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Effect of Fragrance Finish on Mechanical and Comfort Properties of Digitally Printed Fabric

Koku Bitim İşleminin Dijital Baskılı Kumaşların Mekaniksel ve Konfor Özelliklerine Etkisi

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EFFECT OF FRAGRANCE FINISH ON MECHANICAL AND COMFORT PROPERTIES OF DIGITALLY PRINTED FABRIC

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ABSTRACT: With the growing demands of fragrance finished fabrics especially in ladies wear, we have printed 100% cotton fabrics for both corresponding and non-corresponding prints. Digital printing technique has been used for these studies. We have already reported the positive and cost effective impact of corresponding printing along with the fragrance finishing on customer's perception [1]. Along with the aesthetic properties of a fabric, some other properties of fabrics should be accounted for wearing purposes. So in this study, the effects of fragrance finishing on mechanical and comfort properties of fabric have been evaluated. Along with the mechanical properties, the effects of fragrance finish for moisture management, water and air permeability through the fabric has been investigated and reported.

Keywords: Fragrance, Finish, Mechanical, Comfort, Moisture Management, Fabric Properties

KOKU BİTİM İŞLEMİNİN DİJİTAL BASKILI KUMAŞLARIN MEKANİKSEL VE KONFOR ÖZELLİKLERİNE ETKİSİ

ÖZET: Özellikle bayan giyiminde koku bitim işlemi görmüş kumaşlara olan talep artmasının bir sonucu olarak, bu çalışmada da %100 pamuklu kumaşlara eşlenik veya eşlenik olmayan baskılar, dijital baskı tekniği kullanılarak uygulanmıştır. Önceki çalışmamızda koku bitim işleminin kullanıcının algısına etkisinin yanısıra eşlenik (karşılıklı) baskı işleminin pozitif ve daha az maliyetli etkisini belirtmiştik [1]. Kumaşın estetik özelliklerinin yanı sıra, giyim amaçlı diğer bazı özellikleri de hesaba katılmalıdır. Bu sebeple bu çalışmada, koku bitim işleminin kumaşın mekaniksel ve konfor özelliklerine etkisi incelenmiştir. Mekanik özelliklerinin yanı sıra koku bitim işleminin kumaştaki nem yönetimine, su ve hava geçirgenliğine etkisi araştırılmış ve sonuçları sunulmuştur

Anahtar Kelimeler: Koku, Bitim işlemi, Mekanik, Konfor, Nem yönetimi, Kumaş özellikleri

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1. INTRODUCTION

In textile technology, along with the technological evolution of fabrication, the growing awareness and demands about fabric finishing is increasing. Much kind of fabric finishes are being used like anti-microbial, anti-bacterial, anti-fungal and fragrance finishes. These functional finishes improve the value addition in the ultimate products [2]. Finishes can be applied on fabric through different techniques involving conventional methods and technological advanced methods like microencapsulation by which release of finish can be controlled through various triggers like temperature, humidity or rubbing [3]. The cost of such finishes make product's price high. We have already developed a novel technique for reducing the cost of finish by playing with the design elements. We applied fragrance finish on corresponding printed fabric as 5% of the weight of fabric compared with the finish applied on non-corresponding printed fabric as 10% of the weight of fabric; the assessment of consumer's perception was equivalent in both cases [1].

2. PROBLEM STATEMENT & OBJECTIVES OF STUDY

When fragrance finish is applied on fabrics, although it enhances the aesthetic properties of fabric but it can also deteriorate some performance properties of fabrics. [4] So In this study we will investigate the effects of specific fragrance finishes on the performance properties of fabrics by focusing mechanical and comfort properties of digitally printed fabric as these properties are very essential for fabrics to be wearable. In terms of mechanical properties of fabrics: tensile strength, tear strength, stiffness and bending length will be evaluated. Along with the mechanical properties, the effect of fragrance finish for moisture management (moisture transportation out of the fabric) and air permeability of the printed fabric are investigated because these properties are very important for a fabric to be wearable. The tests are performed before and after finishing and the percentage loss or gain is critically analysed.

