An Investigation into the Fabric Properties Affecting Swimwear Drying Performance

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Introduction: Swimwear is one of the biggest activewear markets with an annual increase of sales due to a warmer climate and various fashion trends derived from the category as consumers tend to wear swimwear in other occasions because of its versatility (Lloyd, 2007). The growth in technology has also contributed to versatile apparel development for sporting activities to satisfy consumer needs and achieve the performance quality (Holme, 2007). In the swimwear industry, water repellent and moisture wicking technology can be found in swim shorts marketed towards men appearing as everyday use bottoms (Uttam, 2013). For instance, Nike Inc. (2018) advertised that this type of shorts has a nature of quick drying despite wetting. Even though there are many apparel industry companies that advertise the high drying speed of swimwear garments with either high water repellency or moisture wicking, there is a lack of study examining the drying performance of these fabric properties in the actual swimwear garment. The purpose of this study was to investigate water repellency and moisture wicking property to determine a suitable fabric property which provides higher drying efficiency for versatile swimwear development.

Method: 1) *Fabric Testing.* To determine drying efficiency, a fabric test was conducted using two fabrics: 1) Fabric A which is Tricot made of 80% polyester and 20% spandex intended to avoid water absorbency and 2) Fabric B which is DryFlex Lite Spandex made of 92% polyester and 8% spandex intended to absorb water easily and dry out water quickly. Five 2"x2" specimens per fabric were cut and weighed before and after saturation. After saturation, specimens were hung outside to dry with weight taken every 10 minutes until complete drying. The mean scores of the five specimen weights were compared between the two fabrics. The test results showed that Fabric B specimens weighed heavier than Fabric A specimens. The test results indicated that Fabric A's drying efficiency is higher than Fabric B due to less water absorption. Figure 1 shows the drying behavior tendency for Fabric A and B.

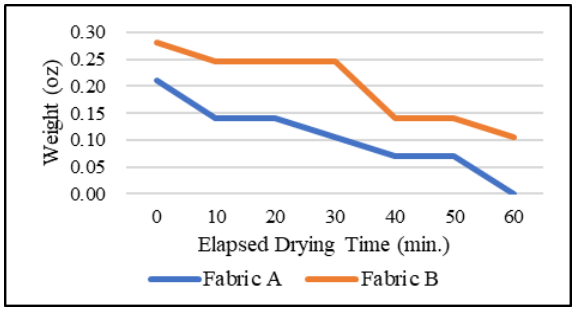

Figure 1. Drying behavior tendency for Fabric A and B

2) Prototype Development. This study focused on women's swimwear as the technologies in women's swimwear have not been actively explored. To evaluate the drying efficiency of an actual garment, two prototypes consisting of a dress with coverage from upper torso to mid-thigh featuring shoulder straps and shorts were developed. First prototype was made of Fabric A, referred to as WRFD and the second prototype was made of Fabric B, referred to as WFD. To examine drying speed of the actual size fabrics and to evaluate wearer acceptability of the garments, a wear test was conducted for three hours on three female participants

between the ages of 22 to 29 years old. Each prototype saturated with ocean water was worn for one hour including five times of a two-minute break to weigh the prototypes every 10 minutes to record the prototype weight loss. The process was repeated for the second prototype. The mean scores of the garment weights were compared between the two prototypes. After testing, the participants completed a prototype evaluation questionnaire regarding comfort, drying speed, and willingness to purchase for each prototype.

Results: 1) *Drying Efficiency.* The wear test results indicated that water repellency is a critical fabric property in drying efficiency. In the wear test, WRFD lost a significant amount of water after the first 10 minutes compared to WFD. As water repellency prevents water absorption into fabric, it contributes to the lighter weight of the garment when wet. The data below shows the drying behavior of prototype WRFD aiming for high water repellency and prototype WFD aiming for high moisture wicking property (Table 1). The results of the wear test reflect the drying efficiency test results found in the Fabric Testing section described above. However, it is indicated that the swim dress may not completely dry within a short period time as the considerable amount of water remains in the whole garment. To enhance drying performance, further study is needed to explore more design element options such as bi-layering, adding finish onto the surface, designing panel applications, etc.

Table 1. Weight loss tendency in swim dress and shorts (oz)

	Dress (WRFD)	Dress (WFD)	Shorts (WRFD)	Shorts (WFD)
Time (min)	M ± SD	M ± SD	M ± SD	M ± SD
0	18.3 ± 0.3	18.3 ± 0.3	5.6 ± 0.1	5.6 ± 0.1
10	12.9 ± 1.3	17.6 ± 0.44	5.1 ± 0.2	5.4 ± 0.1
20	11.6 ± 1.7	16.5 ± 0.72	4.9 ± 0.1	5.1 ± 0.2
30	10.3 ± 2.0	15.5 ± 1.19	4.5 ± 0.3	4.9 ± 0.2
40	9.5 ± 2.2	14.5 ± 1.02	4.1 ± 0.4	4.6 ± 0.4
50	8.3 ± 2.1	13.3 ± 1.08	3.8 ± 0.4	4.4 ± 0.4

2) Wearer Acceptability. The drying efficiency test results showed that WFD weighed heavier than WRFD. However, participants indicated that WFD was more aesthetically pleasing while drying as the fabric absorbs water evenly. Although WRFD did not show an ideal drying appearance, two out of three participants answered that they are more willing to purchase the swim dress made of Fabric A due to the light weight. As a dress requires a large amount of fabrics, the garment weight when wet can be a critical factor in wearer acceptability. This study results indicate that water repellency needs to be considered more in swimwear design. However, there is a room for improvement on the textile structure/surface finish for better drying appearances while providing enough breathability and comfort. Figure 2 shows the fabric surface appearances while drying. To get more consumer responses in depth, a comprehensive test will be conducted.

a. Fabric A used in WRFD b. Fabric B used in WFD

Figure 2. Fabric surface appearances while drying

Conclusion: It was found that water repellency is an important fabric property to consider in developing a versatile swimwear. This study results may guide designers to select suitable materials and technologies in developing a swim dress to be worn in water and continually worn into leisurely day and night time activities after swimming to save time and resources.

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