



## The Effect of Eco-Clothing on Human Health and the Environment inside the Kingdom of Saudi Arabia

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**Abstract:** This research aims to evaluate consumer awareness about eco-clothing and to determine the safety limits of existing, imported and local clothes in the Kingdom of Saudi Arabia (KSA)'s markets. Descriptive and empirical methods were used to evaluate a sample of 150 Saudi customers and a number of children's, men's and women's clothing shops regarding both underwear and outerwear. A set of clothes, consisting of 10 types, were analyzed using questionnaires and ecological analyses. The results indicated that Saudi consumer awareness about eco-clothing is weak. In terms of imported clothes, most consumers do not know about clothing safety limits, and this lack of knowledge suggests that all clothing exports into KSA's markets should be regulated.

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### Introduction:

The environment is subjected to serious danger from industrial development in general and from textiles and clothing manufacturing in particular. Outputs from these industries often affect human health and environmental safety.

Despite the great pressures from regional and international authorities to use substances and means that are environmentally friendly, there are certain countries that do not follow these rules and often do not even take them into consideration.

Currently, the world is experiencing successive developments over a short time period in terms of environmental regulation. As a result, the environment has become a more pressing issue amid tough global competition in terms of the type and size of clothing and textile manufacturing. This heightened importance of environmental issues has led to the emergence of a group of environmental and international standards and rules being established to avoid the dangers related to these industries. This increased regulation was especially the case with the start of the World Trade Organization and the liberation of international trade, as advanced countries began to establish rules to maintain uniform environmental safety expectations regarding imports from all over the world, especially from second world countries [Yucell, O. 2003].

These environmental restrictions and standards, aimed at limiting environmental pollution, are

represented by what is called Eco-Labeling. Eco-Labeling is a certificate that can be obtained if certain restrictions are achieved in the producing country. These restrictions are among the hardest obstacles for countries to meet to participate in global markets.

Gehan Nawar (2001) explained the concept of textile products that are "environment ecological". She said that such products should not harm human health and should not cause any type of irreparable environmental harm. Environmental standards are in demand internationally and attract widespread attention.

These standards led to the emergence of the International Association for Research and Testing in the Field of Textile Ecology (OEKO-TEX®). These centers issue and give licensed certificates to textile producers with permission to use the OEKO-TEX® label. This label provides information about the safety of textile products, ensuring that they do not contain elements that are harmful to human health and the environment [Abdelhamid Khirallah (2002)].

Turan, A. (2007) indicated that OEKO-TEX® ensures customers that these products are environmentally secure and are made with environmentally friendly substances that do not contain harmful chemicals or, at most, are present in allowable amounts. Furthermore, the association encourage the design, production and marketing of

environmentally friendly products that reduce harmful production inputs in the environment throughout their life cycle.

Samia, E, et al (2009) studied environmental safety in children's clothing in terms of the use of safe natural substances. These substances replaced harmful NA2S with active glucose in dyes in place of the aldehyde group (cho).

Jago, P. (2003) studied consumer concerns regarding potential health problems from clothing and found that consumers became more aware and educated concerning the harmful effects of industrial pollution on the environment and human health. This made him/her choose clothing made using environmentally friendly chemicals and manufactured with methods verified by eco-labels that validate the product's cleanliness, safety and the absence of any harmful substances.

In terms of the health problems that may affect consumers, Libosa et al (1994), Menzir et al (1996), and Seidenaria et al (1999) found that pimples may appear on human skin because of contact with clothing dye from direct or indirect pressure on the skin.

In terms of consumer protection, the Customer's Protection Authority (2008) referenced an Egyptian law that was issued in 2006 that included several elements. These elements included the consumer's right to basic needs (food, clothes, medicine, education and healthcare) and the right to product and consumer safety. Other elements in this law included: the right to obtain information needed to be able to protect oneself, the right to choose from a variety of products to ensure price and quality comparisons, the right to complete, clear and easily readable data about a product, and the right to a replacement or fair compensation for defected products.

The Customer's Protection Authority (2008) determined that a customer is responsible for the following: reading product pamphlets and for meeting the conditions, commitments and obligations after sale, not buying products from an unknown source, not trusting oral guarantees, keeping a bill of sale and guarantee certificate, not being swayed by advertisements, examining products well, and ensuring their safety and high quality.

The term "Green Customer" has emerged as a result of increasing environmental awareness as customers became able to determine their purchase standards based on eco-clothing or environmentally friendly options [Wagner, S. A. (2003)].

The United Nation Conference (2004) reviewed the special demands and conditions set by importers or buyers. They are usually from international trade companies that depend on separate producers in many countries for providing many of their product inputs.

In order for these companies to ensure that all of their suppliers are committed to acceptable conditions that allow the final products to compete in Western European markets, these global companies set certain environmental and health conditions. In addition, the companies established conditions for worker protection and the factory environment with the expectation of receiving contracts in a supply chain.

#### **The OEKO-TEX® 100 Label:**

As previously explained by Nabil Abdelbaset, Mohamed Abu Shosha (2000), Abdelhamid Khirallah (September 2000) and Yucell (2003), the OEKO-TEX® label is related to finished textile products and is not related to the manufacturing process. Moreover, this label cannot be put on a product without a license from the producer. This license is called "The OEKO-TEX® 100" certificate, which is granted after testing by producers to ensure that these products agree with the standards of OEKO-TEX® 100.

#### **The OEKO-TEX® 100 Standard:**

Abdelhamid Khirallah (2000), the Egyptian Standards 3786/2002 OEKO-TEX® 100, Mohamed Abu Shosha, Nabil Abdelbaset (2000) explained that the OEKO-TEX® 100 Standards include detailed tables that show the secure limits of substances, elements and harmful chemical components that may exist in textiles, along with the pH value and color consistency.

Yousef Abdelaziz and Ashraf Mahmoud Hashim (2001) researched the "Presence and Permanence of some Poisonous Components which Cause Cancer in Dying Materials Extracted from Children's Clothes & Textiles Circulated in Egyptian Markets". This study determined that wearing clothing of a certain color is an important factor in the development of cancer and the experience of light poisoning and allergies. The research also found that the use of solutions from certain manufacturers had cleaner substances. This led to less color permanency with variable degrees, as well as an increase in the leakage of poisonous and carcinogenic substances into washing machine water.

Mucella, G (2005) presented to the first world environmental session on energy and the environment in Turkey. This session included a group of 13 European institutions from the textile industry. The session managed to issue the OEKO-TEX® 100 standard, which became one of the fundamental documents outlining the ecology of textiles, including the sorts of textile products that do not contact skin directly and products for babies, as well as bed sheets, quilts, home textiles and other textiles that do not stick to the skin. The session also strived to determine the limiting values of substances that threaten human health as well as the techniques of various tests; the session outlined the types of clothes that come in direct contact with the skin as well as the types of

clothes mentioned previously that enjoy more sensitive limit values.

Exeter University in England and Peninsula Medical School in the USA (2010) undertook a study that showed the possible relationship between thyroid disease and a person's exposure to Perfluoro Octanoic Pfoa acid, which is used in making home furnishings and water and fire-resistant clothing. The study included 3,966 people and determined that those people with a high concentration of PFOA in their blood are, to a great extent, predisposed to thyroid disease; this study was published in the environment journal [Sanaa Ahmed Ragab (2010)].

The OEKO-TEX® Organization declared that starting in January 2010, the OEKO-TEX® 100 certificate will include a note saying that the certificate terms require the fulfillment of annex 17 of the REACH rules (which include a ban on the use of Azo dye and nickel and include a commitment to the American Standards requiring the non-existence of lead in children's clothes).

It should be noted that these instructions will be required after a transitional period of 3 months, starting in April 2010.

As for the Green Customer Standards, Bank, J. (1992), Peattie, K. (1996) and Wasik, J. (1996) suggested that this customer was the one most committed to environmental activity. This customer enjoys a high economic and social status and is ready to pay a higher price for products that meet environmental standards.

