Physical Properties and Antibacterial Activity of White Cotton Clothing from Queen Sirikit Arts and Crafts Centre and Application for Female Involved in Religious Activities

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Abstract : The objectives of this research are to study physical properties of plain weave white cotton fabric, finishing and clothing design for females. The sample included 60 Thai females involved in religious activities in Bangkok and surrounding areas. The methods used were testing of yarn per inches and yarn number, finishing of antibacterial agent and moisture management textile. Three tops and three bottoms were designed for females. These designs were used in the survey in order to determine satisfaction levels. The statistics were reported in percentages. Results of the research found that the yarn number was 34.93 machine directions and 57.83 cross direction of Tex, 66 yarn machine direction and 27 cross direction per inch. The finishing test found that fungus and antibacterial finishes were 92.61 percentages effective. The testing of moisture management textiles found that the value after finishing was higher than before finishing (101:92 millimeter machine direction and 93:78 millimeter cross direction). The testing of tensile strength showed that before finishing was stronger than after finishing (719.30:659.30 and 426.83:346.40 newtons cross direction). The testing of tearing strength revealed that before finishing was stronger than after finishing (63.40:57.38 and 56.02:41.74 newtons cross direction). It was found that 70 percent of the round neck shirts was selected for tops, while 55 percent of mid length-side buckle closure skirts was selected for bottoms.

Keywords : Arts and Crafts Centre in Her Majesty Queen Sirikit Support, Physical properties, antibacterial, Religious Activity, Female

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1. Introduction

On 21July 1975, "The Foundation For the Promotion of Supplementary Occupations and Related Techniques under the Royal Patronage of Her Majestic the Queen" (SUPPORT) was established by Her Majesty the Queen. The organization aims to promote the products of farmers and low income people through community enterprise. In addition, the organization helps preserve Thailand's arts and crafts and improve the quality of the products to meet customers' satisfaction. Especially, members created fantastic pieces of arts and crafts. The "support" promoted the products differently based on abilities of the people in each area such as the Cotton Weaving Project which was developed in Pamoke District, Arngthong Province, Bangpahan District, Ayuthaya Province. The Krajud mat project was developed in Tumbol Salamai, Takbai District, Narativat Province. The Silk Weaving Project was developed in Tapaya District and Vatananakorn District, Sakaew Province. The PrawaSilk Project was developed in Tumbol Poon, Kummoung District, Kalasil Province, ect. (Elibrary, 2012).

On 2nd May 2011, during the visit to the Arts and Crafts International Center of Thailand (Public Organization) "SACICT",which is part of "The Foundation For the Promotion of Supplementary Occupations and Related Techniques under the Royal Patronage of Her Majesty the Queen",researchersfound that some of the handmade fabric and products made by Thai farmers from all over the country, which were promoted by "SUPPORT", were damaged from the flood in 2011. Researchers immediately followed the idea of The Queen. Previously, researchers had seen some women wearing white outfits to the temple, but styles and sizes were improper and difficult to clean because of the white color. If we have new innovative treatment, it will help for easy cleaning. The research methodology was to study white woven cotton bought from "SACICT" in term of physical properties, then finishing by using antibacterial and moisture management techniques. Finally, the goal was to design and develop women's wear for religious activities propose.

When this particular project succeeds, there will be more value added for hand woven cotton produced by farmers and community enterprises. More work and more careers will be created for members of "SUPPORT", using new innovative fabrics produced by industrial techniques which create better quality products. Lastly, more income will be returned to community enterprises.

Objectives

1.1.1 To study the physical properties of white woven cotton

1.1.2 To finish fabrics using antibacterial and moisture management techniques

1.2.3 To design and development women's wear for religious activity

2. Experiment

2.1 Materials

The sample population is 60 Thai women who usually visit a temple in Bangkok and perimeter.

2.2 Instruments

The fabric used was white hand woven cotton from "The Foundation for the Promotion of Supplementary Occupations and Related Techniques under the Royal Patronage of Her Majestic the Queen" (SUPPORT).The design equipment was Illustrator software. The sewing equipment were industrial sewing machine, pattern equipment, testing and chemical laboratory etc.

2.3 Antibacterial finishing process

2.3.1 Study of physical properties of white hand woven cotton

2.3.1.1 Thread number testing standard was ASTM D 1059-01

2.3.1.2 Thread per inch testing standard was ISO 7211/2-1984

2.3.2 Antibacterial and moisture management technique for textiles

2.3.2.1 Antimicrobial finishes by using anti –bacterial NICCANON RB 5% of (on weight Fabric) dry at 40 degree Celsius for 20 seconds.

