(REFEREED RESEARCH)

DURABILITY OF FABRIC SOFTENERS' ODORS USED IN HOME TYPE OF WASHINGS AT COTTON PRODUCTS DURING WEARING

EV TİPİ YIKAMALARDA KULLANILAN KUMAŞ YUMUŞATICILARININ PAMUKLU ÜRÜNLERDE GİYİM SIRASINDA KALICILIĞI

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ABSTRACT

In summer, especially in the Mediterranean Region, basic T-shirts produced of cotton fibers in daily wear are frequently used. Consumers wash these products by detergents to perform cleaning, maintenance and soften them by softeners to fulfill the expectations of softening, freshness and nice odor. In this study, the odor durabilities of softeners over t-shirts with the blends of 5 % elasthane and 95 % cotton,a popular blend for spring- summer wear, was searched. Softeners were chosen as one of them included microcapsules and the other one did not. After various keeping durations treated with home type of washing by an odorless detergent and the softener, 18 panelists wore them during a work day and evaluated the scents by a determined scale. As a result, during a busy work day, softener that contained microcapsules had more durable scents and was found superior by the panelists.

Keywords: Body Odor, Natural Fiber, Fabric Softener, Microcapsules, Fragranced Textiles

ÖZET

Yaz aylarında, özellikle Akdeniz Bölgesi'nde, pamuklu tişörtler günlük yaşamda sıkça kullanılmaktadır. Tüketiciler temizlik amaçlı bu ürünleri deterjanla yıkamakta, yumuşatma, tazelik ve hoş koku beklentilerini karşılamak için yumuşatıcı kullanmaktadırlar. Bu çalışmada, ilkbahar-yaz aylarında popüler bir karışım olan yumuşatıcıların % 5 elastan/ %95 pamuk karışımı tişörtler üzerindeki koku kalıcılıkları araştırılmıştır. Yumuşatıcılar, mikrokapsül içeren ve içermeyen olarak seçilmiştir. Parfümsüz ev tipi deterjan ve yumuşatıcı ile yıkanan numuneler, 18 panelist tarafından gün boyunca giyilmiş ve belirli süreler sonunda skalaya göre koku dereceleri değerlendirilmiştir. Panelistler tarafından yapılan değerlendirme sonucunda, yoğun bir iş günü süresince mikrokapsül içeren yumuşatıcının koku dayanımının daha iyi olduğu bulunmuştur.

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1. INTRODUCTION

Smell is a very important and vital sense. This sense is linked to the parts of the brain that are responsible to evoke emotions and memories. The capacities for both smell and emotion are rooted in the same network of brain structures, the limbic system. Of the five senses, only our sense of smell is linked directly to the limbic lobe of the brain, our emotional control center. Fear, anxiety, depression, anger, and joy all emanate from this region of the brain [1].

Upon inhalation of a fragrance, the odor molecules travel up the nose where they are captured by the olfactory membrane. Each odor molecule fits into specific receptor cell lining the olfactory epithelium. There are hundreds of millions of nerve cells and they are each replaced every 28 days. Odor molecules stimulate the lining of nerve cells which trigger electrical impulses to the olfactory bulb, which then transmits impulses to the gustatory center (where the sensation of taste is perceived), the amygdala (where emotional memories are stored), and other parts of the limbic system of the brain. Essential oils and some fragrances made of these oils have some very strong physiological and psychological effects because the limbic system is directly connected to those parts of the brain that

control heart rate, blood pressure, breathing, stress levels, hormone balance, and memory [2].

By the function of smell, humans and animals are alerted to dangers. Smell also enables us find food, water and mate. Although humans' odor detection ability is lower than animals, a person can feel approximately 10,000 different odor molecules. Smell is directly related with the sense of taste; most of the taste of the foods cannot be detected if capacity of smell is lost. Today taste enjoyment and using perfumes for various reasons occupy our smell sense unlike its duty of saving from dangers which was more important for humans in the past. Perfumery industry has been growing more and more as interest on fragrance increases. Fragrance is taking place not only in perfumes but also in many products to attract the attention of consumers and make them wish to buy those products. Fragrance may be used as an additive in food, drinks, detergents, soaps, household cleaners, fabric softeners, cigarettes etc. Smelling good can also be a sign of cleaning with fresh fragrances. The pleasantness of the smell of flowers and spices as well as many other natural products has attracted humans over the ages. Our ancestors in ancient Egypt and Greece developed the first methods to extract odorants from different natural sources. These odorants acted as highly valuable materials for the creation of the first fine fragrances. Besides volatile organic molecules isolated from plants and other natural sources, modern synthetic organic chemistry has considerably enlarged the number of compounds that are now available to the perfumer [3].

