ANALYZING THE THERMAL SHRINKAGE BEHAVIOR OF POLYESTER/ ELASTOMERIC WEFT KNITTED FABRICS

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ABSTRACT

Thermoplastic polymer fabrics are normally heat set to make them dimensionally stable. These fabrics in garment panel form may again be exposed to heat during the processes such as rubber print curing and cause to change their dimensions. The key issue addressed in this study; the thermal shrinkage of heat-set polyester/elastomeric knitted fabrics during post-heat treatment processes which is a practical and a current problem in the garment industry.

The thermal shrinkage behavior of heat-set polyester knitted fabrics, under a wide range of conditions, mainly to simulate the post-heat treatment processes, using geometric and thermodynamic parameters were investigated. The findings present a statistically sound analysis of different thermal behavior patterns, while examining their causes based on both material properties and dimensions of the plain knitted fabrics.

The key findings reveal that heat-setting and heat-curing temperatures have a significant effect on thermal shrinkage behavior. Thermal shrinkage in course direction is highly related to the width-wise extension applied during heat-setting and the wale direction is highly correlated to the shrinkage behavior of the yarns in hank form. Noticeable changes in polyester thermal behavior occur at 160°C and thermal shrinkage is heavily influenced by thermal history of materials. Taut-end and slack-end conditions maintained while heat-setting and heat-curing significantly affected thermal shrinkage. The higher percentage of overfeed during heat-setting leads to lower thermal shrinkages in subsequent thermal activities.

Thermal shrinkage was evidence of a change in the structural parameters of knitted material. Structural changes are mainly due to the change of shape of the loop and/or thermal shrinkage of the stitch length. The introduction of elastomeric yarn to the polyester knitted structure led to make more thermally stable fabrics. In order to reduce thermal shrinkage during subsequent heat treatment, a high temperature heat-setting and a moderate percentage over feed should be retained during thermal setting.

The post heat treatment results revealed that the low temperatures during heat treatments though have no trend but causes comparatively low thermal shrinkage or expansion, it is safe and advisable to use low post heat setting temperatures where possible.

Key words: Polyester, Spandex, Plain knitted fabric, Thermal shrinkage, Post-heat treatments

