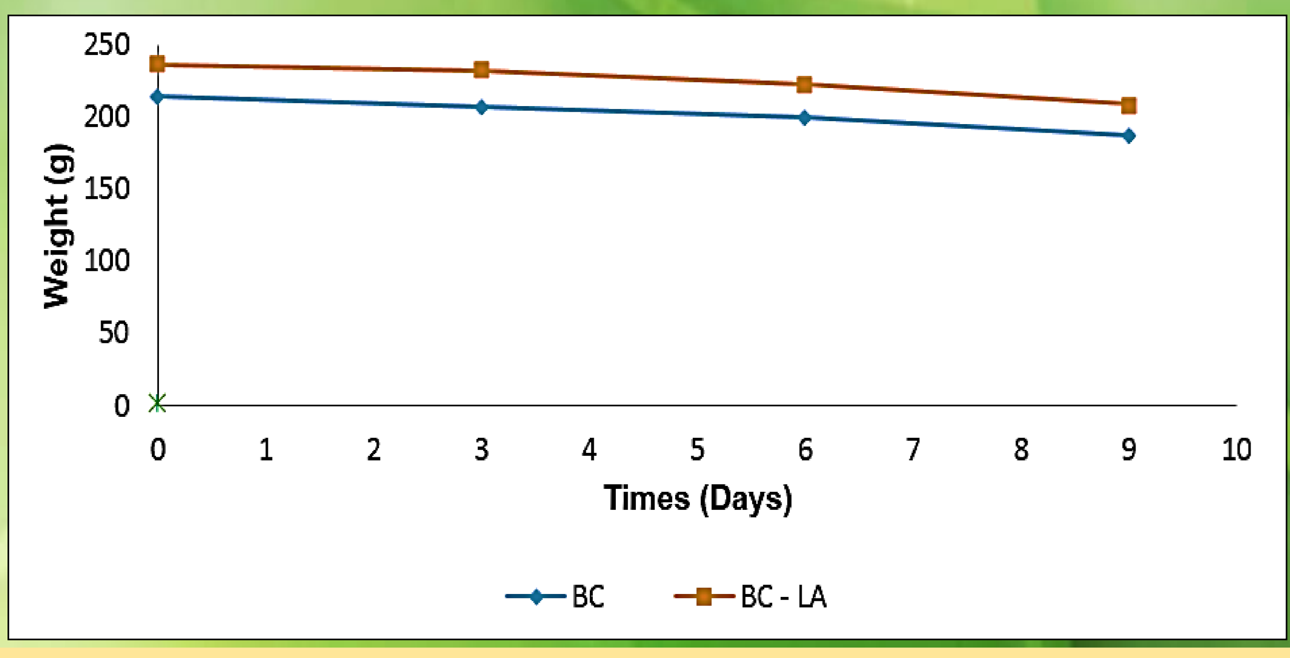

Figure 3: Water Permeability Test

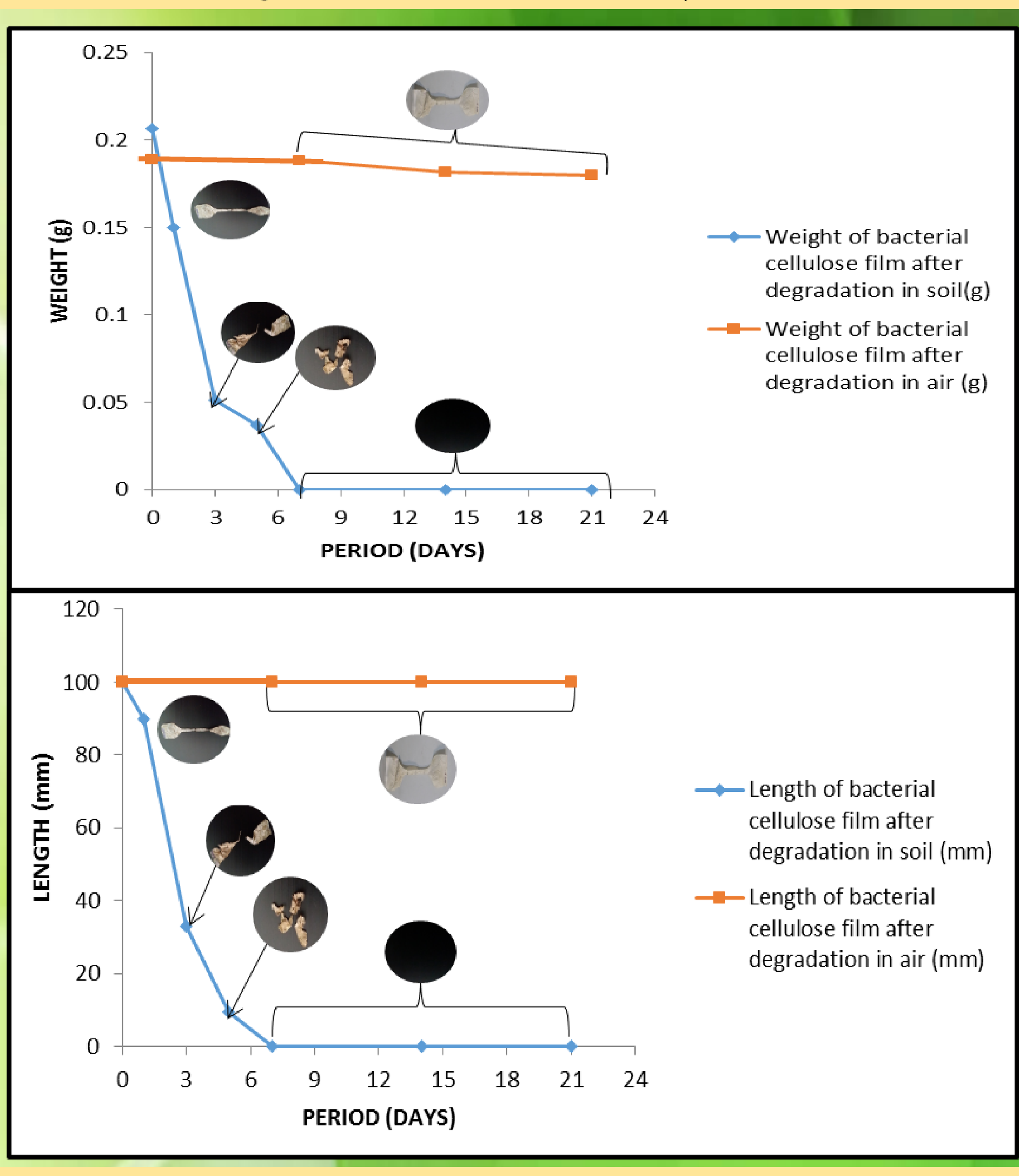

Figure 4: Biodegradation Analysis (Weight and Length of BC Film in Soil and Air)