2.3.3 Antimicrobial testing before and after finishing using AATCC 100-2004

2.4 Moisture management

Moisture management textiles used (Moisture management) hydro perm PPUM for 60 grams/liter andArkofix30grams/liter (more laundry time) and dried at 130 degree Celsius for 30 seconds ;pH 4.5-5.5.

2.4.1 Water resistant and wicking testing before and after finishing using JIS L 1907 2004 standard.

2.4.2 Tensile strength testing before and after finishing using ASTM D 5034

2.4.3 Tearing strength testing before and after finishing using ASTMD 142 Testing Laboratory is located at Institute of Textiles Industrial Development, Faculty of Science, RMUTT.

2.5 Evaluation of antibacterial activity, physical and moisture management properties.

2.5.1 Design and Development

Design and Development of white women's wear for religious activity

2.5.1.1Design 3 Tops and 3 bottoms using Illustrator software

2.5.1.2 Creating 1 set of Prototypes using Thai female standard size M (Medium size) bust 87cm.,waist 71 cm. and hip 94 cm. (Jataphatwarodom, S. 2010).Sewing laboratory is located at Textiles and Clothing Department, Faculty of Home Economics, RMUTT.

2.5.2 Satisfaction survey

White outfit satisfaction survey: There were 2parts Part 1 is a questionnaire of basic data about the sample. Part 2 is questionnaire about style and

Fabric satisfaction; Percentage used for analysis

3.RESULTS AND DISUSSION

3.1 The study of physical properties of white hand woven cotton

3.1.1 The result found that the warp direction was 34.93, weft direction was 57.83 (tex)

3.1.2 The result of the threads per inch showed that warp direction were66 threads/inch; weft direction were27 thread/ inch.

3.2 Antibacterial and moisture management textiles

3.2.1 The result of efficiency testing of antibacterial:

Staphylococcus aurous used the AATCC 100-2004 standard; results showed that fungus and antibacterial finishes were92.61 percentages, which is similar to fungus and antimicrobial finishes which used AATCC TM 100-2004 standard of sirikasemlears, C. (2012) which found that fungus and antimicrobial finishes were 95.00 percentages. Different from Reddy, N (Reddy, N., Han, S., Zhao, Y., and Yang, Y.,2013) who study of antibacterial activities by using Chitosan and Glutaricdialdehyde to treat cotton fabrics. Then the evaluated using the modified Quinn method. Both of Cotton fabrics treated with glutaricdialdehyde and chitosan show a good ability to inhibit bacteria reproduction. (Zhang, Z., Chen, L., Ji, J., Huang, Y., and Chen, D., 2003), which is similar to antimicrobial finishing of cotton fabrics with a citric acid and chitosan treatment of Silk (Chung, Y., Keun Lee, K., and Woo Kim, J. (1998), which found that the cotton fabric treated with citric acid alone shows antimicrobial properties. In addition, The 4-Hydroxybenzophenone treated cotton fabric showed the most powerful antibacterial activity. (Hang, K.H., and Sun, G., 2008) The Zinc oxide–soluble starch nanocomposites (nano-ZnO) impregnated cotton fabrics showed excellent antibacterial activity. Also, (Vigneshwaran, N., Kumar, S., Kathe, AA.,Varadarajan, P. V., and Prasad, V., 2006). Study of antimicrobial activity of aloevera, chitosan, and curcumin on cotton of L. Ammayappan, and J. Jeyakodi Moses. (2009) found that aloevera better antimicrobial activity than chitosan and curcumin when applied.

3.2.2 Moisture management Textiles treated on white fabric.

The results are shown in Table 1:

Table 1The results of moisture management textiles

Unit: Millimeter

Thread row	Unit: Millimeter		Differentials	
	Before Finishing	After Finishing	Different	Percentage
Warp direction	92	101	9	9.78
Weft direction	78	93	15	19.23

Table1 shows the results of wicking testing using JIS L1907:2004 (BYRECK METHOD) standard. The results show that the warp direction before finishing was 92:101 mm. and after finishing it was higher, 9.78 percentage. The weft direction before finishing was 78:93 mm. and after finishing it was higher, 19.23 percentage. In summary, fabric which was treated by wicking testing could absorb water better and fabric that was treated by moisture management textiles became

hydrophilic and caught water suspended, and the garment became cool to touch (Textile Testing Center, 2012).

Yoo, S., and Barker, L.R. (2004) study to Moisture management properties of heat-resistant work wear fabrics— effects of hydrophilic finishes and hygroscopic fiber blends found that the wicking treatment was increases the rate of absorption of fabrics but does not affect their absorption capacity and water vapor absorption. But he cotton fabric shows the highest percentage of remaining water after the evaporation test. Wang, S. X., and Others. (2007) study to effect of moisture management on functional performance of cold protective clothing for traditional clothing system and a specially designed moisture management clothing system for underwear, Vest, coat, and outer jacket. Both systems have the same four – layer structure but used of different functional fabrics, the moisture management diffusion and temperature distributions in the cold protective clothing systems, and influenced thermal and moisture sensations.