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Table of Contents

Declaration of the candidate & supervisor i

Abstract ii

Acknowledgment iii

Table of Contents iv

List of Figures xi

List of Tables xvii

List of Abbreviations xxiii

List of Appendices xxiv

1 INTRODUCTION 1

1.1 Background of the Problem 1

1.2 Introduction to Thermal Shrinkage 3

1.3 Impact of Thermal Shrinkage Behavior of Heat-Set Polyester Knitted Fabrics on Sri Lankan Garment Industry 4

1.4 Research Problem Statement 5

1.5 Research Objectives 6

1.6 Significance of the Study 6

1.7 Scope and Limitations 8

1.7.1 The following main areas were discussed in this study 8

2 LITERATURE REVIEW 9

2.1 Use of Polyester in the Textile and Apparel Industry 9

2.2 Polyester 10

2.2.1 What is polyester? 10

2.2.2 Chemical structure of polyester 10

2.2.3 Different forms of polyester 11

2.2.4 Forms of polyester in commercial application 14

2.3 Behavior of Polyester Fibre 19

2.3.1 Models 20

2.3.2 Models describing the semi-crystalline polyester fibre 24

2.3.3 DSC analysis to determine structure and morphology of PET 27

2.4 Polyester Knitted Fabrics 28

2.5 Heat-Setting of Synthetic Polymer Materials 30

2.5.1 Hot-air pin stenter machine 34

2.5.2 The effect of heat-setting on thermoplastic fibres 37
2.5.3 Effect of temperature and tension during annealing 38
2.6 Shrinkage Mechanism of Polyester Fibres, Yarns and Fabrics 42
2.6.1 Thermal shrinkage mechanism of semi-crystalline polyester 42
2.7 Standard Testing Methods Available for Thermal Shrinkage Measurement 48
2.8 Use of Spandex® in Knitted Fabrics 49
2.8.1 Chemical structure of Spandex® 50
2.8.2 Knitting with Spandex® yarn 51
2.8.3 Effect of heat-setting on polyester/Spandex® knitted fabrics 53
2.9 Application of Heat on PET During Garment Manufacturing 54
2.10 Summary 56
3 METHODOLOGY 58
3.1 Introduction 58
3.2 Materials 58
3.3 Heat-Setting Process 58
3.4 Post-Heat Treatment Process 59
3.5 Experiments 60
3.6 Statistical Analysis 63
4 SIGNIFICANCE OF THERMAL SHRINKAGES DUE TO POST-HEAT TREATMENT PROCESSES 65
4.1 Introduction 65
4.2 Materials and Methods 65
4.2.1 Materials and knitting 65
4.2.2 Dyeing and heat-setting of fabrics 66
4.3 Experiments and Testing 66
4.3.1 Thermal shrinkage (S_T) 67
4.3.2 Dimensional change due to laundering (DC) 67
4.4 The Mean Thermal Shrinkage in the Course Direction and Wale Direction of Post-Heat-Treated Fabrics A, B, C and D 68
4.5 Statistical Analysis to Determine the Effect of Fabric Type, Post-Heat Treatments and Their Interactions on Thermal Shrinkage 69
4.5.1 Statistical analysis of thermal shrinkage in the course direction resulted when fabrics subjected to post-heat treatment processes 69

4.5.2 Statistical analysis of thermal shrinkage in the wale direction resulted when fabrics subjected to post-heat treatment processes 75

4.5.3 Dimensional changes of fabrics after laundering 79

4.6 Summary 80

5 EFFECTS OF PANEL PARAMETERS AND HEAT-SETTING TEMPERATURE ON THERMAL SHRINKAGE 81

5.1 Introduction 81

5.2 Materials and Experiments 81

5.3 Statistical Analysis on Fabric Shrinkage 84

5.3.1 Significance of the thermal shrinkage values among three pairs of points 84

5.3.2 Mean thermal shrinkage 87

5.3.3 Correlation analysis of thermal shrinkage 92

5.3.4 Multiple linear regression analysis of thermal shrinkage in the course direction 95

5.4 The Factors to Consider in Determining the Test Specimen Dimensions 102

5.4.1 Selection of the Cut panel lay out for further thermal shrinkage behavior analysis 102

5.4.2 Specimen size selection for further thermal shrinkage behavior investigation 102

5.4.3 The machine parameters of subsequent heat treatments 103

5.5 Summary 103

6 THERMAL BEHAVIOR OF HEAT TREATED POLYESTER PLAIN KNITTED FABRICS 105

6.1 Introduction 105

6.2 Materials and Method 105

6.2.1 Knitting and heat-setting 105

6.2.2 Treatments carried out on fabric A 106

6.2.3 Differential Scanning Calorimetry (DSC) measurements of fabric A 106

6.2.4 Post-heat treatments and measuring shrinkage of the yarns in the fabric 107

6.3 Differential Scanning Calorimetry (DSC) Analysis of Heat-Set Fabrics of Fabric A 108

6.3.1 Analyse of DSC thermograms of heat-set fabric samples of fabric A 108

6.4 DSC Analysis of Heat-Cured Fabric (Fabric A) 114
6.5 Significance of the Effective Temperature on Heat-Curing Process 115
6.5.1 Statistical analysis to assess the impact of effective temperature in subsequent heat treatments of fabric A 116
6.5.2 Mean thermal shrinkage of stitch length of heat-set fabrics due to curing 117
6.5.3 Analysis of variance test to assess the effect of curing treatment on thermal shrinkage of stitch length 119
6.6 Differential Scanning Calorimetric and Thermal Shrinkage Analysis of Fabric B 121
6.6.1 Heat treatments carried out for fabric B 121
6.6.2 Differential scanning calorimetric (DSC) analysis of fabric B 122
6.6.3 Statistical analysis to assess the impact of effective temperature in subsequent heat treatments of fabric B 125
6.6.4 Mean thermal shrinkages of heat-set and heat-cured fabrics of fabric B 126
6.6.5 Analysis of variance for stitch length thermal shrinkage 127
6.7 Summary 128
7 COMPARATIVE STUDY ON THE THERMAL SHRINKAGE BEHAVIOR OF POLYESTER YARN AND ITS PLAIN KNITTED FABRICS 129
7.1 Introduction 129
7.2 Materials and Methods 129
7.2.1 Dyeing, heat-setting and subsequent heat-curing of yarns in hank form of yarn A 130
7.2.2 Dyeing, heat-setting and heat-curing of 100% polyester plain knitted fabrics (fabric A) 132
7.3 Thermal Effects on Yarns in Hank and Yarns in Fabric (Stitch Length) Due to Dyeing (Yarn A and Fabric A) 135
7.4 Thermal Effects of Yarns in Hank and Yarns in Fabric Due to Heat-Setting and Heat-Curing (Yarn A and Fabric A) 136
7.4.1 Comparison of mean thermal shrinkage behavior of yarn in hank and yarn in fabric due to process of heat-setting (yarn A and fabric A) 139
7.4.2 Thermal effects of heat-curing on the yarn in hank and yarn in fabric 141
7.5 Statistical Analysis to Evaluate the Effect of Heat-Curing Treatment on Yarn Length in Hank and Yarns in Fabric (Yarn A and Fabric A) 143
7.5.1 Statistical analysis to assess the effect of heat-setting and heat-curing temperature on the length of yarns in hank due to curing 143