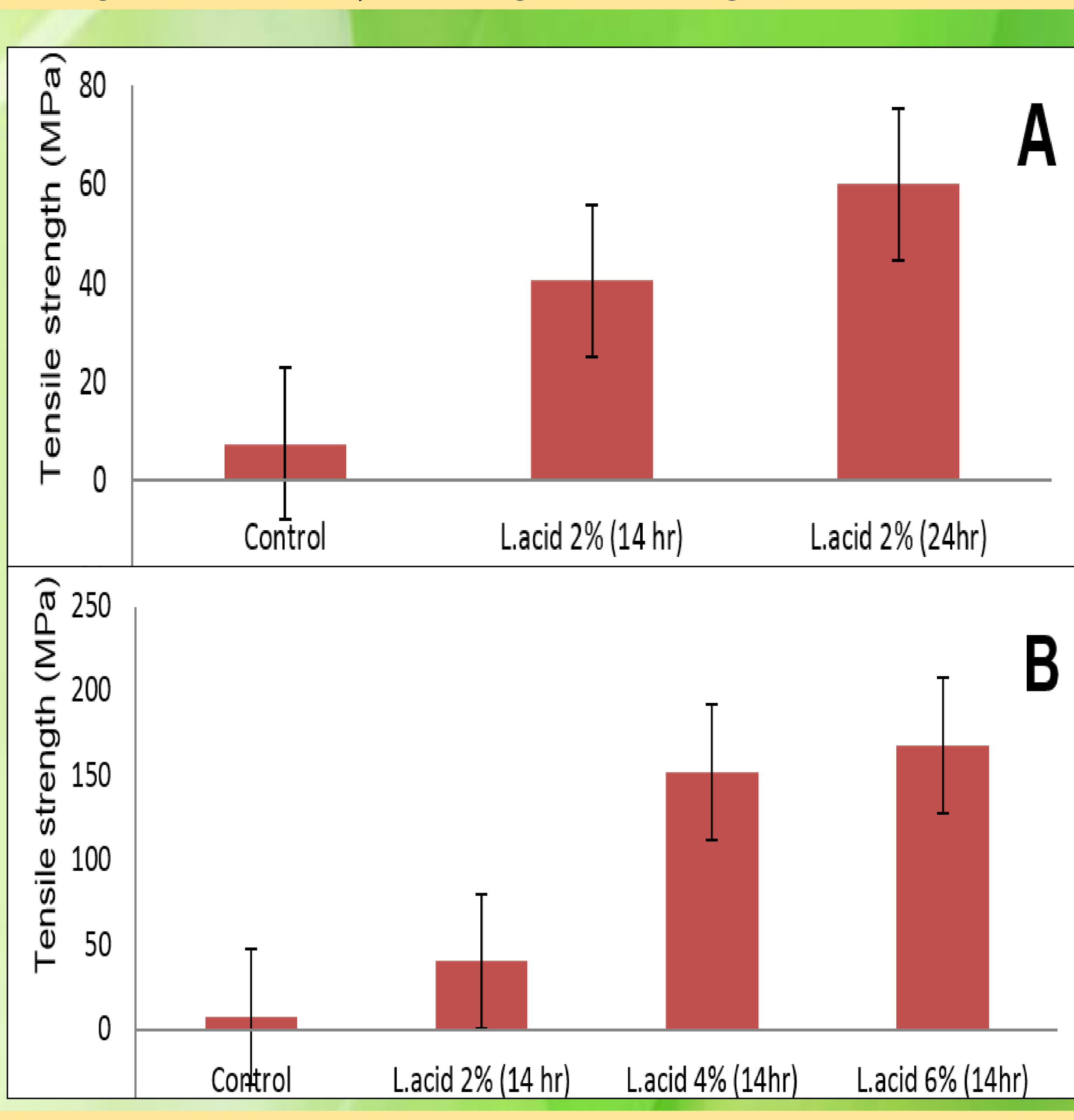

Figure 5: Tensile Strength of BC-LA Film at (A) Different Soaking Time; (B) Different Concentration of LA