3. MATERIALS & METHODS

The substrate fabric was digitally printed and fragrance finish (Rose) was applied on fabric having concentrations 2%, 3% and 5% as previously reported [1]. The mechanical and comfort properties of standard fabric (Unfinished) and finished fabrics at different concentrations were analysed. The specifications of substrate fabric used are given in Table 1.

Table 1. Fabric Specification

Properties	Values	Standard
Fabric construction	Plain weave 1/1	ASTM-20
Blend ratio	100% cotton	----------
GSM (g/mm)	77.7 g	ASTM 3776
Ends per inch	80	ASTM 3775
Picks per inch	64	ASTM 3775
Warp count (Ne)	30	ASTM 1095
Weft count (Ne)	30	ASTM 1095

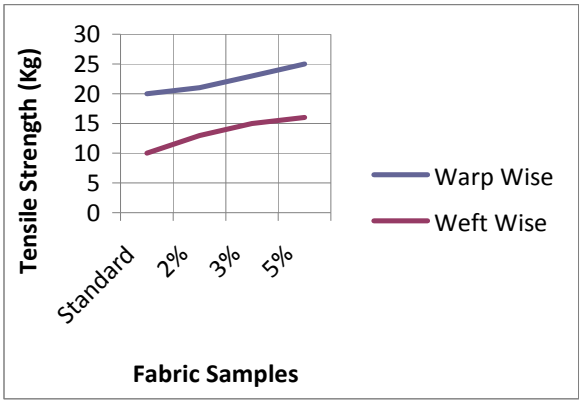
4. RESULTS & DISCUSSION

Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method) ASTM D 5035 – 11 was used and for stiffness determination, Standard Test Method for Stiffness of Fabrics ASTM D1388 - 08(2012) was used. The results in graph 1 & 2 show the tensile strength and stiffness of standard and finished samples at concentrations 2%, 3% and 5%. The trend in both graphs shows that tensile strength and stiffness of samples are increasing as the concentration of finishing is increasing. Tensile strength is increased 25% & 60% in warp and weft directions respectively from standard to maximum (5%) finished fabric. In terms of stiffness there is 67% & 47% increase in warp and weft wise respectively. This increase can be attributed to the density of fabric due to the mechanical deposition of finishing agents in the interstices of fabric. As the increase of stiffness too much is also not favorable for wearing purposes so it can be avoided by using suitable softeners.

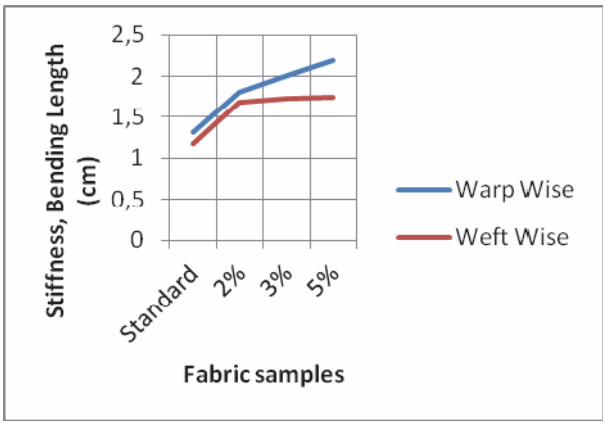
Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum (Elmendorf-Type) Apparatus ASTM D1424 - 09(2013) was used. Standard Test Method for Air Permeability of Textile Fabrics- ASTM D737 - 04(2012) was used for determining the air permeability of samples.

In graphs 3 and 4, the trend shows decrease in tear strength and air permeability of finished fabrics. There is 13% and 60% decrease in tear strength warp and weft wise respectively. The more loss in tear strength along weft direction can be due to the less picks/inch as compared to ends/inch. Less picks/inch provides more interstitial spaces in weft direction and more penetration of finish. So in tear strength measurement once tear is produced and allowed to propagate under force then it is easier to torn the fabric from the place where there is insufficient yarns interlacement due to the sufficient presence of finish. Air permeability value has also been decreased by 8.5% due to the blocking of interstitial pores as expected.