7.5.2 Statistical analysis to evaluate the effect of heat-curing on the length of yarns in fabric 145

7.6 Comparison of Heat Treatment Effect for Yarn in Fabric and Yarn in Hank 147

7.7 Effect of Heat-Setting and Post-Heat Treatments on Course and Wale Direction Thermal Deformations of Fabric A 149

7.7.1 Course direction (width-wise) and wale direction (lengthwise) thermal shrinkage of fabric due to heat-setting (fabric A) 150

7.7.2 Effect of curing temperature on width and length dimensions of fabric A 152

7.7.3 Comparison of the thermal shrinkage of yarn in hank and wale direction of fabric (yarn A and fabric A) 155

7.7.4 The effect of curing temperature on area shrinkage of the fabric A 158

7.8 Thermal Shrinkage Behavior of Yarn B and Fabric B 159

7.8.1 Thermal shrinkage behavior of yarn in hank and yarn in fabric B due to dyeing 160

7.8.2 Thermal effects of yarns in hank and yarns in fabric due to heat-setting and post heat treatment (heat-curing) Fabric B 160

7.8.3 Statistical analysis to evaluate the effect of heat-setting temperature and heat-curing temperature on yarn length in hank and yarns in fabric due to curing (yarn B and fabric B) 165

7.8.4 Statistical analysis to assess the effect heat-curing temperature on the length of yarns in hank (yarn B) 165

7.8.5 Analysis of variation of yarn in hank due to heat-curing (yarn B) 166

7.8.6 Statistical analysis to evaluate the effect heat-curing temperatures on the length of yarns in fabric B 167

7.9 Comparison of the Effect of Heat Treatments on Yarns in Fabric and Yarn in Hank (Yarn B and Fabric B) 169

7.10 Course Direction (Width-wise) and Wale Direction (Length-wise) Thermal Shrinkage of Fabric B Due to Heat-Setting 170