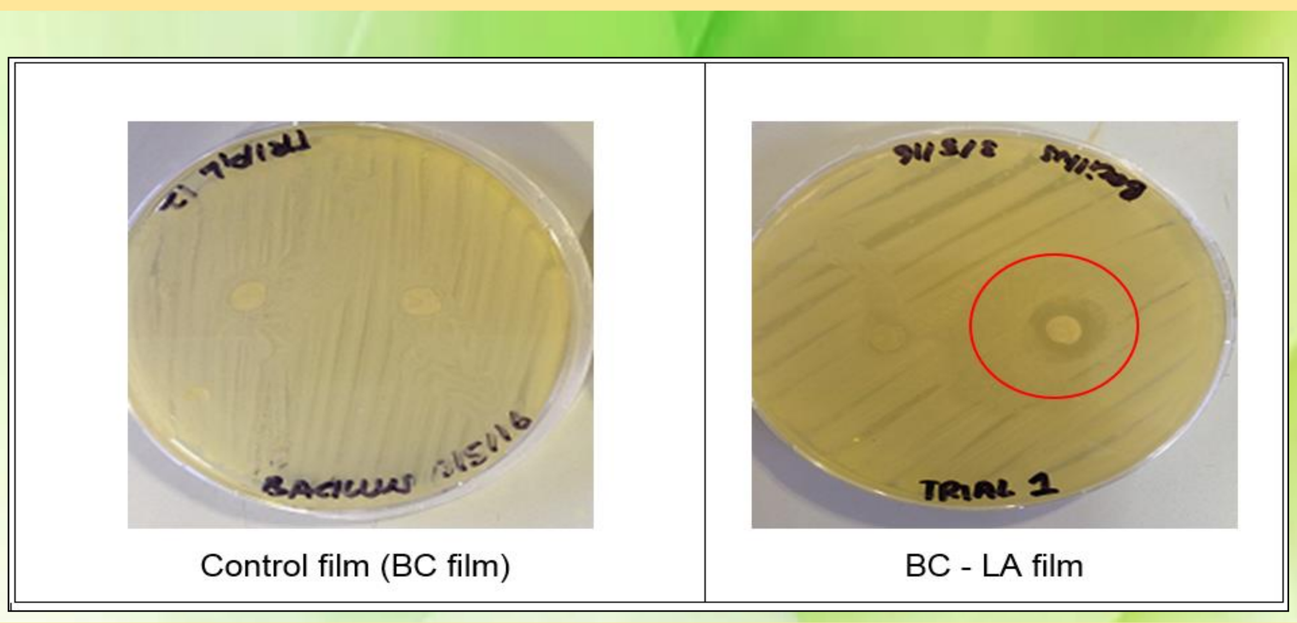

Figure 6: Inhibition Zone (Comparison between Control Film and BC-LA Film)

The 6th Made in UniKL Final Year Project Competition 2016