Grooming behaviors, including the application of fragranced products, are thought to reflect a means of managing social impressions and self-image. Application of deodorants makes individuals appear more confident to others because they mask body odors mainly depending on sweating [4]. Sweating is human body's mechanism to cool down. The average person has about 2.6 million sweat glands [5]. It has long been accepted that axillary sweat is initially odorless and sterile but becomes odorous through degradation by certain gram-positive bacteria present on the surface of the skin. This is due, predominantly, to bacterial metabolism of the milky, protein-rich fluid secreted by the apocrine glands located in this area, with the eccrine glands providing the humid conditions which encourage bacterial growth. Strong axillary odor has been found to be related to increased numbers of aerobic bacteria, particularly corynebacteria [6].

Deodorants deal with the smell by neutralizing it and by killing the bacteria that metabolize the proteins and fatty acids. Antiperspirants work by clogging, closing, or blocking the pores with aluminum salts in order to prevent the release of sweat, effectively changing the function of the body. Antiperspirants are considered to be drugs because they affect the physiology of the body [5]. Many antiperspirants also have a deodorant component. It might be for this reason that 'deodorant' and 'antiperspirant' are used interchangeably. Antiperspirants and deodorants contain many ingredients but they are considered to be safe by the FDA, the American Cancer Society, the National Cancer Institute and the Mayo Clinic. However, FDA regulation does not mean that a drug is without danger [5].

Deodorants and antiperspirants are a hot topic in manner of health. There are some suspects about toxic chemicals in deodorants and antiperspirants that they may cause cancer, Alzheimer's and allergic reactions. Most conventional deodorants contain a slew of toxic chemicals, such as aluminum chlorohydrate, parabens, propylene glycol, triclosan, triethanolamine (TEA), diethanolamine (DEA), FD&C colors, and talc, among others.

Aluminum-based compounds are the active ingredients in antiperspirants. They block the sweat glands to keep sweat from getting to the skin's surface. Some research has suggested that these aluminum compounds may be absorbed by the skin and cause changes in breast cells. some scientists have suggested that using the aluminum-based compounds in antiperspirants may be a risk factor. Parabens in their many forms (methylparaben, propylparaben, ethylparaben, or butylparaben) are a class of artificial preservatives widely used in cosmetics and personal care products that are being investigated for their possible role in breast cancer. Propylene glycol—a humectant which means it keeps substances from drying out, and it was originally developed as an anti-freeze, but is now included in some deodorants and antiperspirants. It is a neurotoxin known to cause contact dermatitis, kidney damage, and liver damage. TEA and DEA adjust the pH, and used with many fatty acids to convert acid to salt (stearate), which then becomes the base for a cleanser. They both could be toxic if absorbed into the body over a long period of time where DEA can cause liver and kidney damage and TEA can cause allergic reactions.

Triclosan is an artificial antimicrobial chemical used to kill bacteria on the skin and other surfaces. Triclosan is a skin irritant and may cause contact dermatitis. FD&C colors are artificial/synthetic colors approved by the FDA for food, drug and cosmetics. Some are made from coal tar derivatives and have known to be carcinogenic; they also often cause allergic skin reactions. Talc, hydrous magnesium silicate, is a soft mineral used in personal care products as an absorbent and color additive. It is classified as a carcinogen by the International Agency for Research on Cancer if it contains asbestiform fibers. Regardless, whether there is a definitive answer for a direct correlation between deodorant and antiperspirant use and some health problems or not, inconclusive results is enough reason for concern, as even the idea of using a suspicious product is frightening [4]. Then what will people do in their daily lives against natural body odors? Attempts to mask, reduce or eliminate natural body odors is common in Western cultures, as strong odors associated with a person's physiology are often perceived as unacceptable. Clothing textiles are in close contact with the microorganisms of the skin and those of the environment. The clothes create a warm and often moist environment on the skin, which leads to the growth of bacteria. In some cases, these microorganisms lead to unpleasant odors, staining, fabric deterioration, and even physical irritation, such as skin allergies and skin infections. Apparel fabrics can differ in the extent to which they retain and emit odor during wear and even after removal from the human body [6]. An important factor determining bacterium-fiber interaction is the origin and the composition of the