As previously illustrated, all scientific centers took into consideration the principle of moving towards a cleaner global environment with the slogan of these authorities. This slogan was aimed at ending pollution, not treating it. This will not be achieved except through environmental awareness among individuals, institutions and the public and with their awareness about the safety limits for clothing as well as textile manufacturing sustainability.

The markets of the K.S.A are considered to be attractive areas for many imported products from different countries. Certain importation institutions have no social or environmental responsibility, lack information about sustainable clothing and have a low standard of environmental awareness among the traders and customers; there is a general lack of awareness about the necessity of importing environmentally sustainable clothing and textiles. This has resulted in the importation of harmful clothing for individuals and the environment.

Therefore, it was necessary for researchers to clarify the complex relationship between technology and the environment. The environment in which humans live is formed through a large and sophisticated atmosphere of mutual interactions

between organic elements, technological elements and human elements.

#### **Study Rationale:**

Humans and the environment are exposed to many serious dangers as a result of technological advances from textile and clothing manufacturing; this unexpected development has impacted the environment, while ignoring environmental considerations.

Despite establishing legislation for environmental protection that is aimed at ensuring that textiles and clothing do not contain harmful materials, in line with safety limits, there are still some countries with industrial methods that harm the environment and human health, putting material profits above any consideration of the environment.

The spread of these products to K.S.A's markets contributes to the problem because of social and environmental irresponsibility among importation institutions and low levels of environmental awareness among traders and customers. Both of them are unaware of the necessity of sustainable clothing and textiles, which leads to customer's attraction to unsafe clothing that may harm him/her.

There is an increase in environmental awareness among importers, traders and customers concerning legislation that bans and warns against using certain dyes or other manufacturing substances in producing textiles. This is one of the most important factors for authorities in terms of families, in general, and consumers, in particular.

The environmental dimension has become one of the important factors that not only governs a customer's choice of textiles but also establishes these products in import markets (Yucell, O. 2003).

Accordingly, all of the scientific research centers took into consideration the important principle of a better environment, with the slogan of ending pollution, not treating it. This will not be achieved without environmental awareness among individuals, institutions and the public or without their awareness of safety limits for clothing as well as the sustainability of clothing.

#### **Study Objectives:**

This study aims to evaluate the effect of non-environmentally sustainable clothing on human health and the surrounding environment and how aware the traders and customers are regarding the environment and environmentally friendly clothing. A group of secondary goals emerged as follows:

1- To determine the countries of clothing imports (children, men and women) into KSA markets.

2- To determine how environmentally sustainable these products are based on the environment ecology certificate, and how committed

the producing countries and importers are towards choosing clothes that agree with the OEKO-TEX® standard. They do not contain harmful elements to man and the environment after measuring the safety limits of some products.

3- Measuring customer awareness (based on his/her knowledge and practices about sustainable clothing and the related motivations of customer choice for environmentally friendly clothes).

#### Methodology:

The researcher used both descriptive and empirical approaches.

#### 1- Descriptive Method:

This method was used to achieve the study objectives related to customer awareness about eco-clothing using the following:

Sample: The study included all family members who buy outerwear and underwear for family members. A sample was chosen to represent the 150 individuals who buy clothing for their family members.

#### Study Tools:

A questionnaire was used as a tool for scientific research. It included six elements, as follows:

The first element: Sample properties, including sex, age, marital status, qualification, and number of family members.

The second element: Consumer information about environmentally friendly clothing.

The third element: Consumer clothing trends for friends of the environment.

The fourth element: Consumer practices while buying clothes for family members.

The fifth element: Consumer motivations while buying clothes.

The sixth element: Consumer information and practices when evaluating packaging and wrapping options.

#### 2- Empirical Method:

This method was used to achieve the study's objectives of testing the health and environmental properties of clothing products in K.S.A's markets.

Sample: 10 clothing pieces, including underwear and outerwear for men, women and children.

#### Testing:

Due to the Egyptian Standard (2008), and European German OEKO-TEX® testing 100/2012, the following tests were conducted:

PH-Value, Hydrogen Peroxide, Formaldehyde free & released (ppm), Phthalates – PVC plasticizer and Cleavable Aryl amines test.

#### Results & Discussion

##### First:

##### Descriptive Study:

The results of the consumer questionnaires included:

- 1- Sample description.
- 2- Consumer information, trends or practices related to environmentally friendly clothing.
- 3- Consumer purchase motivations.
- 4- Packaging and wrapping.
- 5- Relationship between general properties of:
  - a) Consumer information trends and practices.
  - b) Consumer information trends and practices in a packaging and wrapping test.
  - c) Consumer emotional and mental motivations.

#### Sample Description:

Table (1) shows sample individuals, based on demographic properties that included sex, age, marital status, qualifications, job, family members and income.

Table (1): Sample Distribution according to the Demographic Data

	Frequency	%
<b>Sex</b>		
Male	75	50.0
Female	75	50.0
<b>Age</b>		
18-24	27	18.0
25-31	46	30.7
32-38	38	25.3
39-45	23	15.3
45-more	16	10.7
<b>Marital Status</b>		
Single	44	29.3
Married	103	68.7
Widowed	3	2.0
<b>Education</b>		
Uneducated	4	2.7
Primary	3	2.0
Middle	8	5.3
Secondary	43	28.7
College	72	48.0
Graduate School	20	13.3
<b>Wife Employment</b>		
Employed	86	41
Unemployed	67.7	32.3
<b>Husband Employment</b>		
Free work	16	12.2
Employee	90	68.7
Unemployed	14	10.7
Retired	11	8.4
<b>Family Members</b>	2.41±5.48	
<b>Sons</b>	1.40±1.57	
<b>Daughters</b>	1.66±1.69	
<b>Children</b>	1.59±1.41	
<b>Family Income</b>	6060.28±8595.33	



This table shows that the study sample included 50% men and 50% women, 30% of the sample ranged in age from 31 years old, 68% of them were married, about half of the sample (48%) had academic qualifications, 41% of wives were employed, family members involved more than 5 individuals, and a

family's annual income reached 850 thousand dirham in the majority.

#### Consumer knowledge about environmentally friendly clothes:

Table (2) shows the research distribution of knowledge about environmentally friendly clothing, as follows:

Table (2): Sample Distribution of Consumer Knowledge about Environment-Friendly Clothing

Consumer knowledge about environmentally friendly clothing	Yes		No		Don't know	
	F	%	F	%	F	%
There are clothes called environmentally friendly	65	43.3	74	49.3	11	7.3
Environmentally friendly clothes are free of harmful substances	96	64.0	47	31.3	7	4.7
Environmentally friendly clothes keep man's health not the environment	42	28.0	63	42.0	45	30.0
I know the safety limits of clothing	61	40.7	67	44.7	22	14.7
I know the importance of the environmental label on clothing	70	46.7	59	39.3	21	14.0
I know that environmentally friendly clothes are highest in price	39	26.0	58	38.7	53	35.3
The environmental label indicates safety limits	72	48.0	63	42.0	15	10.0
There are fabrics that cause danger to health	124	82.7	20	13.3	6	4.0
There are some dyes that cause harm to health	131	87.3	14	9.3	5	3.3
Some fabrics may cause allergies to children's skin	134	89.3	9	6.0	7	4.7
Some dyes may cause allergies to children's skin	132	88.0	13	8.7	5	3.3
Some underwear causes skin infections	137	91.3	9	6.0	4	2.7
<b>Consumer knowledge about environmental protection</b>						
We can benefit from treating water after washing	51	34.0	39	26.0	60	40.0
We can use treatments and benefit from treating water after washing	72	48.0	48	32.0	30	20.0
Materials in clothes are dangerous to human health	77	51.3	58	38.7	15	10.0
Printing on clothes are dangerous to human health	67	44.7	52	34.7	31	20.7
Dye in clothes causes harm to human health	79	52.7	47	31.3	24	16.0

This table shows that half of the sample did not know about what is called "Environmentally friendly clothing", 64% of them know that this means being free of harmful substances, 42% did not know that they protect human health, 44% did not know about safety limits, 46% knew about environmental label, approximately 39% did not know the price of this type of clothing, 48% had incorrect information about the environmental label's contents, approximately 83% had correct information about fabrics that cause dangers, 87% knew that dyes can cause skin infections, 89% - 88% - 91%, consecutively, had the correct information about fabrics, dyes and underwear that cause harm to children's health.