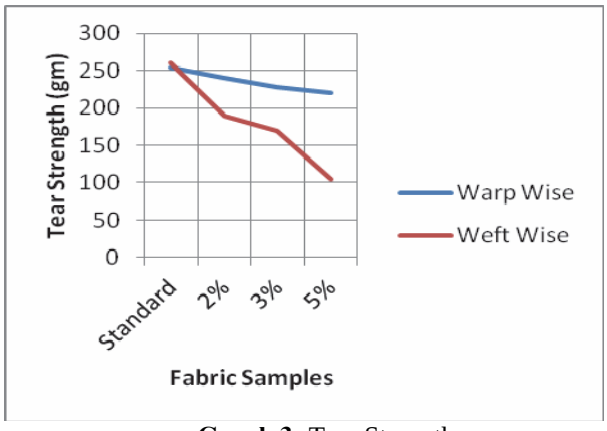
Tables 2, 3, 4 & 5 are showing the results of standard and finished fabrics regarding moisture management properties. Overall moisture management value (OMMC) is decreasing for increasing finish concentration as illustrated by graph 5. The largest decrease in OMMC value is almost 14.83% between standard fabric and highly finished fabric (5%). As we can see from the tables 2, 3, 4 & 5, OMMC is an overall result and its value is being affected by a multiple factors like top & bottom side wetting time, top and bottom side absorption rate, maximum top & bottom wetted radius, top & bottom spreading speed and accumulatively one way transport index %. So it shows that the nature of finish applied on the surface of fabric will affect overall moisture management properties of a fabric. Hydrophilic natured finishes can serve this purpose well [5].



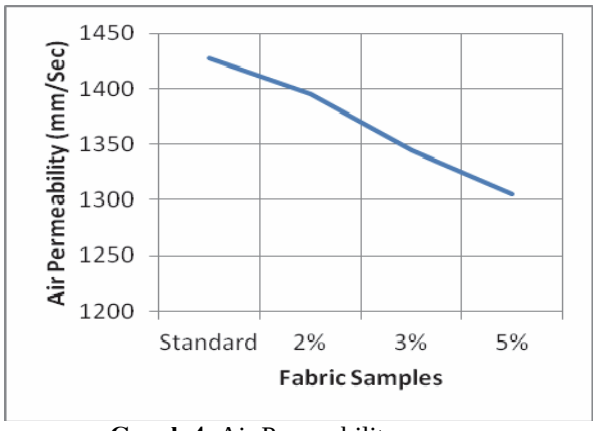
Graph 1: Tensile Strength



Graph 2: Stiffness



Graph 3: Tear Strength



Graph 4: Air Permeability

Table 2. Moisture Management Values for Standard Fabric

	Wetting Time Top (sec)	Wetting Time Bottom (sec)	Top Absorption Rate (%/sec)	Bottom Absorption Rate (%/sec)	Top Max Wetted Radius (mm)	Bottom Max Wetted Radius (mm)	Top Spreading Speed (mm/sec)	Bottom Spreading Speed (mm/sec)	Accumulative one-way transport Index (%)	OMMC
Mean	2.2997	2.273	28.5747	48.2724	30	30	6.6719	6.5833	262.9843	0.7041
S-Deviation	0.4415	0.4875	3.8191	2.713	0	0	0.4401	0.3558	19.7929	0.0235
CV	0.192	0.2145	0.1337	0.0562	0	0	0.066	0.054	0.0753	0.0334