clothing textile [7]. For example, natural fibers such as wool and cotton, in preference to synthetics, have been recommended to people who are concerned about strong body odor. Even in the 19th century, before the advent of synthetic fibers, some physicians acknowledged the superior low-odor properties of wool, recommending it over linen and cotton clothes that 'smell much more strongly'. Several manufacturers and suppliers of merino wool garments market these products as effective in limiting or avoiding odor build-up, even after months of continual wear. Recent works confirmed that differences in fiber type do influence the odor intensity following wear, with fabrics in wool perceived as low in odor intensity by a panel of assessors and those in polyester as high. Cotton was perceived to have low-mid odor intensity. Therefore, a trend evident from the end of the 20th century towards odor-resistant fabrics has involved imparting antimicrobial treatments to the textile fibers and fabrics [6]. Besides the aim of getting rid of the unpleasant odors of the worn clothes, avoiding the risks of the direct contacts of deodorants and/or antiperspirants to the skin of the underarm also make the usage of fragrant finishing of fabrics a current issue. Axillary malodor does not only emanate from the axillary skin but also from the textiles near the axillary region [7]. Antibacterial finishing of textiles may have risks depending upon the finishing agent used over the skin so the way of controlling the odor that does not have the risk of altering a person's natural microflora may be more desirable.

Obtaining durable fragrances onto the textile surfaces attracted the attention of scientists but the disadvantages of perfume compounds used in textile industry include little solubility, high volatilization, oxidation, instability under light or heat, and easy loading that distorts the scent, and these limit their use[1]. So, researchers are eager to find a practical way to protect fragrances and to improve their stability and processability. It is known that controlling the volatilization rate and degradation is the key to prolonging the sensory characteristics and improving the stability of fragrance materials. Effective encapsulation is one way to deal with this. Microcapsules perform a variety of functions, including the controlled release of functional substances and the protection of unstable materials within a particular environment. Consequently, microencapsulation has become a mainstream technology of fragrance encapsulation to protect fragrant materials, improve their heat resistance ability, extend their aroma-reserving time, and increase their applicability for various products [8].

In the field of textiles, this cost-effective method is used for applying different functional agents to fabrics to achieve higher durability of functionality; for example, finding a way to prolong the durability of aromas on textiles has been a long-time goal of textile chemists. Numerous attempts have been made to add fragrances directly to fibers and fabrics; however, all fragrances are volatile, and so their durability is poor. Furthermore, the intended aroma is thoroughly removed after one or two wash cycles. Utilizing microencapsulated fragrances changes the situation– the aroma remains on fabrics for a longer period of time, a consequence of the fragrance being safely stored inside the capsule. During wash cycles and wear, outer forces, e.g. rubbing, pressing, etc., cause a slow, gradual release of the fragrance by rupturing some of the capsule coatings. The microencapsulation of essential oils has led to many novel applications, including children's garments, hosiery, sheets, towels, cushions, fragrant ties and shoe insoles, as a consequence not only of the pleasant smell of the essential oils released but also of the wide variety of therapeutic benefits. Some of them help with insomnia, some provide relief from respiratory problems, some stimulate mental activity, etc. [9]. Encapsulated fragrant oils are also used in laundry detergents and especially in fabric softeners to enhance the consumer's enjoyment. The softener was encapsulated in a polymer coating to extend the release rate and increase the persistence of the fragrance during wearing [10].

In this article, fabrics were treated by a softener with scent microcapsules and a softener without microcapsule in order to find out the durabilities of pleasant odors in tops which were in the form of basic t-shirts for summer. By this way it was searched if the fragrances of the softeners could be smelled during a work day with the same intensity and could this kind of strong smells be alternatives for the people who didn't prefer to use antiperspirants and deodorants because of the direct contacts of them with the skin. Also some tests about how the current deodorants left residues were made. For this aim some market deodorants were tested against black cotton fabrics.

2. MATERIAL AND METHOD

2.1. Materials

In the wash and wear tests for softeners, basic white t-shirts were used. T-shirts were made of knitted fabrics in the composition of 95 % cotton, 5 % elastane fibers. Cotton fiber was chosen as the main fiber because of its popularity for the usage especially in summer time. Cotton was also perceived to have low-mid body odor intensity [6].Yarn count of cotton fabrics of the white t-shirts is Ne31, weight of the fabric is 171,4 g/m2. Fabrics were bleached and optically brightened. T-Shirts were provided as ready made from a local textile company. Fabric softeners were supplied from the market with and without microcapsule type of the same brand and both them had lavender odor. The presence of microcapsules was confirmed by a SEM graph given in Figure 1.