In terms of information related to protecting the environment, we found that information respondents about the benefits of treating water after washing, the possibility of treating sewage water, the risks from the presence of metals, printings and dyes to human health were as follows: 40% wrong answers, 48% correct answers, 51% - 44.7% - 52.7%, consecutively, were correct answers.

#### Respondent Trends Towards Purchasing Environmentally friendly Clothes:

Table (3) shows results about respondent trends towards purchasing environmentally friendly clothing were as follows:

Table (3): Sample Distribution of the Trends Towards Purchasing Environmentally friendly Clothing:

Trend towards environmentally friendly clothes	Agree		Neutral		Don't agree	
	F	%	F	%	F	%
I prefer wearing imported clothing from foreign countries	64	42.7	69	46.0	17	11.3
I tend to use white underwear	109	72.7	26	17.3	15	10.0

Table 3 shows that 46% of respondents prefer wearing imported clothes from foreign countries and approximately 73% of them prefer wearing white underwear.

#### Consumer Practices While Buying Clothes:

Table (4) shows respondents' distribution of consumer practices when choosing, buying or using outerwear or underwear as follows:

Table (4): Sample Distribution of Consumer Practices While Buying Clothing:

Consumer practices while buying	Yes		Don't know		No	
	F	%	F	%	F	%
<b>While choosing clothes</b>						
I choose my clothes and my family's knowing the source	67	31.3	62	41.3	41	27.3
I choose my family's clothes after reading the guiding card.	47	31.3	62	41.3	41	27.3
I choose imported clothes from the USA & Europe	50	33.3	68	45.3	32	21.3
I buy clothes that contain guidance cards	48	32.0	59	39.3	43	28.7
<b>While examining the guidance card, I can read</b>						
Size	130	86.7	98	60.0	11	7.3
Material type	115	76.7	24	16.0	11	7.3
Care method	99	66.0	41	27.3	10	6.7
Brand	115	76.7	22	14.7	13	8.7
I check the material type when buying	106	70.7	38	25.3	6	4.0
I check the dye consistency when buying	80	53.3	51	34.0	19	12.7
<b>Choosing colored underwear</b>						
White	106	70.7	30	20.0	14	9.3
Light	80	53.3	53	35.3	17	11.3
Dark	78	52.0	46	30.7	26	17.3
Colored	66	44.0	51	34.0	33	22.0
<b>Choosing outerwear prepared against</b>						
Bacteria and rot	72	48.0	30	20.0	48	32.0
Fire	49	32.7	41	27.3	60	40.0
Lumps	85	56.7	43	28.7	22	14.7
Shrinking	84	56.0	36	24.0	30	20.0
I buy cotton children's wear	127	84.7	18	12.0	5	3.3
I buy cotton underwear	122	81.3	32	15.3	5	3.3
I buy lump resistant underwear	67	44.7	58	38.7	25	16.7
<b>Daily dressing practices and their effect on health</b>						
After buying underwear, I wash them	98	65.3	19	12.7	33	22.0
Before wearing underwear, I iron them	58	38.7	42	28.0	50	33.3
Some underwear causes allergies while wearing	35	23.3	57	38.0	58	38.7
Some clothing dyes cause allergies	51	34.0	54	36.0	45	30.0
Some clothing causes children's allergies	104	69.3	30	20.0	16	10.7
<b>When ironing clothes</b>						
Kerosene smell emitted	37	24.7	44	29.3	69	46.0
Egg smell emitted	19	12.7	34	22.7	97	64.7
Fish smell emitted	22	14.7	30	20.0	98	65.3
I feel electric charges when wearing some clothes	88	58.7	50	33.3	12	8.0
I buy clothes decorated with metal buttons	31	20.7	75	50.0	44	29.3
I buy clothes, including belts, with metal heads	27	18.0	65	43.3	58	38.7

**Practices while choosing clothes:**

There are negative practices related to consumer knowledge of the source (41%), reading of the card (41%), choosing imported clothes from the USA & Europe (45%) and about reading the guidance card (39%).

**Practices Related to the Guidance Card:**

There are positive practices related to selecting the size (approximately 87%), the material type (77%), the material care (66%), the brand (77%), the fabric type (71%) and the dye consistency (52%).

**Consumer practice in choosing underwear color:**

We found that approximately 71% chose white, 53% chose light colors, 52% chose dark colors and 44% chose colored underwear.

**Consumer practices in preparing outerwear:**

We found that 48% of outerwear is prepared to resist rot and bacteria, 33% to resist fires, 57% to

resist lumping and 56% to resist shrinking; 85% of customers chose cotton fiber for children's clothes, 81% chose cotton underwear and 45% chose underwear that resists lumping.

**Daily practices and their effects on health:**

In terms of positive practices, clothing should be washed before wearing and ironed (65% and 39% of customers did this, respectively). In terms of negative practices, these included underwear allergies (36%), dye allergies (36%) and children's allergies (69%).

**Practices when ironing clothes:**

The selected clothing do not emit smells such as kerosene (46%), egg (65%) or fish (65%). As for the danger of an electrostatic charge, 58% of customers feel these charges, 50% do not know about the risks of metal buttons and 43% were concerned about belts with metal heads.

**5- Consumer's motivations during buying clothes:**

Table (5): sample distribution according to consumer's motivations during buying clothes:

Consumer motivations when buying clothes	Yes		Sometimes		No	
	F	%	F	%	F	%
<b>Psychological Motivations</b>						
High price	28	18.7	71	49.7	51	34.0
Material quality	74	49.3	57	38.0	19	12.7
Brand "type"	124	82.7	21	14.0	5	3.3
Color consistency	91	60.7	47	31.3	12	8.0
Not causing allergies	118	78.7	28	18.7	4	2.7
Protecting the environment	112	74.7	29	19.3	9	6.0
Trust in the producing company	33	22.0	61	40.7	56	37.3
Individual safety & protection	33	22.0	64	42.7	53	35.3
Durability	81	54.0	40	26.7	29	19.3
Previous experiment	69	46.0	43	28.7	38	25.3
Safe to protect the environment	20	13.3	51	34.0	79	52.7
<b>Emotional Motivations</b>						
Exporting countries	25	16.7	72	48.0	53	35.3
Advertisement & propaganda	98	65.3	44	29.3	8	5.3
Imitation & simulation	94	62.7	38	25.3	18	12.0
Distinction & Exclusivity	87	58.0	53	35.3	10	6.7
Seller's effect	100	66.7	44	29.3	6	4.0
Others' opinions' effect	55	36.7	55	36.7	40	26.7

**Mental Motivations:**

The table shows that positive psychological motivations include the following: the testing of materials (49%), the color consistency (61%), allergen-free clothing (79%), environmental protection (75%), durability (40%) and previous experiments (46%).

**Emotional Motivations:**

The table shows that negative emotional motivations included the following: 65% from advertisement & propaganda, 63% from imitation and simulation, 58% from distinction and exclusivity and 67% from the seller's effect.

