

## CONTENTS

<b>ABSTRACT.....</b>	<b>I</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>II</b>
<b>CONTENTS.....</b>	<b>III</b>
<b>LIST OF TABLES.....</b>	<b>IV</b>
<b>LIST OF FIGURES.....</b>	<b>V</b>
<b>CHAPTER 1. INTRODUCTION.....</b>	<b>1</b>
1.1 Background .....	1
1.2 Research Problem.....	3
1.3 Objectives.....	3
<b>CHAPTER 2. LITERATURE REVIEW.....</b>	<b>4</b>
2.1 Biodegradable Packaging.....	4
2.2 Durian Seed Starch Based Films.....	5
2.2.1 Description of Starch.....	5
2.2.2 Starch Molecular Structure.....	6
2.2.3 Durian Seed Starch.....	7
2.2.4 Film Preparation.....	8
2.3 Antimicrobial Packaging.....	9
2.3.1 Effectiveness of Antimicrobial Packaging.....	9
2.3.2 Application of Antimicrobial Packaging in Foods.....	12
2.4 Cinnamon Essential Oil.....	13
2.4.1 Essential Oil Classification.....	14
2.4.2 Properties of Cinnamon Essential Oil.....	14
2.4.3 Structure and Antimicrobial Activity of Cinnamon Essential Oil...	15
<b>CHAPTER 3. MATERIALS AND METHODS.....</b>	<b>18</b>
3.1 Materials.....	18

3.2 Instruments.....	18
3.3 Methods.....	20
3.3.1 Films Preparation.....	20
3.3.2 Film Analysis.....	21
<b>CHAPTER 4. RESULTS AND DISCUSSION.....</b>	<b>27</b>
4.1 Effect of Cinnamon Essential Oil in Durian Seed Starch Film Properties ....	27
4.1.1 Antimicrobial Properties.....	27
4.1.2 Physical Property.....	30
4.1.3 Mechanical Properties.....	33
4.1.4 Barrier Property.....	36
4.1.5 Morphology Property.....	38
4.2 Effect of Cinnamon Essential Oil in Durian Seed Starch Film in Ham Shelf Life.....	40
<b>CHAPTER 5. CONCLUSION AND SUGGESTION.....</b>	<b>42</b>
5.1 Conclusion.....	42
5.2 Suggestion.....	42
<b>REFFERENCES.....</b>	<b>43</b>
<b>APPENDICES.....</b>	<b>57</b>

## **LIST OF TABLES**

**Table.2.1 Chemical Composition of Durian Seeds Starch**

**Table 2.2. Compositions of compound found in Essential Oil ( EOs )**

**Table.4.1 Minimum Inhibitory Concentration of CEO towards *Staphylococcus aureus* and *Eschericia coli* Strains Using Disc Diffusion Method**

**Table 4.2 Comparison Inhibition Zone of MIC and Disc Diffusion Method Against *Staphylococcus aureus* Strain**

**Table 4.3 Effect of CEO with various concentrations on the L\* value of Durian Seed Starch Film**

**Table.4.4 Effect of CEO in WVP of Durian Seed Starch Film**

**Table. 4.5 The Total Plate Count of Ham Product Using Various Types of Film Sample During Storage for 18 Days**

## LIST OF FIGURES

**Fig. 2.1.  $\alpha$ -1,4 and  $\alpha$ -1,6 Glycosidic Bonds of Starch**

**Fig. 2.2 Eugenol**

**Fig. 2.3 Cinnamaldehyde**

**Fig. 3.1 Tristimulus Colorimeter (Lewis,2006)**

**Fig 4.1 MIC Analysis of CEO towards Gram Positive and Gram Negative Bacteria**

**(a) *Eschericia coli* (b) *Stapylococcus aureus***

**Fig.4.2 Inhibition Zone of Durian Seed Starch Film that incorporated with various concentration of CEO against *E.coli* and *S.aureus* strains**

**Fig. 4.3 Comparison Inhibition Zone of MIC and Disc Diffusion Method Against *Staphylococcus aureus* Strain**

**Fig. 4.4 Inhibitory Zone of Disc Diffusion Method from DSS Film Incorporated Again *Eschericia coli* Strain**

**Fig. 4.5 Effect of CEO with various concentrations on the Transparency Values of Durian Seed Starch Film**

**Fig 4.6 Effect of CEO with various concentrations on the Tensile Strength of Durian Seed Starch Film**

**Fig 4.7 Effect of CEO with various concentrations on the Elongation at Break of Durian Seed Starch Film**

**Fig. 4.8 Effect of CEO on film surface : (a) Control Film (b) Film-CEO2% (c) Film-CEO5% (d) Film-CEO7% and (e) Film-CEO10%**