3.2.3The results of Tensile strength testing

Fabrics treated with antimicrobial finishes and moisture management textiles then tensile strength testing are shown in Table2 and Table3.

Table 2 The results of tensile strength testing on hand woven cotton

Unit: Newton

Thread row	Unit: Newton		Differentials	
	Before Finishing	After Finishing	Different	Percentage
Warp direction	719.3	659.3	60	8.34
Weft direction	426.83	346.40	80.43	18.84

Table2 shows the results of tensile strength testing: the warp direction had more strength before being treated,719.30:659.30 Newtons, 8.34 percentage, and the weft direction was 426.83:346.40, 18.84percentage.

3.2.4 The results of tearing strength

Table 3The results of tearing strength testing on hand woven cotton

Unit: Newton

Thread row	Unit: Newton		Differentials	
	Before Finishing	After Finishing	Different	Percentage
Warp direction	63.4	57.38	6.02	9.49
Weft direction	56.02	41.74	14.28	25.49

Table 3 shows the results of the tearing strength of hand woven cotton: the warp direction had more strength before being treated 63.40:57.38 Newtons, 9.49percentages,and the weft direction was 56.02:41.74, 25.49percentages.

3.3 Design and making white women's wear for religious activity

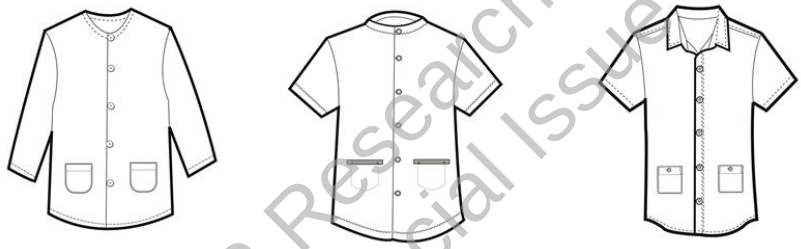
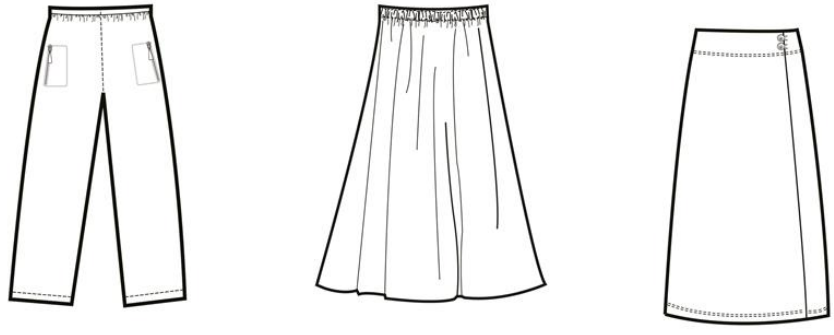


Figure1: 3 tops design; round neck, mandarin and shirt collar

3.3.1 Designed3 tops and 3 bottoms

The 3 tops were designed used Illustrator software: design#1 round neck (a)three quarter sleeves with two patch pockets, design # 2 mandarin collar (b) short sleeves with two buttonhole pockets, design #3 shirt collar(c) short sleeves with two patch pockets.



(d) (e) (f)

Figure2.3bottoms design, elastic waist pants (d) elastic waist skirt(e) and wrap skirt (f)

All 3 designs made by Illustrator software: design # 1(d) elastic waist pants with two pockets, design # 2 (e) elastic waist flare maxi skirt, design# 3 (f) wrap maxi A line skirt as Figure 2.

3.3.2The result of the satisfaction survey of white women's wear for religious activity found as the follows:

3.3.2.1 Basic data of questionnaire answered

1) Women's Age: 40-49 years old, 26.67 percentages; 50-59 and 60-69 years old were both23.33 percentages;70 years old ormore,21.33 percentages,30-39 years old,5 percentages.

2) The status of married women was 60 percentages; widow/divorcee/separated was 23.33 percentages; single was 16.67 percentages.

3) Education: otherwas43.34 percentages; below undergraduate was 38.33 percentages; undergraduate was18.33 percentages.

2.3.2.2 The result of styles and fabric types satisfaction about white women's wear for religious activity:

Table 4 The results of the survey Style of Tops and Bottoms

Tops	persons	percentages	Bottom	persons	percentages
a. Round neck	42	70	d. Elastic waist pants	10	16.67
b. Mandarin neck	17	28.33	e. Elastic waist skirt	17	28.33
c. Shirt collar	1	1.67	f. Wrap skirt	33	55
Total	60	100	Total	60	100

Table4 shows the results of the survey style of tops and bottoms found that:

1) Top: Round neck top (a) 70 percentages, mandarin collar (b) 28.33 percentages, and shirt collar (c) 1.67 percentages.