7.10.1 Effect of curing temperature on width and length dimensions of fabric B 171

7.10.2 Comparison of the thermal shrinkage of yarn in hank and wale direction of fabric 173

7.10.3 The effect of curing temperature on area shrinkage of the fabric B177

7.11 Summary 177

8 THE INFLUENCE OF OVER FEED DURING HEAT-SETTING ON THE THERMAL SHRINKAGE BEHAVIOR 179

8.1 Introduction 179
8.2 Materials and Method 179
8.2.1 Measuring fabric parameters 180
8.3 Structural Analysis of Heat-set Fabrics and Heat-cured Fabrics 181
8.3.1 Correlation analysis 183
8.3.2 The effect of initial stitch length and percentage of over feed on structural parameters of heat-cured fabrics 184
8.3.3 Analysis of variance of thermal shrinkage of stitch length due to heat-curing treatment 185
8.4 Mean Thermal Shrinkage in Course Direction and Wale Direction Due to Heat-curing Treatment 186
8.5 Correlation Analysis of Thermal Shrinkages in the Course and Wale Direction of Heat-cured Fabrics 187
8.6 Multiple Linear Regression Analysis of Thermal shrinkages in the Course and Wale Directions 188
8.6.1 Dummy variable recoding for categorical variables 189
8.6.2 Regression equation to express the relationship between thermal shrinkage in the course direction, initial stitch length and percentage of over feed 190
8.6.3 Regression equation to express the relationship between the thermal shrinkage in the wale direction, initial stitch length and percentage of over feed 196
8.7 Thermal Shrinkage Behavior of Heat-cured Fabrics in the Course and Wale Directions 201
8.8 Summary 204
9 THERMAL SHRINKAGE BEHAVIOR OF POLYESTER/ELASTOMERIC PLAIN KNITTED FABRICS 205
9.1 Introduction 205
9.2 Materials and Experiments 205
9.2.1 Knitting process 205
9.2.2 Pre-heat-setting and dyeing process 206
9.2.3 Final-heat-setting process 206
9.2.4 Post-heat-treatment (Heat-curing treatment) 207
9.3 Thermal Shrinkage Values of Heat-Cured Polyester/Spandex Fabric Specimens 208
9.4 Statistical analysis of the effect of heat-curing temperature on the thermal shrinkage of the course and wale directions of polyester/spandex fabrics 209

9.4.1 Analysis of variance to evaluate the effect of heat-curing temperature on the thermal shrinkage in the course direction of polyester/spandex fabrics 209

9.4.2 Analysis of variance to evaluate the effect of heat-curing temperature on the thermal shrinkage in the wale direction 211

9.5 Student-Newman-keuls test for comparison of thermal shrinkage in the course direction and wale direction of polyester/spandex knitted fabrics 212

9.6 Summary 215

10 DISCUSSION 217

11 CONCLUSION 225

Reference List 228

Bibliography

Appendix A1 241

Appendix A2 248

List of Figures

Page

Figure 2.1 : The demand of polyester from 1980 to 2030 (Carmichael, 2015) 9

Figure 2.2 : Condensation polymerization of terephthalic acid and ethylene glycol (Oxtoby, Gillis, & Campion, 2011) 11

Figure 2.3 : Methods of producing semi-crystalline and amorphous polyester (Gschel, 1996; Trznadel & Kryszewski, 1988; Vries, 1980) 12

Figure 2.4 : Structures presenting amorphous and semi-crystalline polyester (Kajiwara & Ohta, 2009) 13

Figure 2.5 : Main production steps of polyester fibres (“Polyester”, n.d.) 17

Figure 2.6 : Two-phase model of molecular arrangement of PET fibre (Park & Seo, 2011) 20

Figure 2.7 : Schematic diagram of Fringed-micelle model (Kajiwara & Ohta, 2009) 21

Figure 2.8 : Schematic diagram of high-order structure model of a synthetic fibre (Kajiwara & Ohta, 2009) 21

Figure 2.9 : Schematic diagram of various phases of polymer chains (Kajiwara & Ohta, 2009) 22

Figure 2.10 : Schematic representation of (a) folded microfibrils and (b) drawing process (Kajiwara & Ohta, 2009) 23

Figure 2.11 : Structural model of drawn PET yarn suggested by Huisman and Heuvel (1989) 24

Figure 2.12 : Schematic representation of Takayangi model for highly oriented semi-crystalline polymers: C crystalline block, A amorphous region, T taut tie molecules (Prevorsek et al., 1974; Prevorsek & Tobolsky, 1963) 25

Figure 2.13 : Schematic structure of PET Fibre (Prevorsek et al., 1974) 26

Figure 2.14 : Schematic diagram showing the structure of a highly oriented semi-crystalline polymer as suggested by Choy, Chen and Young (1981). 26

Figure 2.15 : DSC thermogram of PET (Blaine, 2010) 28

Figure 2.16 : Loop diagram and the technical face of the plain fabric (Spencer, 1996) 29

Figure 2.17 : Schematic diagram and fabric flow path of hot air pin stenter ("Heat Setting Stenter (Stenter Machine)," 2017) 33

Figure 2.18 : Fabric over feeding system (Swastik, 2012) 35

Figure 2.19 : Inlet chain track (Swastik, 2012) 36

Figure 2.20 : Schematic diagram of the hard and soft segments of polyurathane structure (Otaigbe & Madbouly, 2009). 51

Figure 2.21 : Chemical structure of spandex (Otaigbe & Madbouly, 2009) 51

Figure 2.22 : Elastane plated single jersey plain knitted fabric pattern (Abdessalem, Abdelkader, Mokhtar, & Elmarzougui, 2009) 52