**Consumer Information & Practices about Wrapping Type:**

Table (6) shows customer information & practices about choosing the wrapping and packaging type for clothing:

Table (6): Sample Distribution of Packaging &amp; Wrapping Selection

Packaging & Wrapping	Yes		Sometimes		No	
	F	%	F	%	F	%
<b>Packaging &amp; Wrapping Practice</b>						
I buy clothes wrapped in plastic	77	51.3	58	38.7	15	10.0
I buy clothes wrapped in paper	33	22.0	75	50.0	42	28.0
I buy clothes without wrapping	23	15.3	76	50.7	51	34.0
I buy clothes from displays	29	19.3	65	43.3	56	37.3
<b>Information about Packaging &amp; Wrapping</b>						
I know about environmentally friendly wrapping	44	29.3	30	20.0	76	50.7
I know about the environmental harm from wrapping	61	40.7	25	16.7	64	42.7
I know that some packaging may cause allergies	68	45.3	22	14.7	60	40.0

**Information about packaging and wrapping:**

The table shows that respondents have incorrect information about environmentally friendly wrapping because they represent approximately 51%; 43% know about wrapping that harms the environment. As for correct information, we found that 45% of the samples cause allergies.

**Consumer Practices when buying:**

We found that consumer practices were either wrong or had an average of 51% purchasing clothing wrapped in plastic; 50% of the clothing were wrapped in paper, 50% were without wrapping and 43% were from display cases.

**General Level of Information:**

Table (7) shows the general level of respondent knowledge about environmentally friendly clothing, which protects the environment and promotes

knowledge about wrapping. The following table displays this knowledge:

**Table (7): Knowledge level**

Information	Weak		Average		Good	
	F	%	F	%	F	%
Environmentally friendly clothing	2	1.3	21	14.0	127	84.7
Protecting the environment	26	17.3	53	35.3	71	47.3
Total information without wrapping	4	2.77	42	28.0	104	69.3
Wrapping information	51	34.0	36	24.0	63	42.0
Total wrapping information	5	3.3	60	40.0	85	56.7

The previous table shows the following:

**Knowledge about environmentally friendly clothing:**

A total of 85% of the sample had high levels of knowledge, 47% knew that these clothes are

environmentally friendly and 57% had high levels of knowledge about wrapping.

**General level of respondent trends:**

Table (8) shows these trends of buying and testing clothing:

**Table (8): Sample distribution according to trends:**

Trend	Frequency	%
Negative trends	12	8.0
Positive trends	138	92.0

This table shows that positive trends are at 92%.

**General level of buying motivations:**

Table (9) shows the general level of buying motivations, whether emotional or psychological, as follows:

**Table (9) Sample distribution of motivations:**

Motivations	Weak		Average		Good	
	F	%	F	%	F	%
Mental motivations	2	1.3	43	28.7	105	70.0
Emotional motivations	26	17.3	79	52.7	45	30.0
Total paying	1	0.7	70	46.7	79	52.7

This table shows that 70% of consumers have a good level of psychological motivation, whereas 30% have a good level of emotional motivation.

**General level of consumer practices about testing, buying and using clothes:**

**Table (10) shows the general level of consumer practices:**

Practices	Weak		Average		Good	
	Frequency	%	Frequency	%	Frequency	%
Selection	32	21.3	77	51.3	41	27.3
Card check	2	1.3	17	11.3	131	87.3
Colors	18	12.0	93	62.0	39	26.0
Preparation	9	6.0	66	44.0	75	50.0
Daily practices	7	4.7	80	53.3	63	42.0
Ironing	20	13.3	55	36.7	75	50.0
Wrapping practices	32	21.3	111	74.0	7	4.7
Total wrapping practices	0	0.0	101	67.3	49	32.7

This table shows that 51% of the research sample had an average level during selection, 87% for colors, 53% for daily practices and 74% for total wrapping

practices. Concerning good practices, 87% of samples related to guiding card check and 50% to preparation.



**First: The relationship between sample properties and consumer knowledge about environmentally friendly clothing:**

Table (11) shows the relationship between consumer knowledge and properties that include: sex,

age, qualification, family members and income. There is a material relationship between sex and consumer knowledge about environmentally friendly clothing, and there is a moral relationship between consumer knowledge and marital status.

**Table (11): Relationship between consumer knowledge about environmentally friendly clothing and general properties of the study sample:**

Sample properties	Consumer knowledge about environmentally friendly clothing						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	2	100.0	12	57.1	61	48.0	2	Chi <sup>2</sup> = 2.625	Insignificant
Female	0	0.0	9	42.9	66	52.0			
<b>Age</b>									
18-24	1	50.0	4	19.0	22	17.3	8	Chi <sup>2</sup> = 3.325	Insignificant
25-31	1	5.0	5	2.8	40	31.5			
32-38	0	0.0	5	23.8	33	26.0			
39-45	0	0.0	4	19.0	19	15.0			
45- more	0	0.0	3	14.3	13	10.2			
<b>Marital Status</b>									
Single	2	100.0	7	33.3	35	27.6	4	Chi <sup>2</sup> = 12.518	Significant
Married	0	0.0	12	57.1	91	71.7			
Bachelor	0	0.0	2	9.5	1	0.8			
<b>Qualification</b>									
Uneducated	0	0.0	2	9.5	2	1.6	10	Chi <sup>2</sup> = 14.810	Insignificant
Primary	0	0.0	0	0.0	3	2.4			
Middle	1	50.0	1	4.8	6	4.7			
Secondary	0	0.0	6	28.6	37	29.1			
Academic	1	50.0	11	52.4	60	47.2			
Higher than Academic	0	0.0	1	4.8	19	15.0			
Family members	-		3.25±6.14		2.27±5.38		104	T=1.102	Insignificant
Family Income	42442.64±9000.0		7751.80±8595.24		5809.26±8588.98		147.2	F=0.004	Insignificant

These values agree with Hardner's (2002) findings that say that it is necessary for the state to adopt an emphasis on raising awareness among the study sample. Raising awareness about the environmental marketing culture has a good effect on human health and environmental safety. In his study, Donaldson (2005) stressed the importance of creating new consuming values that agree with environmental trends and their importance.

**Consumer Knowledge about Protecting the Environment:**

Table (12) shows that there is a concrete relationship between sex, marital status, family members and knowledge about protecting the environment. We also found that there is an abstract relationship between age, qualification, family income and knowledge about protecting the environment.

**Table (12): Relationship between consumer knowledge about protecting the environment and general properties of the study sample**

Sample properties	Consumer knowledge about protecting the environment						Freedom Degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	11	42.3	23	43.4	41	57.7	2	Chi <sup>2</sup> = 3.244	Insignificant
Female	15	57.7	30	56.6	30	42.3			
<b>Age</b>									
18-24	2	7.7	17	32.1	8	11.3	8	Chi <sup>2</sup> = 15.493	Significant

25-31	8	30.8	13	24.5	25	35.2			
32-38	9	34.6	14	26.4	15	21.1			
39-45	5	19.2	4	7.5	14	19.7			
45- more	2	7.7	5	9.4	9	12.7			
<b>Marital Status</b>									
Single	6	23.1	16	30.2	22	31.0	4	Chi <sup>2</sup> = 1.512	Insignificant
Married	20	76.9	36	67.9	47	66.2			
Bachelor	0	0.0	1	1.9	2	2.8			
<b>Qualification</b>									
Uneducated	0	0.0	0	0.0	4	5.6	10	Chi <sup>2</sup> = 18.407	Significant
Primary	0	0.0	0	0.0	3	4.2			
Middle	0	0.0	3	5.7	5	7.0			
Secondary	8	30.8	11	20.8	24	33.8			
Academic	14	53.8	34	64.2	24	33.8			
Higher than Academic	4	15.4	5	9.4	11	15.5			
Family members	1.50±5.15		2.31±5.17		2.75±5.84		103.2	F=1.046	Insignificant
Family Income	7936.28±12230.77		6267.82±8750.94		4409.72±7141.89		147.2	F=7.288	Significant

These values agree with the view of Schwartz, J (1991) et al. and Newell et al. (1997) concerning the link between mental abilities and the level of education and income. This relationship has a direct effect on consumer knowledge about the environment.

#### Consumer Knowledge about the Harms of Packaging and Wrapping:

Table (13) indicates that there is a concrete relationship between age, marital status, qualification, family members, income and information level related to the risks that result from the wrapping type. There is an abstract relationship between sex and information level related to the risks that may result from the wrapping type.