Table 3. Moisture Management Values for 2% Rose Finished Fabric

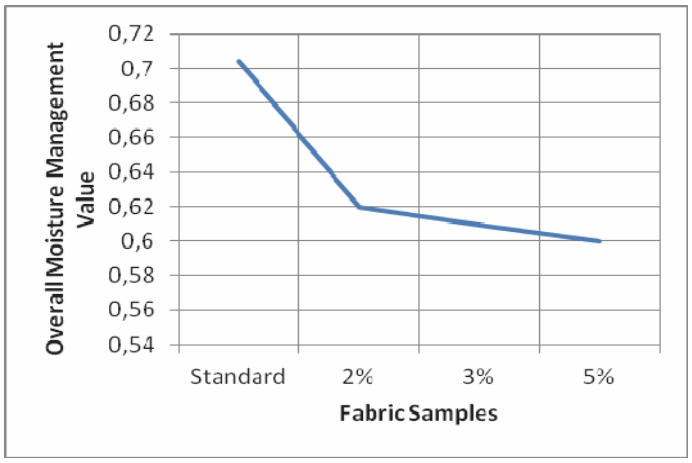
	Wetting Time Top(sec)	Wetting Time Bottom(sec)	Top Absorption Rate(%/sec)	Bottom Absorption Rate(%/sec)	Top Max Wetted Radius (mm)	Bottom Max Wetted Radius (mm)	Top Spreading Speed (mm/sec)	Bottom Spreading Speed (mm/sec)	Accumulative one-way transport Index (%)	OMMC
Mean	2.3263	2.353	30.2626	46.0754	30	30	7.2731	7.2523	192.6311	0.6198
S-Deviation	0.0924	0.08	1.3344	4.1158	0	0	0.139	0.1909	42.4719	0.0581
CV	0.0397	0.034	0.0441	0.0893	0	0	0.0191	0.0263	0.2205	0.0937

Table 4. Moisture Management Values for 3% Rose Finished Fabric

	Wetting Time Top(sec)	Wetting Time Bottom(sec)	Top Absorption Rate(%/sec)	Bottom Absorption Rate(%/sec)	Top Max Wetted Radius (mm)	Bottom Max Wetted Radius (mm)	Top Spreading Speed (mm/sec)	Bottom Spreading Speed (mm/sec)	Accumulative one-way transport Index (%)	OMMC
Mean	2.5935	2.8345	25.6368	41.0485	30	30	6.8585	6.7846	177.8212	0.6094
S-Deviation	0.227	0.4533	3.0163	3.5012	0	0	0.8416	0.8895	7.1442	0.0177
CV	0.0875	0.1599	0.1177	0.0853	0	0	0.1227	0.1311	0.0402	0.03

Table 5. Moisture Management Values for 5% Rose Finished Fabric

	Wetting Time Top(sec)	Wetting Time Bottom(sec)	Top Absorption Rate(%/sec)	Bottom Absorption Rate(%/sec)	Top Max Wetted Radius (mm)	Bottom Max Wetted Radius (mm)	Top Spreading Speed (mm/sec)	Bottom Spreading Speed (mm/sec)	Accumulative one-way transport Index (%)	OMMC
Mean	2.2997	2.273	30.2245	46.1634	30	30	7.5818	7.549	174.2986	0.5997
S-Deviation	0.0924	0.1386	0.1221	5.9713	0	0	0.4056	0.4781	37.3453	0.0581
CV	0.0402	0.061	0.004	0.1294	0	0	0.0535	0.0633	0.2143	0.0969



Graph 5. Overall Moisture Management Values for Standard and Finished Fabrics

The comparison of standard fabric with 2% finished fabric has been done. In case of 2% finished fabric, the losses in values of tear strength, air permeability and moisture management values are shown in Table 6.

Table 6. Comparison of Standard and 2% Finished Fabric

Sample	Warp Wise Tear Strength	Weft Wise Tear Strength	Air Permeability	OMMC
Standard	254	260	1427	0.7041
2% Rose Finished	240	190	1395	0.6198
%age Loss	**5.5%**	**26.9%**	**2.24%**	**11.97%**

5. CONCLUSION

In this study we have investigated the effect of rose finish on the performance and comfort properties of fabrics for lady wear. We have already reported a novel method for decreasing the finish cost by keeping in view the concept of corresponding printing. So in this study we have analysed the effect of finishing for tensile strength, tear strength, stiffness, air permeability and moisture management properties of finished fabrics. From results, we have seen the decrease in tear strength, air permeability and overall moisture management values. The loss in tear strength can be minimized by using fabric having high picks/inch. So from results, we have concluded that the fabric printed with corresponding prints and then finished by fragrance with 2% concentration is best choice for lady wear as seen from table 6. The corresponding printing will serve the purpose even with low concentration of fragrance. This idea of decreasing the concentration will be beneficial for decreasing the finish cost as well as the less loss of tear strength, air permeability and overall moisture management values.

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