2.2. Method

For the deodorant residue test, 4 aerosol deodorants were provided from the market. 2 of them were for women, 2 of them were for men. Deodorant residue test fabric was a cotton black woven fabric dyed with a reactive dyestuff and bought from a local store. Black fabric was chosen for the contrast in order to see the residues easily.Yarn count of the black fabric is Ne29. Weft yarn per unit length is 30 yarns/cm, warp yarns per unit length is 34 yarns/cm. Weight of the fabric is 140 gr/m^2. Test fabric was prepared as small samples with the dimensions of 12 cm x12 cm for the deodorant residue test.

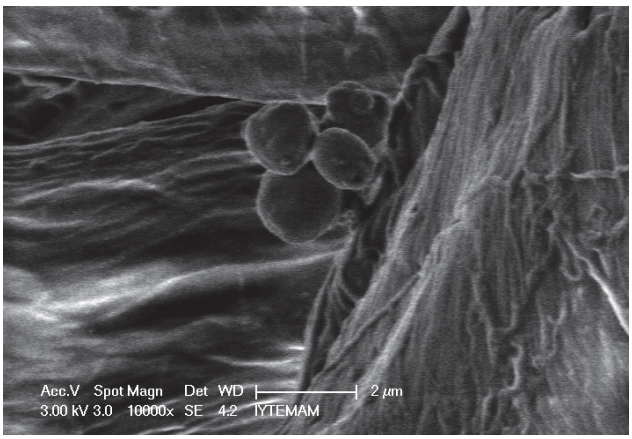

Fig 1. SEM graph of the softener sold as microcapsulated softener

2.3. Washing Procedure

The steps of the washing test are given below:

1- The Washing Procedure was done by using Arçelik Full Automatic 3650 SJ washing machine, the most used one in Turkey. In the washing, main wash (without pre-washing) program was used.

2- The water hardness in the washing was 20° F.

3- ECE nonphosphate reference detergent was used as a washing detergent because it was an un-perfumed detergent.

4- T-shirt samples to be used in tests were washed one cycle at 40°C cotton program without pre-washing by using 10 g/L ECE detergent. After that, they were washed only by water for providing their being completely odorless.

5- The washed samples were dried by hanging in a perfume-free and dark environment.

6- The application of fabric softeners was made by simulating home type washing.

T-shirt samples were washed one cycle at 40°C cotton program without pre-washing by using 10 gr/lt unperfumed detergent and softener. The softeners (Product with microcapsules and without microcapsules) were added as 40 and 100 ml respectively to the last rinsing cycle automatically

7- The fabric softener amounts were used as recommended dosages at the back of the products' packages.

8- The washed samples were dried by hanging in a scentless environment and sunlight free room conditions then folded, placed in a scentless closet and held in the closet for different durations such as 1 day, 7 days, 14 days, 21 days and 28 days.

9- At the end of post-washing, 1st Day, 1st Week (7 Days), 2nd Week (14 Days), 3rd Week (21 Days), 4th Week (28 Days) t-shirt samples were worn during a work day (8 hours) by a group of 18 individuals with high olfaction endowment.

10-A control t-shirt was prepared for the blind test by only washing with ECE and water. The drying of this test was made by hanging in a scentless environment and sunlight free room conditions.

2.4. Wear Tests

All the tests were performed by trained experienced panelists and all have minimum 10 years in the evaluation & execution of objective tests (perfume intensity and softness etc.). The panelists are trained at regular intervals by fragrance experts to maintain their acuity. The training was recently validated by Firmenich, an international producer of perfumery and flavor chemicals since 1895. The evaluation group was composed of 18 female individuals with high olfaction endowment. The testers all worked in a Research and Development Center dealing with textiles. The wear tests were made during work days for 8 hours. The group of 18 individuals were told to come to the work without taking a shower in the morning (showers were allowed to be taken at night) and without using any perfumes and deodorants. It was also forbidden to smoke and to drink coffee during the test day (Firmenich advised to behave in this way).The group received their t-shirts in the morning and began to wear them at 9 o'clock. At the moment they wore the t-shirts they evaluated the strength of the scent after smelling the left bottom side of the t-shirt. The panelists evaluated T-shirt samples with 4 hours interval in terms of perfume odor. They continued the test during the day and the test ended at 17 o'clock. The panelists also made a blind test by wearing the t-shirts without perfume intensity washing (samples were washed only with ECE and water) at the first day after drying.