**Table (13): Relationship between knowledge about the risks of packaging and the general properties of the study sample:**

Sample properties	Consumer knowledge about the risks of packaging						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>							2	Chi <sup>2</sup> = 7.542	Significant
Male	27	52.9	11	30.6	37	58.7			
Female	24	47.1	25	96.4	26	41.3			
<b>Age</b>							8	Chi <sup>2</sup> = 3.526	Insignificant
18-24	7	13.7	9	25.0	11	17.5			
25-31	17	33.3	12	33.3	17	27.0			
32-38	14	27.5	6	16.7	18	28.6			
39-45	8	15.7	5	13.9	10	15.9			
45- more	5	9.8	4	11.1	7	11.1			
<b>Marital Status</b>							4	Chi <sup>2</sup> = 4.121	Insignificant
Single	12	23.5	8	22.2	24	38.1			
Married	38	74.5	27	75.0	38	60.3			
Bachelor	1	2.0	1	2.8	1	1.6			
<b>Qualification</b>							10	Chi <sup>2</sup> = 12.169	Insignificant
Uneducated	0	0.0	1	2.8	3	4.8			
Primary	2	3.9	0	0.0	1	1.6			
Middle	2	3.9	2	5.6	4	6.3			
Secondary	15	29.4	10	27.8	18	28.6			
College	30	58.8	15	41.7	27	42.9			
Graduate Degree	2	3.9	8	22.2	10	15.9			
Family members	1.97±4.89		3.10±5.86		2.17±5.77		103.2	F=1.785	Insignificant
Family Income	6868.06±9431.37		5327.53±8055.56		5772.21±8226.98		147.2	F=0.742	Insignificant

Philip. K (1999) says that packaging materials affect human health and the environment and wrapping that protects human health is called Green Packaging and is less harmful to the environment. Green Packaging relies on 3 elements (3Re), as follows: reducing harm, reuse and recycling; this is called an Eco Pack.

#### Trend toward Environmentally Friendly Clothing:

Table (14) shows the abstract relationship between trends towards environmentally friendly clothing and sex, age, marital status and number of family members. There is also an abstract relationship with the educational qualifications and number of family members.

**Table (14): Relationship between the trends toward environmentally friendly clothing and the general properties of the study sample:**

Sample properties	Trends toward environmentally friendly clothing				Freedom degree	Test Type	Significance
	Negative		Positive				
	Sample	%	Sample	%			
<b>Sex</b>							
Male	6	50.0	69	50.0	1	Chi <sup>2</sup> = 0.0	Insignificant
Female	6	50.0	69	50.0			
<b>Age</b>							
18-24	2	16.7	25	18.1	4	Chi <sup>2</sup> = 1.935	Insignificant
25-31	5	41.7	41	29.7			
32-38	3	25.0	35	25.4			
39-45	2	16.7	21	15.2			
45- more	0	0.0	16	11.6			
<b>Marital Status</b>							
Single	2	16.7	42	30.4	2	Chi <sup>2</sup> = 3.406	Insignificant
Married	9	75.0	94	68.1.4			
Bachelor	1	8.3	2	1.4			
<b>Qualification</b>							
Uneducated	2	16.7	2	1.4	5	Chi <sup>2</sup> = 12.639	Significant
Primary	0	0.0	3	2.2			
Middle	1	8.3	7	5.1			
Secondary	2	16.7	41	29.7			
Academic	4	33.3	68	49.3			
Higher than Academic	3	25.0	17	12.3			
Family members	3.30±7.30		2.24±5.29		104	T=52.568	Significant
Family Income	5266.21±56250.0		6072.66±8853.62		148	T=1.783	Insignificant

Turam A. (2007) says that the consumer has a desire for environmentally friendly clothes and products that are environmentally safe and contain environmentally friendly substances and do not contain chemical substances that harm the environment.

#### Total Buying Motivations:

Table (15) indicates that there is a concrete relationship between clothing buying motivations and emotional or psychological as well as all sample properties.

Sample properties	Total Motivations						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	0	0.0	37	52.9	38	48.1	2	Chi <sup>2</sup> = 1.342	Insignificant
Female	1	100.0	33	47.1	41	51.9			
<b>Age</b>									
18-24	0	0.0	14	20.0	13	16.5	8	Chi <sup>2</sup> = 10.350	Insignificant
25-31	0	0.0	22	31.4	24	30.4			
32-38	0	0.0	14	20.0	24	30.4			
39-45	1	100.0	14	20.0	8	10.1			

45- more	0	0.0	6	8.6	10	12.7			
<b>Marital Status</b>									
Single	0	0.0	20	28.6	24	30.4	4	Chi <sup>2</sup> = 0.971	Insignificant
Married	1	100.0	48	68.6	54	68.4			
Bachelor	0	0.0	2	2.9	1	1.3			
<b>Qualification</b>									
Uneducated	0	0.0	3	4.3	1	1.3	10	Chi <sup>2</sup> = 6.284	Insignificant
Primary	0	0.0	2	2.9	1	1.3			
Middle	0	0.0	2	2.9	6	7.6			
Secondary	1	100.0	20	28.6	22	27.8			
Academic	0	0.0	35	50.0	37	46.8			
Higher than Academic	0	0.0	8	11.4	12	15.2			
Family members	7.0		2.68±5.58		2.18±5.36		103.2	F=0.301	Insignificant
Family Income	23000.0		6329.4±8600.0		5658.8±8408.8		147.2	F=2.937	Insignificant

In his study, Todd. A (2004) analyzed the main aspects of advertising of environmental products in three large companies. The results showed that these companies are interested in creating new consumer values by focusing on showing the aesthetic aspects of environmental commodities that represent a motivation for consumers to move toward these commodities.

### Consumer Practices:

#### - Consumer practice level when buying clothes

Table (16) indicates that all of the sample properties, including sex, age, marital status, qualification, number of family members and income, have a concrete relationship with the practices when buying.

**Table (16): Relationship between the consumer practices when buying and general properties of study sample:**

Sample properties	Consumer Practices When Buying						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	13	40.6	51.9	51.9	22	53.7	2	Chi <sup>2</sup> = 1.461	Insignificant
Female	19	59.4	48.1	48.1	19	46.3			
<b>Age</b>									
18-24	7	21.9	14	18.2	6	14.6	8	Chi <sup>2</sup> = 3.151	Insignificant
25-31	9	28.1	23	29.9	14	34.1			
32-38	8	25.0	17	22.1	13	31.7			
39-45	5	15.6	14	18.2	4	9.8			
45- more	3	9.74	9	11.7	4	9.8			
<b>Marital Status</b>									
Single	9	28.1	28	31.2	11	26.8	4	Chi <sup>2</sup> = 1.539	Insignificant
Married	22	68.8	51	66.2	30	73.2			
Bachelor	1	3.1	2	2.60	0	0.0			
<b>Qualification</b>									
Uneducated	0	0.0	4	5.2	0	0.0	10	Chi <sup>2</sup> = 12.499	Insignificant
Primary	1	3.1	1	1.3	1	2.4			
Middle	1	3.1	5	6.5	2	4.9			
Secondary	8	25.0	23	29.9	12	29.3			
Academic	20	62.5	36	48.6	16	39.0			
Higher than	2	6.3	8	10.4	10	24.4			
Academic									
Family members	1.57±4.55		2.81±5.54		1.96±6.07		103.2	F=2.626	Significant
Family Income	8028.11 ± 10531.25		5382.07 ± 8016.88		5291.04 ± 8170.73		147.2	F=2.115	Significant

These results agree with the view of Robert. T (1996); he indicates that the relationship between age and purchasing behavior is undetermined and often has a concrete relationship.

These results differ from the findings of Schwartz. J (1991) and his study about determining the type of relationship between consumer behavior and educational level. The results of this study showed that there is a positive relationship between education and purchasing behavior. This asserts the

importance of education and its effects on future results related to improving environmental protection.