2) Bottom: wrap skirt (f) 55 percentages, elastic waist skirt (e) 28.33 percentages, and elastic waist pants (d) 16.67 percentages.

Table 5 The results of the survey of antibacterial finishing

Fabric types	persons	percentages
1. 100%Cotton without antibacterial finishing	1	1.67
2. 100% Cotton treated with antibacterial finishing / easy cleaning	58	96.66
3.Cotton /polyester	1	1.67
Total	60	100

Table5 shows the results of the survey of antibacterial finishing found that:

Fabric types: 100% cotton treated with antibacterial finishing and easy forcleaning, 96.66percentages, 100% cotton without antibacterial finishing treated, and cotton/ polyester1.67 percentages.

The results of the survey regarding satisfaction of styles and fabric type of white women's wear showed that round neck top (a) and wrap skirt (f) were most favorable. They both were comfortable to wear according to the survey. The fabric selected was 100%cotton treated with antibacterial finishing which was easy for cleaning. Sitting might cause them to become dirty. If there is a new innovative cleaning method, it would be more preferable. Although 100% cotton is cellulose fiber that is cool, there is a problem with fungi and bacteria on the fabric; therefore, there should be a new treatment method which can reduce this weakness.

4. Conclusion

4.1 The study of physical property of white hand woven cotton: the testing physical property of white cotton regarding thread number found that warp direction was 34.93, weft direction was 57.83 (tex) and the threads per inch were warp direction66threads/inch and weft direction 27threads/inch.

4.2 Antibacterial and moisture management textile finishing: testing of efficiency of antibacterial Staphylococcus Aurous found that fungus and antibacterial finishes were effective 92.61 percentages. Testing for wicking on fabric found that a warp direction after testing absorbed more than 9.78 percentages water and the weft direction after treatment absorbed more19.23 percentages.

4.3 The survey of satisfaction for designing and making white women's wear for religious activity showed that the most popular styles and fabric types were round neck top (a) 70 percentages, wrap skirt (f) 55 percentages, and 96.66 percentages for fabric that was suitable for 100% cotton white outfits treated with an antibacterial finishing.

5. Acknowledgements

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6. References

[1] Elibrary. 2012. The support Arts and Crafts International Centre Thailand (Public Organization), Available from http://www.sacict.net/th:15th December, 2012.

[2] Hang, K.H., and Sun, G. 2008. Antimicrobial and chemical detoxifying functions of cotton fabrics containing different benzophenone derivatives. Carbohydrate Polymers., 71(4): 598-605.

[3] Jatuphatwarodom, S. 2010.The Development of Thai Standard Size Models,Ph.D.'s Thesis,Bangkok: Kasetseat University.

[4] L. Ammayappan, and J. Jeyakodi Moses. 2009. Study of antimicrobial activity of aloevera, chitosan, and curcumin on cotton, wool, and rabbit hair. Journal of Fibers and Polymers., 11(2): 161-166.

[5] Reddy, N., Han, S., Zhao, Y., and Yang, Y. 2013. Antimicrobial activity of cotton fabrics treated with curcumin.Journal of Applied Polymer Science., 127(4): 2698-2702.
[6] Sirikasemrlet, C: Innovative Hand-woven Fabrics, Available from http://www.ttistextiledigest.com: 25thDecember, 2012.
[7] Sik Chung, Y., Keun Lee, K., and Woo Kim, J. 1998. Durable Press and Antimicrobial Finishing of Cotton Fabrics with a Citric Acid and Chitosan Treatment.Textile Research Journal., 68(10):772-775.
[8] Textile Testing Center. 2012. RUCO-PUR SEC, Bangkok: Thailand Textile Institute.
[9] Vigneshwaran, N., Kumar, S., Kathe, AA., Varadarajan, P V., and Prasad, V. 2006.Functional finishing of cotton fabrics using zinc oxide–soluble starch nanocomposites.http://www.iopscience.iop.org, Available from15thJuly, 2013.
[10] Wang, S. X., and Others. 2007. Effect of Moisture Management on Functional Performance of Cold Protective Clothing. Textiles Research Journal., 77(12):968-980.
[11] Yoo, S., and Barker, L.R. 2004. Moisture Management Properties of Heat-Resistant Workwear Fabrics— Effects of Hydrophilic Finishes and Hygroscopic Fiber Blends. Textile Research Journal., 74(11):995-1000.
[12] Zhang, Z., Chen, L., Ji, J., Huang, Y., and Chen, D. 2003. Antibacterial Properties of Cotton Fabrics Treated with Chitosan. Textile Research Journal., (73): 1103-1106.