2.5. Scent Evaluation

The assessments of the scent of the t-shirts were done by panelists after smelling the samples with the in-house scale below,

0 : Scentless
1-2: Light Scented (very low)
3-4: Fair Scented
5-6: High Scented (strong)
7-8: Very High Scented (very strong)

Assessment of perfume intensity was made for 2 times as before rubbing and after rubbing in order to feel the effects of microcapsules. Panelists rubbed the inner part and the outer part of their own t-shirts for 2 times at relevant region and smelled. In the assessment, in order to eliminate the differences depending on the place of the smelling regions, the regions of rubbing and smelling were described as in Figure 2.

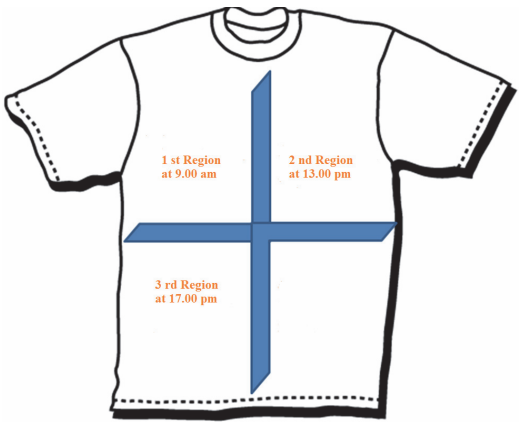

Fig 2. The regions of testing according to the time.

2.6. Deodorant Residue Test

The same panelist group who tested softener scent durability also made deodorant residue tests. These tests were made to find out whether the market deodorants left residues or not. The residues are bothering because they perform stains over fabrics and the idea of having chemical residues over the skin is a problem for some people. The tests were made as 2 repeats. For the first repeat, panelists cleaned their right underarm with wet a paper towel, dried with a dry paper towel and then applied the deodorant sample from a distance of 15 cm. and with the amount of 1,5-2 gr. The application amount was determined by weighing the deodorant before and after spraying. Black fabric samples were placed at underarms, arms were lowered and the black fabric samples were pulled out immediately. 10 minutes later the same black samples were put at the axillas and pulled again. For the second repeat the same procedure defined above was applied for the left underarm.

The stains of residues over the black fabrics were evaluated by the panelists with an in-house scale below:

1-2 : No stain or very few residues

3-4 : Fair level of residues

5-6 : Medium level of residues

7-8 : High level of residues

9-10: Very high level of residues

he assessments were made in two steps. One of them is made immediately after pulling the samples out of the axillas, the other one is made after 20 minutes in order to see the dry form of the stains.

3.RESULTS

3.1.Effect of Softeners

Scent evaluation results are given in Table 1.The results were evaluated statistically by SAS program in which “A” means the best, “B” and “C” comes second and third respectively. In the results when the letters are the same, it means that they are statistically equal.