#### **Consumer Practices related to checking the Guidance Card:**

Table (17) says that there is a concrete relationship between consumer practices related to checking the guidance card and the sex, age, marital status and qualifications; furthermore, there is an abstract relationship between the practices and the number of family members and income.

**Table (17): Relationship between consumer practices related to checking the guidance card and the study sample's general properties:**

Sample properties	Consumer practices related to checking the guidance card						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	1	50.0	11	64.7	63	48.1	2	Chi <sup>2</sup> = 1.661	Insignificant
Female	1	50.0	6	35.3	68	51.9			
<b>Age</b>									
18-24	0	0.0	4	23.5	23	17.6	8	Chi <sup>2</sup> = 7.221	Insignificant
25-31	1	50.0	2	11.8	43	32.8			
32-38	0	0.0	4	23.5	34	26.0			
39-45	1	50.0	4	23.5	18	13.7			
45- more	0	0.0	3	17.6	13	9.9			
<b>Marital Status</b>									
Single	1	50.0	6	35.3	37	28.2	4	Chi <sup>2</sup> = 1.138	Insignificant
Married	1	50.0	11	64.7	91	69.5			
Bachelor	0	0.0	0	0.0	3	2.3			
<b>Qualification</b>									
Uneducated	0	0.0	0	0.0	4	3.1	10	Chi <sup>2</sup> = 21.663	Insignificant
Primary	0	0.0	2	11.8	1	0.8			
Middle	1	50.0	2	11.8	5	3.8			
Secondary	1	50.0	4	23.5	38	29.0			
Academic	0	0.0	8	47.1	64	48.9			
Higher than Academic	0	0.0	1	5.9	19	14.5			
Family members	- ±7.0		2.66±6.09		2.40±5.39		103.2	F=0.605	Significant
Family Income	778.17 ± 17500.0		6345.45±7529.41		5941.83±8597.71		147.2	F=2.470	Significant

My, H. (2005) indicates that those who trust the guidance cards when buying clothes belong to a culture of consumers, especially from general classes of the public, that are interested in information regarding the fabrics' properties and how to take care of them and their effect on the environment. This culture helps consumers to practice good habits and this will preserve fabric durability and protect the environment.

#### **Practice Level when Choosing Clothing Colors:**

Table (18) says that there is a concrete relationship between consumer practices related to choosing clothing color and their age, qualifications, number of family members and income. There is also an abstract relation between their sex and social status.



**Table (18): Relationship between consumer practices related to choosing clothing colors and the study sample's general properties:**

Sample properties	Consumer practices related to choosing clothing colors						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	13	72.2	52	55.9	10	25.6	2	Chi <sup>2</sup> = 14.113	Significant
Female	5	27.8	41	44.1	29	74.4			
<b>Age</b>									
18-24	6	33.3	15	16.1	6	15.4	8	Chi <sup>2</sup> = 7.073	Insignificant
25-31	7	38.9	26	28.0	13	33.3			
32-38	2	11.1	24	25.8	12	30.8			
39-45	2	11.1	16	17.2	5	12.8			
45- more	1	5.6	12	12.9	3	7.7			
<b>Marital Status</b>									
Single	11	61.1	22	23.7	11	28.2	4	Chi <sup>2</sup> = 12.906	Significant
Married	6	33.3	69	74.2	28	71.8			
Bachelor	1	5.6	2	2.2	0	0.0			
<b>Qualification</b>									
Uneducated	0	0.0	3	3.2	1	2.6	10	Chi <sup>2</sup> = 6.514	Insignificant
Primary	0	0.0	1	1.1	2	5.1			
Middle	1	5.6	5	5.4	2	5.1			
Secondary	6	33.3	30	32.3	7	17.9			
Academic	11	61.12	40	43.0	21	53.8			
Higher than Academic	0	0.0	14	15.0	6	15.4			
Family members	2.0±5.0		2.52±5.63		2.27±5.21		103.2	F=0.447	Insignificant
Family Income	6548.21±6944.44		6177.82± 8712.90		5555.39± 9076.92		147.2	F=0806	Insignificant

The European Union issued a Law EEC/61/2002 that bans using color dyes that contain Azo dyes, which is a carcinogen.

#### Consumer Practices Related to Choosing Technical Clothing

Table (19) shows that there is a concrete relationship between the practice of choosing technical clothing (resistant to fires, microorganisms and lumps) and their age, social status, qualification, number of family members and income. There is an abstract relationship with their sex.

**Table (19) Relationship between consumer practices when choosing technical clothing and the general properties of the study sample:**

Sample properties	Consumer practices when choosing technical clothing						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	8	88.9	33	50.0	34	45.3	2	Chi <sup>2</sup> = 6098	Significant
Female	1	11.1	33	50.0	41	54			
<b>Age</b>									
18-24	1	11.1	12	18.2	14	18.7	8	Chi <sup>2</sup> = 5.801	Insignificant
25-31	2	22.2	23	34.8	21	28.0			
32-38	3	33.3	13	19.7	22	29.3			
39-45	2	22.2	13	19.7	8	10.7			
45- more	1	11.1	5	7.6	10	13.3			
<b>Marital Status</b>									
Single	3	33.3	18	27.3	23	30.7	4	Chi <sup>2</sup> = 5.840	Insignificant
Married	5	55.6	48	72.7	51	66.7			

Sample properties	Consumer practices when choosing technical clothing						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
Bachelor	1	11.1	0	0.0	2	2.7			
<b>Qualification</b>									
Uneducated	0	0.0	1	1.5	3	4.0	10	Chi <sup>2</sup> = 4.193	Insignificant
Primary	0	0.0	1	1.5	2	2.7			
Middle	1	11.1	4	6.1	3	4.0			
Secondary	3	33.3	20	30.3	20	26.7			
Academic	5	55.6	30	45.5	37	49.3			
Higher than Academic	0	0.0	10	15.2	10	13.3			
Family members	1.97±5.33		2.39±5.55		2.52±5.43		103.2	F=0.042	Insignificant
Family Income	9327.38 ± 9666.67		4730.21 ± 7633.33		6588.16 ± 9313.33		147.2	F=1.509	Insignificant

The Hohenstein Research Institute (1991) asserts that we should examine the added substances required to prepare clothes in a way that is not harmful to individual health or the environment. Furthermore, any added chemicals should be used to improve clothing within the allowed safety limits.

#### Practices Related to Choosing Clothing Packaging:

Table (20) shows the concrete relationship between consumer practices related to choosing packaging and the sample properties.

**Table (20): Relationship between general practices related to choosing packaging and the general properties of the study sample:**

Sample properties	General practices related to choosing packaging						Freedom degree	Test Type	Significance
	Weak		Average		Good				
	Sample	%	Sample	%	Sample	%			
<b>Sex</b>									
Male	19	59.4	52	46.8	4	57.1	2	Chi <sup>2</sup> = 1.709	Insignificant
Female	13	40.6	59	53.2	3	42.9			
<b>Age</b>									
18-24	6	18.8	20	18.0	1	14.3	8	Chi <sup>2</sup> = 4.138	Insignificant
25-31	9	28.1	33	29.7	4	57.1			
32-38	9	28.1	29	26.1	0	0.0			
39-45	4	12.5	18	16.2	1	14.3			
45- more	4	12.5	11	9.9	1	14.3			
<b>Marital Status</b>									
Single	10	31.3	32	28.8	2	28.6	4	Chi <sup>2</sup> = 0.474	Insignificant
Married	21	65.6	77	69.4	5	71.4			
Bachelor	1	3.1	2	1.8	0	0.0			
<b>Qualification</b>									
Uneducated	0	0.0	3	2.7	1	14.3	10	Chi <sup>2</sup> = 9.838	Insignificant
Primary	2	6.3	1	0.9	0	0.0			
Middle	3	9.4	5	4.5	0	0.0			
Secondary	6	28.1	32	28.8	2	28.6			
Academic	14	43.8	55	49.5	3	42.9			
Higher than Academic	4	12.5	15	13.5	1	14.3			
Family members	2.02±5.09		2.56±5.59		1.67±5.40		103.2	F=0.373	Insignificant
Family Income	6848.68±8759.37		5951.85±8644.14		4167.62±7071.43		147.2	F=0.234	Insignificant

Rondinelli, G. (1996) outlines the practice of packaging clothes in easily disposable packaging or

recycling and takes into account the environmental dimension, health levels, professional safety and

consumer acceptance of such practices. Countries in the European Union issued packaging guidelines and the acceptable packaging materials. This guide was put into practice in 1996. It says that it is necessary to review packaging substances before sending them to market.

