

TABLE OF CONTENTS

LEMBAR PENGESAHAN TESIS	i
LETTER OF STATEMENT.....	ii
ACKNOWLEDGMENTS	iii
LIST OF TABLES.....	ix
LIST OF FIGURES	x
ABSTRACT	xii
ABSTRAK.....	xiii
CHAPTER I: INTRODUCTION	1
1.1 Background of the study.....	1
1.2 Objectives	4
1.2.1 General objective	4
1.2.2 Specific Objectives	4
1.3 Significance	4
CHAPTER II: LITERATURE REVIEW	5
2.1 Tomato fruit origin and production in the World, Asia, and Indonesia	5
2.2 History of tomato species	6
2.3 Tomato cultivars	7
2.4 Types of tomatoes.....	8
2.5 The nutritional content of tomato fruit	8
2.6 Health benefits of tomato fruit.....	10
2.7 Tomato fruit products	10
2.8 Tomato fruit maturity and ripening stages.....	10

2.9	The optimal condition for postharvest storage of tomatoes.....	12
2.10	Pectin	14
2.11	Pectin production.....	15
2.12	Pectin-degrading enzymes	16
2.13	The Texture and the application in food products.....	17
2.14	The basic structure and working principle of a texture analyzer	19
2.14.1	Instrumental texture profile analysis (TPA)	20
2.15	Changes in texture during postharvest.....	23
2.15.1	Respiration rate production.....	23
2.15.2	Ethylene production.....	23
2.15.3	Water loss	24
2.15.4	Ripening.....	24
2.16	The Hypothesis of The Study	25
CHAPTER III: MATERIALS AND METHODS		26
3.1	Materials and research tools	26
3.1.1	Main materials	26
3.1.2	Material for analysis	26
3.1.3	Research tools	26
3.2	Time and place of research	27
3.3	Tomato fruit and treatments.....	27
3.4	Quality parameters analysis	27
3.4.1	Determination of fruit pH, °brix and titratable acidity (TA)	27
3.4.2	Color measurement	28
3.4.3	Postharvest physiology	28
3.5	Texture profile analysis (TPA)	30

3.6	Pectinase activity assay	30
3.6.3	Pectin fractions analysis	30
3.6.4	Cell-wall modifying enzymes assay	31
3.7	Experimental design	34
3.8	Statistical data analysis	35
CHAPTER IV: RESULTS AND DISCUSSION		36
4.1	Quality parameters	36
4.1.1	Physicochemical quality parameters	36
4.1.1.1	Titrateable acidity and pH	36
4.1.1.2	Total soluble solids (TSS)	37
4.2	Color	38
4.3	Postharvest Physiology parameters	40
4.3.1	Weight loss	40
4.3.2	Respiration rate	43
4.3.3	Ethylene production.....	43
4.4	Texture Profile Analysis (TPA).....	44
4.4.1	Hardness	44
4.4.2	Gumminess (N).....	47
4.4.3	Chewiness (N)	47
4.4.4	Cohesiveness.....	47
4.4.5	Resilience.....	51
4.4.6	Springiness Index.....	52
4.4.7	Adhesiveness (N mm).....	53
4.5	Pectin cell-wall fractions content.....	54
4.6	Cell-wall modifying enzymes activity assay	56
4.6.1	Polygalacturonase (PG) enzyme activity	56

4.6.2 Pectin methylesterase activity (PME).....	59
CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS.....	61
5.1 Conclusion	61
5.2 Recommendations.....	61
References.....	62
Appendices	74
Abbreviations.....	90

LIST OF TABLES

Table 1. Nutritional Content of Tomato Fruit.....	8
Table 2. The approximate composition of fresh tomato fruit (red) at the stage of commercial consumption.....	9
Table 3. Tomato fruit maturity stages and their color description.....	11
Table 4. Pectic enzymes are active against the pectin HG domain.....	16
Table 5. Preparation of the standard curve for PG enzyme activity.....	32
Table 6. Preparation of the standard curve for PME enzyme activity.....	33
Table 7: Experimental design matrix for TPA and pectinase enzyme activity of tomato fruit during maturity stages and storage temperatures.....	34
Table 8. Effect of maturity stages and storage conditions on the Physicochemical quality parameters of tomato fruits*.....	37
Table 9. Pearson correlation among the TPA parameters.....	53
Table 10. The pectin content of cell-wall fraction (mg/ g CW) of tomato fruit during maturity stages and storage temperatures*.....	56

LIST OF FIGURES

Figure 1. Tomato cultivars (A) Pepper tomato fruit, (B) Edo local tomato fruits, (C) Golden tomato fruits, and (D) Derica tomato fruits.....	7
Figure 2. The Texture Analyzer and Basic Structures.....	19
Figure 3. The working principle of a texture analyzer.....	20
Figure 4. Force-time curve model of texture profile analysis.....	21
Figure 5. Changes in the color of tomato fruit during maturity and temperatures, L*: (A); a*: (B); and b*: (C). Vertical bars denote the standard error ($p \leq 0.05$) of the mean, n-3.....	38
Figure 6. The development of tomato fruit during four weeks after pollination (green mature) week 2; C: week 3; and D: week 4).....	40
Figure 7. Changes in (A) weight loss (B) respiration rate (ml/kg/h) and (C) ethylene production ($\mu\text{L C}_2\text{H}_4/\text{kg/h}$) of tomato fruit during harvesting maturity phases and storage temperatures. Bars represent the standard error ($P \leq 0.05$) of the mean, n-3.....	42
Figure 8. Effect of maturity periods and storage temperatures on the hardness of tomato fruit. Vertical bars indicate standard error (95% Confidence of Interval) mean, n-6.....	45
Figure 9. Gumminess (N) change of tomato fruit during maturity periods and storage temperatures. Vertical bars show standard error ($p < 0.05$) of mean, n-6.....	48
Figure 10. The chewiness of tomato fruit during maturity periods and storage ..temperatures on the Vertical bars indicate standard error ($p < 0.05$) of mean, n-6.....	48
Figure 11. The effect of maturity periods and storage temperatures on the cohesiveness of tomato fruit. Vertical bars indicate standard error ($p < 0.05$) of mean, n-6.....	49
Figure 12. The effect of maturity periods and storage temperatures on the resilience of tomato fruit. Vertical bars indicate standard error ($p \leq 0.05$) of mean, n-6.....	51
Figure 13. The effect of maturity stages and storage temperatures on the springiness of tomato fruit. Vertical bars imply standard error ($p \leq 0.05$) of mean, n-6.....	52
Figure 14. Force-time curve and graphic representation of tomato fruit compression using the texture profile analyzer (TA1) machine.....	54

Figure 15. PG enzymes activity (U. g⁻¹ protein) on tomato fruit during maturity stages and storage temperatures. Vertical bars represent standard error ($p \leq 0.05$) of mean, n-3.....57

Figure 16. PME enzymes activity (U. g⁻¹ protein) on tomato fruit during maturity stages and storage temperatures. Vertical bars represent standard error ($p \leq 0.05$) of mean, n-3.....60