Table 1. Scent Evaluation of the T-shirts

			LSD	MS	S	B	MS	S	B
1st Day	0 Hour	Before Rubbing	0.8625	6.5556	5.8889	4.8333	A	A	B
		After Rubbing	0.8305	7.9444	6.2222	4.8333	A	B	C
	4 Hour	Before Rubbing	0.7398	6.2222	5.6111	3.0556	A	A	B
		After Rubbing	0.7372	7.5556	5.8333	3.0556	A	B	C
	8 Hour	Before Rubbing	0.6889	6.0556	5.2222	1.6667	A	B	C
		After Rubbing	0.6932	7.3889	5.4444	1.6667	A	B	C
1st Week	0 Hour	Before Rubbing	0.8574	6.7222	5.7222	4.8333	A	B	C
		After Rubbing	0.8115	7.8333	6.0000	4.8333	A	B	C
	4 Hour	Before Rubbing	0.7603	6.5556	5.4444	3.0556	A	B	C
		After Rubbing	0.7831	7.5556	5.5556	3.0556	A	B	C
	8 Hour	Before Rubbing	0.6644	6.1667	4.8889	1.6667	A	B	C
		After Rubbing	0.6886	7.3333	5.0000	1.6667	A	B	C
2nd Week	0 Hour	Before Rubbing	0.8273	7.1667	5.9444	4.8333	A	B	C
		After Rubbing	0.7657	7.8333	6.1111	4.8333	A	B	C
	4 Hour	Before Rubbing	0.7332	7.1111	5.8333	3.0556	A	B	C
		After Rubbing	0.6865	7.8889	5.9444	3.0556	A	B	C
	8 Hour	Before Rubbing	0.7194	6.8333	5.4444	1.6667	A	B	C
		After Rubbing	0.6858	7.7778	5.5556	1.6667	A	B	C
3rd Week	0 Hour	Before Rubbing	0.8594	6.5000	5.2222	4.8333	A	B	B
		After Rubbing	0.8246	7.5556	5.5000	4.8333	A	B	B
	4 Hour	Before Rubbing	0.7749	6.5000	5.0556	3.0556	A	B	C
		After Rubbing	0.7464	7.5000	5.3333	3.0556	A	B	C
	8 Hour	Before Rubbing	0.7332	6.0556	4.6111	1.6667	A	B	C
		After Rubbing	0.7302	7.2778	4.7778	1.6667	A	B	C
4th Week	0 Hour	Before Rubbing	0.9561	6.1667	5.7778	4.8333	A	BA	B
		After Rubbing	0.9513	7.2778	6.0556	4.8333	A	B	C
	4 Hour	Before Rubbing	0.8862	6.0000	5.5000	3.0556	A	A	B
		After Rubbing	0.9229	7.1111	5.6111	3.0556	A	B	C
	8 Hour	Before Rubbing	0.7461	5.5556	4.9444	1.6667	A	A	B
		After Rubbing	0.837	6.8889	5.0000	1.6667	A	B	C

MS: T-shirt sample washed by softener with microcapsules,

S: T-shirt sample washed by the softener without microcapsules

B: T-shirt sample washed without softener (blind test), only with ECE detergent.

In Table 1, for the results of 1st day, the products with microcapsules and without microcapsules both show the results which are equal or more than 5. That means both softeners have scents minimum at the medium level according to the scale used. The intensities of the odors continue with the similar levels during whole day. The softener odors that the consumers smell can be accepted as strong enough to mask the body odors because the panelists also stated that they couldn't feel any smell of their sweets. Similar results are obtained at the end of the test weeks. The lowest value was "4,6111" and belonged to the softener without microcapsule. The rubbing has an effect over the microcapsules by revealing the perfumes kept inside the microcapsules and this effect can easily be determined by the results of the softener with microcapsule. In the results of the other softener a slight increase by the effect of rubbing can be seen, but this can be attributed to the psychologies of the panelists or by rubbing a mixing effect of the scent cloud may happen over the surface of the fabric. When the softeners are compared to each other and the blind test is also taken into account, the superiority of the softener with microcapsules is obvious and the results are statistically significant. Generally the classification is 1st MS, 2nd S and the 3rd B. The equal results are very few and they are the results of "before rubbing" situation. After rubbing, the effects of microcapsules could easily be felt. In Figure 3, all the results are given in a graph.

In Figure 3, the superiority of softener with microcapsule can easily be distinguished.

3.2. Effect of deodorants

Assessments of deodorant residue tests are given in Table 2, in which the deodorants are named as W, X (these two products are for women), Y, Z (these two products are for men). The results were evaluated statistically by SAS program in which "A" means the best, "B" and "C" comes second and third respectively.In Figure 4, there are some photos taken during the test to give an idea about how the stains of different levels look like.

