

CONTENTS

HALAMAN PENGESAHAN	3
PERNYATAAN BEBAS PLAGIASI	4
ACKNOWLEDGEMENT	5
Abstract	7
CONTENTS	9
CONTENT OF TABLE	11
CONTENT OF FIGURE	12
CHAPTER 1	14
1.1. Background	14
1.2. Problem statement	15
1.3. Objectives	15
CHAPTER 2	16
2.1. Edible Packaging	16
2.2. Xyloglucan	16
2.2.1. Properties of Xyloglucan	18
2.2.2. Applications of Xyloglucan	19
2.3. Plasticizer	20
2.4. Palmyra Palm Fruit (<i>Borassus flabellifer</i> Linn.)	20
2.4.1. The Functional Properties of Young Seed Coat from Palmyra Palm Fruit	21
CHAPTER 3	27
3.1. Materials	27
3.2. Chemicals	27
3.3. Microorganisms	27
3.4. Equipment	27
3.5. Methods	28
3.5.1. Extraction of Xyloglucan (XG)	28
3.5.2. Characterization of XG	28
3.5.3. Preparation and Characterization of <i>B. flabellifer</i> Seed Coat Extract (BFE)	29
3.5.4. Determination of Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of BFE	29
3.5.5. Fabrication of XG Film.....	30
3.5.6. Film Characterization.....	30
3.5.7. Standardization of XG/BFE Coating Solution.....	31
3.5.8. Coating Characterization	31
3.5.9. Application of Coatings on Strawberries	32



3.5.10. Statistical analysis	34
CHAPTER 4.....	35
4.1. Preliminary Study of Xyloglucan (XG).....	35
4.1.1. Extraction Yield	35
4.1.2. Proximate Analysis of Xyloglucan	35
4.1.3. Fourier-Transform Infrared Spectroscopy (FTIR).....	36
4.1.4. X-Ray Diffraction (XRD).....	37
4.1.5. Scanning Electron Microscopy (SEM).....	38
4.2. Preliminary Study of <i>B. flabellifer</i> seed coat extract (BFE)	38
4.2.1. Extraction Yield.....	38
4.2.2. Fourier-Transform Infrared Spectroscopy (FTIR).....	39
4.2.3. Scanning Electron Microscopy (SEM).....	40
4.2.4. Antimicrobial Activity	40
4.3. Characterization of XG Film	41
4.3.1. Physical Properties.....	41
4.3.2. Mechanical Properties.....	42
4.4. Characterization of XG/BFE Coating Solution.....	45
4.4.1. Viscosity	45
4.4.2. Antimicrobial Properties.....	46
4.4.3. Preliminary Study of XG/BFE Coatings on Strawberries	49
4.5. Effect of Edible Coating Application on Minimally Treated Strawberries	50
4.5.1. Weight Loss	50
4.5.2. Fungal Decay Index	51
4.5.3. Surface Color Measurement	54
4.5.4. Firmness.....	56
4.5.5. Physicochemical Properties (pH, Total Soluble Solids and Titratable Acidity).....	57
4.5.6. Microbiological Count.....	61
CHAPTER 5.....	64
5.1. Conclusions	64
5.2. Suggestions.....	64
BIBLIOGRAPHY	65
APPENDICES.....	78

CONTENT OF TABLE

Table 1. Antibacterial activity of seed coat extracts of <i>B. flabellifer</i> extracted with different solvents against some pathogenic bacteria	22
Table 2. Antifungal activity of seed coat extracts of <i>B. flabellifer</i> extracted with different solvents	23
Table 3. Dose-dependent inhibitory effect of methanol extract of <i>B. flabellifer</i> seed coat against some bacteria	24
Table 4. DPPH radical scavenging activity of ethanol extract of <i>B. flabellifer</i> seed coat	25
Table 5. Proximate analysis result of xyloglucan.	35
Table 6. Minimum inhibition concentration and Minimum bactericidal concentration of <i>B. flabellifer</i> seed coat extract against <i>Staphylococcus aureus</i> and <i>Escherichia coli</i>	41
Table 7. Effect of different xyloglucan concentrations on mechanical properties of the film.....	43
Table 8. Antimicrobial performance of xyloglucan coating solution containing 0, 1, 2, and 5 fold of MIC of <i>B. flabellifer</i> against <i>S. aureus</i> and <i>E. coli</i> bacteria.	48

CONTENT OF FIGURE

Figure 1. Chemical structure of xyloglucan in comparison with typical hemicelluloses and starch macromolecules. (A) Hardwood glucuronoxylan, (B) Softwood galactoglucomannan, (C) Starch macromolecules—amylose and amylopectin, and (D) Xyloglucan (Jose, 2012).	17
Figure 2. The palmyra palm fruit young (left) and palmyra palm fruit ripe (right) (Artnarong et al., 2016).	21
Figure 3. ATR-FTIR spectra of xyloglucan.	36
Figure 4. Pattern of X-ray diffraction of xyloglucan obtained from tamarind seeds.	37
Figure 5. Scanning electron microscopy (SEM) of xyloglucan obtained from tamarind seed. ...	38
Figure 6. ATR-FTIR spectra of BFE	39
Figure 7. Scanning electron microscopy (SEM) of <i>B. flabellifer</i> seed coat extract.	40
Figure 8. XG Films.	42
Figure 9. Mechanical properties such as tensile strength, elongation at break and Young's modulus of XG films (■ 1% XG, ■ 2% XG, ■ 3% XG, and ■ 4% XG). Different letters indicate significant differences among non-active or active films.	44
Figure 10. XG Films containing 1 (left) and 2 (right) folds of MIC of BFE, before (up) and after (down) oven drying.	45
Figure 11. Zone of inhibition test for XG film containing 1, 1.5 and 2 fold of MIC of BFE using <i>S. aureus</i> and <i>E. coli</i> bacteria.	47
Figure 12. Antimicrobial performance of xyloglucan coating solution containing 0, 1, 2, and 5 fold of MIC of <i>B. flabellifer</i> against <i>S. aureus</i> (left) and <i>E. coli</i> (right) bacteria.	48
Figure 13. Preliminary study of XG/BFE coatings on strawberries	49
Figure 14. Loss of weight of strawberries during storage time. Values with different letters (a-c) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-D) in the same column differ significantly ($p < 0.05$).	51
Figure 15. Fungal decay index of strawberries during storage time.	52
Figure 16. Image of strawberries during the experiment.	53
Figure 17. Surface color of strawberries during storage time. Values with different letters (a-c) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-D) in the same column differ significantly ($p < 0.05$).	55



Figure 18. Firmness of strawberries during storage time. Values with different letters (a-c) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-D) in the same column differ significantly ($p < 0.05$). 57

Figure 19. pH value of strawberries during storage time. Values with different letters (a-b) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-C) in the same column differ significantly ($p < 0.05$). 58

Figure 20. Total soluble solid of strawberries during storage time. Values with different letters (a-b) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-B) in the same column differ significantly ($p < 0.05$). 59

Figure 21. Titratable acidity of strawberries during storage time. Values with different letters (a-b) within each parameter in the same row differ significantly ($p < 0.05$). Values with different letters (A-B) in the same column differ significantly ($p < 0.05$). 61

Figure 22. Microbiological count of strawberries during storage time. 63