### Second: Results of Laboratory Tests of the Study Samples:

This section reviews the results of empirical (ecological) tests on the study samples (ten samples). These tests included chemical tests of the study's selected products. These tests were performed according to the Egyptian Standards 2008 / Es 3787 (OEKO-TEX® 200 – testing ways) and European German tests (OEKO-TEX® 100/200:2012).

These standards include results of the tests of environmental and health standards for clothing to ensure that these products are not harmful to health and the environment; if found, these substances should be within the allowable safety limits.

The empirical study included four tests, as follows:

- 1- A pH-value test
- 2- A formaldehyde-free and released ppm test.
- 3- A test for phthalates – PVC plasticizers.
- 4- The test for Azo dyes: Cleavable Aryl amines.

### Samples from the Study:

**Table (21): Codes of local & imported samples:**

Sample	Type	Description	Color	Producer	Fabrics
1	Underwear	Overall for children, printed (3-6 months)	White printed with Orange	UAE (Dubai)	100% cotton
2	Underwear	Shorts for children (9-10 years)	White	UAE (Dubai)	100% cotton
3	Underwear	Women's shirt XL	Red	China	100% polyester
4	Underwear	Men's shorts 30 XL	White	China	80% polyester 20% cotton
5	Underwear	White T-shirt (9:10 years)	White	UAE (Dubai)	100% cotton
6	Outerwear	Men's frock (gelbab) – size 56	White	China	80% polyester 20% cotton
7	Outerwear	Children's frock – size 48	White	China	100% polyester
8	House wear	Men's trousers – size XXL	Grey, dark blue, Red	China	80% polyester 20% cotton
9	Outerwear	Omen's T-shirt – size XL	Printed orange	Syria	95% cotton 5% lycra
10	Underwear	Women's shorts	Beige	KSA	100% nylon

### Results of Chemical Tests on Study Samples:

Table (22) shows the results of the pH & formaldehyde (ppm) values:

Samples		1	2	3	4	5	6	7	8	9	10	Remarks
1- PH – Value	EN 1413	9.6	9.8	8.9	7.4	9.0	7.6	8.5	6.9	6.9	6.8	4.- -7.5
2- Formaldehyde (PPm)	Spot test	n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	n d= not detected

#### A - The pH-value Test:

Table (2) results show that samples 1, 2, 3, 5, 6, and 7 exceeded the allowable safety limits by 1.0, 0.1, 1.5, 1.4, 2.3, and 2.1, respectively and the pH-value were 8.50, 7.60, 9.0, 8.9, 9.8, and 9.6, respectively; this is a very high percentage.

These results also showed that samples 4, 8, 9, and 10 were at the allowable safety limits as follows: 6.8, 6.9, 6.9, and 7.4, respectively and all of them were in the alkaline realm. At the secure limits.

Nabil Abdelbaset et al. (1991) reports that it is easy to enhance the pH to meet the allowable safety

limits, but there are many samples that are refused licensing by the OEKO-TEX® 100 label because they are outside the standard limits. These refused samples usually have a pH that is higher than the allowable safety limits, in alkaline terms, and are rarely found to be too acidic. The Egyptian Standards 3787 OEKO-TEX®/200 (2002) and Abdelhamid Khierallah (2002) say that the increase of the alkaline percentage over the allowable safety limits can cause allergies and skin burns.

#### B - The Formaldehyde-Free and Released (ppm) test:

Our results showed that all of the samples are entirely free of formaldehyde.

Demir Canil, U. (1999) said that formaldehyde causes dangerous diseases and allergies. The study said that an increase in formaldehyde in air to more than 5.0 parts per million causes agitation in the mucous membranes and the respiratory system.

Magda Nasef et al. (2004) said that formaldehyde has the ability to cause cancer. In addition, free formaldehyde agitates the mucous membranes and may cause sore eyes as well as allergies.

German legislation requires that, in case of an increase in formaldehyde in the fabric of more than 1,500 g, a card must be on the product disclosing this level. The card should indicate that the product contains formaldehyde and should guide consumers to wash the products before use to reduce the effect on skin. The legislation also said that lumpiness and shrinking could be better resisted by using technology that requires less formaldehyde.

Sharkar, S. K. (2004) said that formaldehyde was used as to generate easy care fabrics that resist shrinking and lumpiness. It also said that formaldehyde was used in a mixture of Bush substances to prevent the growth of microorganisms and bacteria. Furthermore, formaldehyde compounds were used to treat cotton, fuscus, linen and compound

fabrics, and it is used as a dye stabilizer. It also contains binder substances used in printing on formaldehyde.

Alii Hebish (2011) indicated that the formaldehyde used in the cloth dying process is very dangerous because after washing clothes formaldehyde's density decreases, but it is still present inside clothes and is integrated with preparation substances. When these substances decay, formaldehyde appears again as a result of chemical interactions and it penetrates the fibers and the body absorbs it during direct contact or from the increase in temperature and the mixing of clothes with sweat, which causes dangerous diseases that may lead to cancer.

#### C - The (phthalates) – PVC Plasticizers:

This test was performed because phthalate contains vinyl chloride, and 6 groups of plasticizers were discovered from the family of phthalate compounds (see table 3). The results of the table showed that sample (1) contained di – (2 – ethylhexyl) (phthalate DEHP) of 260 ppm, Butyl benzylphthalate (BBP) of 250 ppm, and di – (2 – ethylhexyl) (phthalate DEHP) of 325 ppm; these are large and dangerous amounts to human health. When dividing  $6/1000=166,6$  as in the Egyptian Standards, 3,787 in a way that neither of the six groups' presence should be more than 166,6 ppm.

Table (23): Study samples & content of phthalates:

Test	Standard Method	1	2	3	4	5	6	7	8	9	10	Remarks
-PVC plasticizers (phthalates) (ppm)												
- di – ISO nonyl phthalate (DINP)	ES:3787	120	<50	<50	<50	<50	250	<50	<50	<50	<50	Limit: - < 1000 ppm For all 6-Phthalates 9
- di – n octyl phthalate (DNOP)		<50	<50	<50	<50	<50	260	<50	<50	<50	<50	
- di – (2 – ethylhexyl) phthalate (DEHP)		260	<50	<50	<50	<50	325	<50	<50	<50	<50	
- di – ISO decyl phthalate (DIDP)		<50	<50	<50	<50	<50	105	<50	<50	<50	<50	
- Butyl benzyl phthalate (BBP)		250	<50	<50	<50	<50	120	<50	<50	<50	<50	
- n-dibutyl phthalate (DBP)		<50	<50	<50	<50	<50	170	<50	<50	<50	<50	

When comparing the limitations standards with the results and values, we found very large values.

We also found di – ISO non yl phthalate (DINP) of 120 ppm, but this percentage was within the allowable safety limits.

Furthermore, samples 6 and 10 were found to contain:

di – ISO non yl phthalate (DINP) of 250 ppm

di – n octyl phthalate (DNOP) of 260 ppm

di – (2 – ethylhexyl) phthalate (DEHP)

Diethyl phthalate (DEP) of 170 ppm

These were large percentages that are very dangerous to human health. When dividing  $6/1000=166,6$ , as in the Egyptian Standards 3787, indicates that neither of the six groups' presence should not be more than 166,6 ppm.