Figure 2.23 : Heat-transfer printing (sublimation) process (Maurer, n.d.) 56

Figure 4.1: The distribution of standardize residuals of thermal shrinkage in the course direction 70

Figure 4.2 : Mean thermal shrinkage in the course direction in relation to fabric type and post-heat treatment processes 74

Figure 4.3 : The distribution of standardize residuals (thermal shrinkage in the wale direction) 75

Figure 5.1 : Cut panel layout 83

Figure 5.2: Three pairs of data lines 83

Figure 5.3 : Specimen size Vs. mean thermal shrinkages of layout 1 and layout 2 of fabric heat-set at (a) 140°C, (b) 160°C and (c) 180°C- wale direction 89

Figure 5.4 : Specimen size vs. mean thermal shrinkages of cut panel layout 1 and cut panel layout 2 of fabric heat-set at (a) 140°C, (b) 160°C and (c) 180°C 91

Figure 5.5 : Residual plots (a) Normal Probability plot, (b) Histogram, (c) Residual Versus fits and (d) Residual versus order to verify the regression equation of thermal shrinkage in the course direction 99

Figure 5.6 : The distribution of standardized residuals 101

Figure 6.1 : The data derived from DSC thermogram for percentage crystallinity calculation 107

Figure 6.2 : DSC thermograms recorded from 25°C to 300°C of the yarn samples of fabrics heat-set at different temperatures (Heat flow (W/g) Vs. Temperature (°C)) 109

Figure 6.3 : DSC thermograms recorded from 60°C to 215°C of yarns of fabrics heat-set at different temperatures (Heat flow (W/g) Vs. Temperature (°C)) 110

Figure 6.4 : DSC thermograms of yarns from fabrics panels heat-cured at 200°C which have been heat-set at 140°C,160°C,180°C and 200°C temperatures (Heat flow (W/g) Vs. Temperature (°C)) 114

Figure 6.5 : The distribution of standardize residuals of percentage thermal shrinkage of stitch length due to curing 117

Figure 6.6 : DSC thermograms recorded from 25°C to 300°C of the yarn samples from heat-set fabrics (Heat flow (W/g) Vs. Temperature (°C)) 122

Figure 6.7 : DSC thermograms recorded from 60 °C to 215 °C of yarns from fabrics heat-set at different temperatures (Heat flow (W/g) Vs. Temperature (°C)) 123

Figure 6.8 : The distribution of standardize residuals of percentage thermal shrinkage of stitch length due to curing 125

Figure 7.1: Thermal shrinkage of (a) yarn in hank and (b) yarn in fabric due to heat-setting (yarn A and fabric A) 139

Figure 7.2 : Thermal shrinkage behavior of yarn in hank due to heat-curing (yarn A) 141

Figure 7.3 : Thermal shrinkage of behavior of yarn in fabric due to heat-curing (fabric A) 142

Figure 7.4 : The distribution of standardize residuals for length of heat-cured yarns in hank (yarn A) 143

Figure 7.5 : The distribution of standardize residuals stitch lengths fabrics (fabric A) 145

Figure 7.6 : Thermal shrinkage behavior of (a) yarn in hank and (b) yarn in fabric at different heat-setting and heat-curing temperatures (yarn A and fabric A) 147

Figure 7.7 : knitted loop distortion due to width-wise extension at the stentering machine 150

Figure 7.8 : Change of wale and course densities of the fabrics due to heat-setting (fabric A) 151

Figure 7.9 : Course direction shrinkage due to curing of heat-set fabrics (fabric A) 152

Figure 7.10 : Wale direction shrinkage due to curing of heat-set fabrics (fabric A) 154

Figure 7.11 : Shrinkages due to heat-curing of yarns (in the hank) those have been heat-set at different temperatures (yarn A) 155

Figure 7.12 : The effect of heat-curing temperature on area shrinkage of heat-set fabrics (fabric A) 158

Figure 7.13 : Thermal shrinkage of (a) yarn in hank and (b) yarn in fabric due to heat-setting (yarn B and fabric B) 163

Figure 7.14 : Thermal shrinkage of yarn in hank due to heat-curing (yarn B) 164

Figure 7.15 : Thermal shrinkage of yarn in fabric due to heat-curing (fabric B) 164