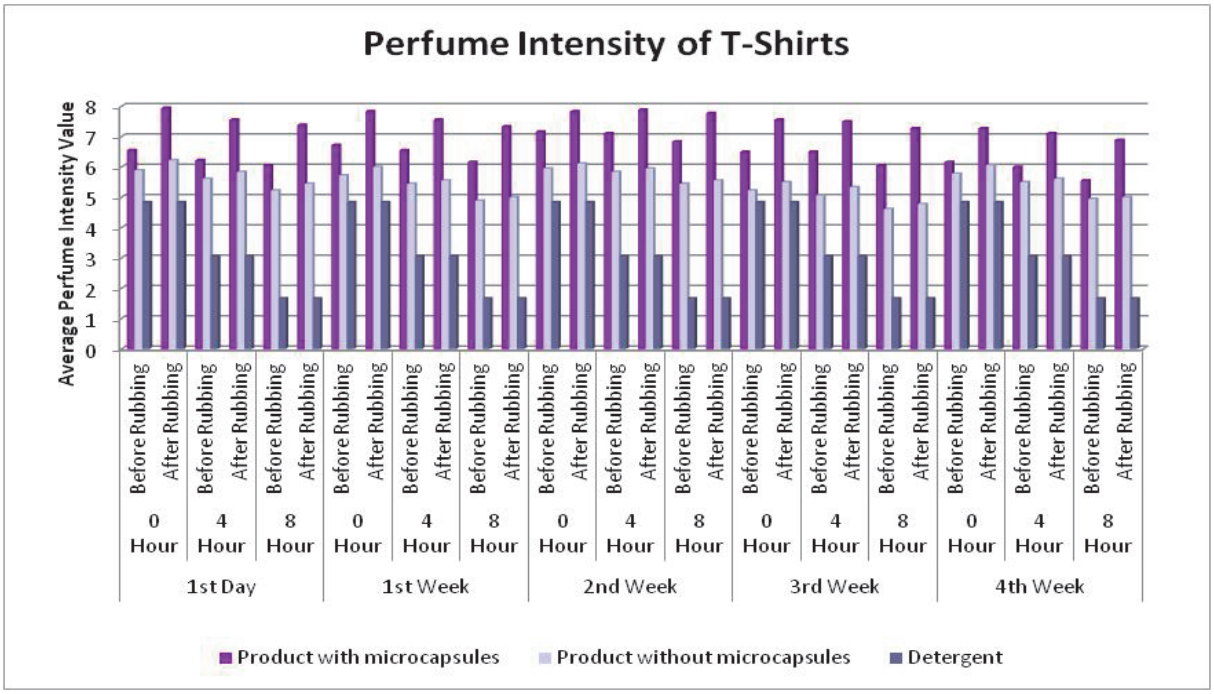

Figure 3. The graphs of the products after scent evalution

9 5 3.5 1.5

Fig 4. Photos of Black Fabrics with deodorant stains of various levels.

Table 2. The evaluation of deodorant stains

Deodorant Application	Time	LSD	W	X	V	Z	W	X	V	Z
Instantly	t=0	1.2793	5.1667	2.9000	3.7333	5.7333	B	A	A	B
Instantly	t=20	1.3594	5.7333	5.3000	4.8333	7.3667	A	A	A	B
10 min. later	t=0	1.1357	4.7000	3.2333	3.8667	5.5667	BC	A	BA	C
10 min. later	t=20	1.1008	5.2667	4.1333	4.5667	6.5333	B	A	BA	C

In Table 2 it is seen that all the tested deodorants left residues. The results are more obvious after 20 minutes (in the dry form). The aim of this test was not to compare the stains of different deodorants but was to see whether all of them leave residue or not, so a person may conclude that using such kind of products to prevent body odor esp. sweat odor. might leave some residues on her/his skin.

4. CONCLUSION

New technologies are being developed or adapted for home type of washing and softening products. Fragrances or aroma chemicals have been essential additives in such kind of consumer products recently. They provide the control of odor delivery of fragrances from detergents and/or softeners onto the textile products and this situation is a challenge for the fabric-care industry. Encapsulation is a good route to control fragrance release and to make more durable fragrant finishing on textiles. To help the development of effective fabric-care products, it is important to develop a better understanding of the factors that influence retention of aroma chemicals on textiles and their release. New methodologies are also used to study the distribution of chemical finishing agents on fibers.

In this study, the scent effects of commercial fabric softeners for home type of washing was searched. For this aim softeners with microcapsules and without microcapsules were compared in terms of scent durability after various keeping durations and wearing during a work day. Because some people think that using cosmetics which are in direct contact with the skin to mask sweat odors may be harmful, using softeners with strong perfumes may be an alternative against body odor.

In the market there are some types of fabric softeners, among them with and without microcapsules types were chosen in order to compare the durability of their scents. After different durations of keeping textile materials made of cotton and treated with softeners, with different times of rubbing and smelling during a work day gave some results about the intensity and durations of softener fragrances. When blind test was also taken into account, the results of the softener with microcapsules were better.

Without using any product to mask or prevent body odor, wearing cotton t-shirt with a durable scent may be preferred by some consumers who are sensitive to the products that may leave residue on the skin. In the coming studies, textile materials with the other types of fibers may also be tried in the same way to find out the sufficiency of scent durability.

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