When comparing the limitation standards with the results and values, we found their values to be very large.

In addition, di – ISO decylphthalate (DIDP) of 105 ppm and Butyl benzylphthalate (BBP) of 120 ppm were found, but these levels were within the allowable safety limits.

As for sample 8, di – n octyl phthalate was found (DNOP) of 230, an amount that is dangerous to human health. When dividing  $6/1000=166,6$  as in the Egyptian Standards 3787 in a way that neither of the six groups' presence should not be more than 166,6 ppm. The rest of the compounds were within the allowable safety limits.

The United States Environmental Protection Agency USEPA (1996) explained that phthalates in the form of chemical substances that are colorless and without a smell, formed from oil, cannot be evaporated and used to make plastics because they contain PVC poly phenyl. This aggregate helps to turn plastic from a solid state into a soft, bendable and formable state, depending on the need; phthalate usually constitutes 30% of vinyl's weight and sometimes reaches 50%.

The USEPA also said that exposure to phthalate levels that exceed the allowable safety limits, even if for a relatively small period, can cause health damage, such as light enteric disturbances and dizziness. The USEPA added that long-term exposure to these levels leads to the possibility of developing cancer, allergies, hormone disorders, sterility and deformity of fetuses.

Moreover, the USEPA issued a report showing a list of poisonous chemicals that contain estrogen mimickers. These substances are the following:

**di – ISO non yl phthalate (DINP)**

**di – n octyl phthalate**

**di – (2 – ethylhexyl) phthalate (DEHP)**

**di – ISO decylphthalate (DIDP)**

**Butyl benzylphthalate (BBP)**

**N- dibutyl phthalate (DBP)**

**di – (2 – ethylhexyl) adipate (DEHA)**

**Diethyl phthalate (DEP)**

**Diallyl phthalate (DAP)**

**Diocetyl phthalate (DoP)**

These substances are used in making toys, diapers, plastic used for packaging foods, rain coats, shower curtains, plastic room covering, clothing and fabric printing, fingernails polish, hair dyes, and essential volatile oil solvents.

The report showed that the DEP and DBP decreased the size of testicles and reduced sperm production in female mice that were exposed to the previously mentioned substances.

The USEPA (1997) issued a report showing the poisonous effects of (DBP) on experimental animals (mice) in the following ways:

- Testicle atrophy
- Being born with penis deformity
- Hanging testicles
- Testicle growth out of the scrotum
- Complete absence of testicles as a result of their non-formation during pregnancy.
- Complete absence or nonexistence of the prostate gland due to its non-development during fetus formation.
- Death of animal fetuses whose mothers were subjected to DBP.
- Deformity of small mice in their muscles, reproductive systems, ribs and chest bones.

The study stressed that fingernail polish, some hair dyes and food packaging plastic contains this substance.

Moreover, the Periodical Brochures of the Environmental Research Center, USA (1999) of environmental toxicologists, included an explanation of the relationship between exposure to chemical compounds known as phthalates and child obesity. This study used measures for determining obesity. The study also included measurements of phthalate compound density from the urine samples of approximately 400 children for determining the measures related to weight, such as a mass indicator for body, length and waist perimeter.

These results indicated that 97% of the participating children were subjected to phthalate compounds and that there was a pertinent relationship between ethyl phthalates and the mass modulus values and waist perimeter of children who gained weight as well as developed disorders in their nervous system development.

Zaki Ben Sadfa (2006) and Eman Abdelaziz (2008) said that there are two main poisonous substances that are used frequently in soft plastics in toys. They are also used for turning plastic from a solid state into a soft state, which is used for printing on clothes and fabrics. These two substances are DINP and DEHP in the phthalate family.

These results indicated that the two substances migrate into children's bodies at disturbing high levels. There are strong indications that DEHP has a carcinogenic and negative effect on the reproductive system. Furthermore, the study said that the presence of this substance leads to an increase in the micro bodies in the liver, which are known as "peroxisomes," which usually develop into liver cancer.

**Accordingly, these results indicate that**

- The studied products are not safe and are a threat to children in terms of cancer, as well as other dangerous diseases.

**D- Testing the Azo Dyes (Cleavable Aryl Amines) in PPM:**



**The Azo Group:**

Table (24): Results of Laboratory Tests of the Study Samples Related to Azo Dyes:

		1	2	3	4	5	6	7	8	9	10	
6- Cleavable Arylamines (PPm)												
- 4- Aminobiphenyl		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- Benzidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4 chloro-o- toluidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2 – Naphthylamine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- p- chloroaniline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2.4 Diaminoanisole		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4.4- Diaminobiphenylmethane		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 3.3 – Dichlorobenzidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 3.3 dimethoxybenzidine	German law 35 - LMBG 82.02- 2.3.4 – ES: 3787 - EN 14362-1.	n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	n d: not detected
- 3.3 Dimethylbenzodone		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 3.3' – Diamino - 4.4' – diaminobiphenylmethane		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- p- Cresidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4.4' – Methylene – bis - 2- chloroaniline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4.4' oxydianiline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4.4" Thiodianiline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- o- Toluidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2.4 Toluidine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2.4.5 – Trimethylaniline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2- methoxyaniline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- Aniline		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 1.4 – phenylenediamine		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 2.4 Xylidinen		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	
- 4- aminoazobenzene (pAAB)		n d	n d	n d	n d	n d	n d	n d	n d	n d	n d	

Table (24) shows the results related to the existence of Azo dye compounds. They consist of two unified hydrogen atoms as follows: -N=N-R. The Azo group comes as a separated component or in a group of dye's chemical formation; this group plays a primary role in the poisonous nature of dyes, especially those that emit ring amines that cause cancer and allergy diseases. Aniline is considered the simplest of the aromatic amines, and it is a highly poisonous compound. Other amines, Benzidine and its derivations, are considered carcinogenic compounds. These amines arise from sweat and children's saliva and they contain alkaline or reduced compounds [ (Magda Nasef (1996)].

Table (24) shows the ten samples that were free of the Azo substance, as the group of CANCERO GENOUS, or the Azo dyes, were discovered and they are the most suspect dyes in carcinogenic diseases, especially diseases from substances that are able to be dissolved and emit organic amine compounds that cause cancer. Furthermore, they are able to cause different types of allergies.

Thomas, K. et al. (2007) said that aniline, an organic compound of fragrant amines, is mainly used

for making dyes, especially blue and bright purple ones, which are called the Blue China Dyes.

Aniline is highly poisonous during skin contact. It affects the nerves while absorbing and leads to body sclerosis and, after a short period of not more than 30 minutes, to death.

The most significant symptoms of this disease are: headaches, dizziness, severe exhaustion with a sudden high temperature, loss of balance, severe shivering and spasms that lead to death; in the case of deadly doses, there is no possibility to save a person's life.

Accordingly, we can conclude that the European Union is committed to providing the highest safety standards for its citizens by banning 23 type of Azo dyes used in clothing, especially those that come in contact with the skin. However, at the same time, in Egypt coordination between technical and supervisory bodies is impossible. In contrast, Egyptian factories use these extremely dangerous substances without any restrictions or regulations.

Eman Abdelaziz (2008) and Ali Hebish (2011), Head of the National Campaign to Develop Fabric Industries, referred to the risk of using certain types of

internationally banned dyes in clothing noting that they are carcinogenic. Hebish also stressed that third world countries that produce these dyes do not take safety standards into consideration during production.

Furthermore, this researcher determined that a group of highly dangerous and banned substances that were discovered from his study are still being used in our products because of the absence of relevant quality standards. He called for imposing strict supervision on imported dyes and clothing, as well as local products. He also warned against Azo benzidine and described it as a very dangerous substance that causes cancer, as well as warning against other substances that produce amines.

These findings indicate that the KSA market allows for a group of clothing that may lead to the development of dangerous diseases.

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