Figure 7.16 : The distribution of standardize residuals for yarn in hank (yarn B) 165

Figure 7.17 : The distribution of standardize residuals for stitch length (heat-cured fabric B) 167

Figure 7.18 : Thermal shrinkage behavior of (a) yarn in hank and (b) yarn in fabric at different heat-setting and heat-curing temperatures (yarn B and fabric B) 169

Figure 7.19: Change in wale and course densities of the fabrics (fabric B) 170

Figure 7.20 : Course direction shrinkage due to curing of heat-set fabrics (fabric B) 172

Figure 7.21 : Wale direction shrinkage due to curing of heat-set fabrics (fabric B) 173

Figure 7.22 : Shrinkage due to heat-curing of the yarns (in the hank) at different temperatures (yarn B) 174

Figure 7.23 : Standardized residual for thermal shrinkage of yarns in hank and thermal shrinkage in wale direction of fabric heat-cured at 200°C (yarn B and fabric B) 175

Figure 7.24 : The effect of heat-curing temperature on area shrinkage of heat-set fabrics (fabric B) 177

Figure 8.1: Change of WPI and CPI of heat-set fabrics and heat-cured fabrics with percentage of over feed 182

Figure 8.2 : Change of stitch densities of heat-set fabrics and heat-cured fabrics with percentage of over feed 182

Figure 8.3 : Residual plots (a) Normal Probability plot, (b) Histogram, (c) Residual versus fits and (d) Residual versus order to verify the regression equation of course direction thermal shrinkage 195

Figure 8.4 : Residual plots (a) Normal Probability plot, (b) Histogram, (c) Residual versus fits and (d) Residual versus order to verify the regression equation of the thermal shrinkage in the wale direction 200

Figure 8.5 : Estimated thermal shrinkages in the (a) wale direction and (b) course direction derived from the regression equations 201

Figure 9.1: Standardized residual for thermal shrinkage (course direction) 209

Figure 9.2 : Standardized residual for thermal shrinkage (wale direction) 211

Figure 9.3 : Mean thermal shrinkage in the course and wale direction of fabric P/S1 213

Figure 9.4 : Mean thermal shrinkage in the course and wale direction of fabric P/S2 214

Figure 9.5 : Mean thermal shrinkage in the course and wale direction of fabric P/S3 214

Figure A.11.1: Three pairs of data lines 241

List of Tables

Page

Table 2.1: Different spinning and drawing conditions to produce polyester with different molecular structures (Rodriguez-Cabello et al., 1996) 18

Table 4.1 : Yarn and fabric specifications to investigate the effect of post-heat treatment process on fabric shrinkage 66

Table 4.2 : Selected post-heat treatment processes and their process parameters 67

Table 4.3 : Mean and standard deviation thermal shrinkage measurements of fabrics A, B, C and D subjected to post-heat treatment processes 68

Table 4.4 : The results of skewness and kurtosis of thermal shrinkage in the course direction 69

Table 4.5 : Analysis of variance – to determine the overall impact of fabric type and post-heat treatment processes on thermal shrinkage in the course directions (R^2=0.921) 72

Table 4.6 : Thermal shrinkage in the course directions resulted due to fabric type and post heat treatment processes 72

Table 4.7 : The results of skewness and kurtosis of thermal shrinkage in the wale direction 75

Table 4.8 : Analysis of variance – to determine the overall impact of fabric type, post-heat treatment processes and their interactions on thermal shrinkage in the wale directions (a: R^2=0.866) 77

Table 4.9 : Thermal shrinkage in the wale directions resulted from the fabric type and post heat treatment processes 77

Table 4.10 : Dimensional changes in fabrics A, B, C and D after home laundering. 80

Table 5.1 : Yarn specifications and fabric specifications after heat-setting 82

Table 5.2 : The one-way ANOVA statistical analysis test for thermal shrinkage in the wale direction 85

Table 5.3 : The one-way ANOVA statistical analysis test for thermal shrinkage in the course direction 87

Table 5.4 : Mean values of thermal shrinkage in the wale direction 88

Table 5.5 : The mean values of thermal shrinkage in the course direction 90

Table 5.6 : Bivariate linear relationships among variables for thermal shrinkage in the wale direction 92

Table 5.7 : Bivariate linear relationships among variables for thermal shrinkage in the course direction 94

Table 5.8: Table of regression coefficients 97

Table 5.9: Summary output 97

Table 5.10: Analysis of variance of thermal shrinkage in the course direction 98

Table 5.11: Comparison of predicted and actual values 101

Table 6.1 : Yarn and fabric specifications of fabric A 106

Table 6.2 : The temperatures of glass transition, pre-melting, secondary melting, primary melting, low and high temperature cold crystallisation peaks and crystallinity of heat-set fabric samples of fabric A 113

Table 6.3 : Mean thermal shrinkage, standard deviation and coefficient of variation of heat-set and heat-cured fabrics of fabric A 118

Table 6.4 : The significant values resulted from one-way ANOVA tests performed for heat-set and heat-cured fabrics based on the Hypothesis test 6.1 and 6.2. 120

Table 6.5 : Yarn and fabric specifications of fabric B 121

Table 6.6 : The temperatures of glass transition, pre-melting, secondary melting, primary melting, low and high temperature cold crystallisation peaks and crystallinity of heat-set fabric samples of fabric B 124

Table 6.7 : Mean thermal shrinkage, standard deviation and coefficient of variation of heat-set and heat-cured fabrics of fabric B 126

Table 6.8 : The ANOVA results of the effect of curing temperature on thermal shrinkage of the yarns in knitted fabric B. 127

Table 7.1: Yarn and fabric specifications 132

Table 7.2 : Thermal shrinkage of yarns and the yarns in the fabric due to dyeing (Standard deviations are indicated in square brackets) 135

Table 7.3 : Mean length shrinkages of yarn in the hank due to heat-setting and heat-curing process and resultant yarn counts (yarn A) 137

Table 7.4 : Mean shrinkages of knitted stitch (yarns in the fabric) due to heat-setting and post-heat treatment (heat-curing) processes and resultant yarn counts (fabric A) 138

Table 7.5 : The ANOVA results to determine the overall impacts of heat-curing temperatures on yarn length of heat-set and heat-cured yarn in hank 144

Table 7.6 : The ANOVA results to assess the overall effects of heat-setting and heat-curing temperatures on stitch lengths of heat-curing fabrics 146

Table 7.7 : wale density and course density of heat-set fabrics of fabric A 150

Table 7.8 : Mean thermal shrinkage percentages in course direction and wale direction due to curing treatment of fabric A 153

Table 7.9 : Percentage wale direction fabric shrinkage and percentage shrinkage of the yarn in the hank when curing is performed at 200°C (yarn A and fabric A) 156

Table 7.10 : The significance values resulted from analysis of variance perform for each heat-setting temperature for wale direction thermal shrinkage of fabric and yarns in hank (yarn A and fabric A) 157

Table 7.11 : Yarn and fabric specifications of fabric B 159

Table 7.12 : Thermal shrinkage of yarns and the yarns in the fabric B due to dyeing (Standard deviations are indicated in square brackets) 160

Table 7.13 : Mean length shrinkages of yarn in the hank due to heat-setting and heat-curing process and resultant yarn counts (yarn B) 161

Table 7.14 : Mean thermal shrinkages of yarns in the fabric B due to heat-setting and heat-curing processes (fabric B) 162

Table 7.15 : Results of ANOVA to determine the overall effects of heat-setting and heat-curing temperatures on heat-cured yarn in hank (yarn B) 166

Table 7.16 : The ANOVA findings to analyze the overall effects of heat-setting and heat-curing temperatures on stitch lengths of heat-cured fabric (yarn B and fabric B) 168

Table 7.17 : Wale and course densities of heat-set fabrics of fabric B 170

Table 7.18 : Mean thermal shrinkage percentages in course direction and wale direction due to curing treatment of fabric B 171

Table 7.19 : Percentage fabric shrinkage in wale direction and percentage shrinkage of the yarn in the hank when curing is performed at 200°C (yarn B and fabric B) 175

Table 7.20 : The analysis of variance performed for thermal shrinkage of the fabric in the wale direction and yarns in hank when heat-cured both at 200°C 176

Table 8.1 : Yarn and fabric specifications 180

Table 8.2 : WPI, CPI and stitch lengths of heat-set fabrics and heat-cured fabrics 181

Table 8.3: Bivariate correlation analysis between heat-set fabric structural parameters (WPI, CPI, stitch length and stitch length) and independent variables (over feed and initial stitch length) 183

Table 8.4 : Bivariate correlation analysis among heat-set and heat-cured WPI, CPI and stitch length, percentage of over feed and initial stitch length 184

Table 8.5 : Analysis of variance of thermal shrinkage of stitch length due to heat-curing 186

Table 8.6 : Mean and standard deviation of thermal shrinkages in the course direction and wale direction of heat-cured fabrics 186

Table 8.7: Bivariate correlation analysis among variables initial stitch length, percentage of over feed, course direction thermal shrinkage and wale direction thermal shrinkage of heat-cured fabric specimens 187

Table 8.8 : Regression coefficient of constant 191

Table 8.9 : Regression coefficients of stitch lengths 192

Table 8.10 : Regression coefficients of percentage of over feed 192

Table 8.11 : Multiple determination coefficient of regression equation of course direction thermal shrinkage 193

Table 8.12 : Analyses of variance results to determine the effect of initial stitch length and percentage of over feed on course direction thermal shrinkage 194

Table 8.13 : Regression coefficient of the constant 197

Table 8.14 : Regression coefficients of initial stitch lengths 197

Table 8.15 : Regression coefficients of percentages of over feed 198

Table 8.16 : Multiple determination coefficient of regression equation of the thermal shrinkage in the wale direction 198

Table 8.17 : Analyses of variance results to determine the effect of initial stitch length and percentage of over feed on the thermal shrinkage in wale direction 199

Table 8.18 : Bivariate correlation analysis between stitch density of heat-set fabric, thermal shrinkage in the course direction and the thermal shrinkage in the wale direction 203

Table 9.1: Yarn specifications and stitch lengths of polyester/spandex knitted fabrics 206

Table 9.2 : Knitting machine parameters 206

Table 9.3 : Pre-heat-setting and dispersed dyeing conditions 206

Table 9.4 : Final-heat-setting conditions 207

Table 9.5 : Mean and standard deviations of thermal shrinkage in the course and wale directions of heat-cured polyester/spandex fabrics 208

Table 9.6 : The ANOVA results to determine the overall impacts of heat-curing temperatures on thermal shrinkage in the course direction 210

Table 9.7 : The ANOVA results to determine the overall impacts of heat-curing temperatures on thermal shrinkage in the wale direction 212

Table 9.8 : Student–Newman–Keuls ranking at 5% significant level of thermal shrinkages in the course direction and wale direction of fabrics P/S1, P/S2 and P/S3of ANOVA model 213

Table A1.11.1: The mean thermal shrinkage in the wale direction at three pairs of data points (left, middle and right) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 140°C 242

Table A1.11.2 : The mean thermal shrinkage in the wale direction at three pairs of data points (left, middle and right) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 160°C 243

Table A1.11.3 : The mean thermal shrinkage in the wale direction at three pairs of data points (left, middle and right) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 180°C 244

Table A1.11.4 : The mean thermal shrinkage in the course directions at three pairs of data points (top, middle and bottom) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 140°C 245

Table A1.11.5: The mean thermal shrinkage in the course directions at three pairs of data points (top, middle and bottom) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 160°C 246

Table A1.11.6: The mean thermal shrinkage in the course directions at three pairs of data points (top, middle and bottom) for each sample size for cut panel layout 1 and 2 of fabric heat set at temperature 180°C 247

List of Abbreviations

Abbreviation	Description
ANOVA	ANalysis Of VAriance (ANOVA)
DSC	Differential Scanning Calorimetry
XDR	X-ray Diffraction
NMR	Nuclear Magnetic Resonance
FOY	Fully or High-speed spun Yarn
HMLS	High-Modulus and Low-Shrinkage
HOY	Highly-Oriented Yarn
LOY	Low-Oriented Yarn
MOY	Medium-Oriented Yarn
PBT	PolyButylene Terephthalate
PET	PolyEthylene Terephthalate
POY	Partially-Oriented Yarn
TTM	Taut Tie Molecules
WPI	Wales Per Inch
CPI	Courses Per Inch

List of Appendices

Appendix	Description	Page
Appendix A1	Mean thermal shrinkages of three pairs of data point of fabric specimens	241
Appendix A2	Results of Levene's test of yarn in hank and yarn in fabric A at 200°C	248