

# Safety and Labelling Requirements for Textile Products - Design and Use Aspects

## Abstract

This article presents an analysis of changes that have occurred in recent times in legislation relating to the safety and labelling of textile products in connection with the coming into force of harmonised Community regulations relating to products containing textile fibres intended for sale on the EU market, with a presentation of a range of issues which may be the subject of future Community legislation. The article discusses, mainly in terms of design, current safety requirements for textile products and also provides guidance for the design of new textile solutions in relation to the assessment of potential adverse effects on the human body.

**Key words:** textile product, safety, labelling, design requirements.

## ■ Introduction

As of 8 May 2012 it is required in Poland, as well as in other European Union member states, to apply the Regulation (EU) No. 1007/2011 of the European Parliament and of the Council (EU) of 27 September 2011 on textile fibre names and related labelling and marking of the fibre composition of textile products, as well as repealing Council Directive 73/44/EEC and Directives 96/73/EC and 2008/121/EC of the European Parliament and of the Council [1]. The Regulation replaced existing Polish legislation on these issues in the form of the Regulation of the Council of Ministers of 6 April 2004 on the safety and labelling of textile products (Journal of Laws No. 81, item 743, as amended), which was repealed on 8 May 2012 on the basis of the Regulation of the Council of Ministers of 6 April 2012, repealing the Regulation on the safety and labelling of textile products (Journal of Laws of 2012, item 485) [3].

The substantive changes that result from the introduction of new regulations affect the textile products sold on the EU market, including, of course, those manufactured and distributed in Poland.

Current regulations should also be taken into account in the design of textile products and products containing at least 80% of fibres by weight, as well as in determining technical requirements in process

technology documentation or technical specifications.

The aim of this paper is to organise knowledge in the context of current safety requirements for materials and textile products that come into direct contact with the human body and to propose guidelines for the design of new textile products and the evaluation of those currently present on the market.

## ■ Safety of textile products

### Changes in the legislation on the safety of textile products

EU regulation - Regulation (EU) No 1007/2011, does not contain requirements for the safety of textile products. In particular, it has no restrictions in relation to:

- permissible concentration of amines in the textile product, which should not form as a result of a reduction in azo dyes,
  - the permissible level, depending on the type of textile product, of the concentration of free or released formaldehyde,
  - safety levels of volatile compounds from textile elements of interior decoration, including upholstery materials,
  - the use in textile products of certain substances and preparations,
- which were clearly defined in Annexes 8 - 11 to the Regulation of the Council of Ministers of 6 April 2004 on the safety and labelling of textile products (Journal of Laws No. 81, item 743, as amended), in force until 8 May 2012, and were an important element in ensuring a safe chemical composition and permissible level of emission from compounds for textile products [1, 2].

### Safety requirements under other provisions

The obligation to provide and sell only safe products results from the provisions of the Act of 12 December 2003 on general product safety (Journal of Laws No. 229, item 2275, as amended). Manufacturers and distributors, as well as academic institutions designing new textile products, must remember that according to the above Act, a product placed on the market should „in ordinary conditions or other reasonably foreseeable conditions of use, including the duration of the use of the product, and also depending on the type of product and method of starting as well as the requirements for installation and maintenance, shall not present a risk to consumers or create a negligible risk, which can be accepted for its normal use and taking into account the high level of requirements for the protection of human health and life”[4].

Also Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, hereinafter referred to as „REACH”, is a legal regulation defining the framework for the safety assessment of chemicals. Its regulations impose restrictions on the manufacture, marketing and use of dangerous substances, mixtures and goods.

In accordance with the provisions of the above regulation, manufacturers, import-

ers and further users have the responsibility to ensure that the substances they manufacture, place on the market or use (either in original form or in mixtures or goods) do not have a harmful impact on the human body or the environment. In addition to the substances, their groups and preparations that are covered by the general prohibition of their use, such as polychlorinated terphenyls (PCTs) with a PCT content higher than 0.005% by mass or the broad group of substances classified (in Part 3 of Annex VI to Regulation (EC) No 1272 / 2008) as carcinogenic, toxic for reproduction or mutagenic to germ cells, the provisions prohibit use, in particular, with regard to the following textile products:

- tris(2,3-dibromopropyl) phosphate / CAS 126-72-7/ in textile products, such as clothing, undergarments and linen, intended to come into contact with the skin and the marketing of products not meeting the above requirement;
- asbestos fibres (crocidolite asbestos /CAS 12001-28-4/, amosite asbestos /CAS 12172-73-5/, anthophyllite asbestos /CAS 77536-67-5/, actinolite asbestos /CAS 77536-66 - 4/, tremolite asbestos /CAS 77536-68-6/ and chrysotile asbestos /CAS 12001-29-5 and CAS 132207-32-0/) for the manufacture and placing on the market of the asbestos fibres mentioned and products containing them as a result of conscious addition (with limited exception);
- tri(aziridinyl) phosphineoxide /CAS 545-55-1/ in textile products, such as clothing, undergarments and linen, intended to come into contact with the skin and the marketing of products not meeting the above requirement;
- polybromobiphenyls and polybrominated biphenyls (PBB)/CAS p9536-65-1/ in textile products, such as clothing, undergarments and linen, intended to come into contact with the skin and the marketing of products not meeting the above requirement;
- mercury compounds for the staining of heavy-duty industrial textiles and yarn intended for their manufacture;
- organic compounds of dioctyltin (DOT) in textile products intended to come into contact with the skin, where the concentration in the product or part thereof is equal to or greater than 0.1% by mass;
- cadmium /CAS 7440-43-9/ and its compounds, and cadmium-plated products in equipment and machines

used in the manufacture of textile products and clothing / in the field of classification: [8444] [8445] [8447] [8448] [8449] [8451] [8452];

- azo dyes releasing any of the aromatic amines listed in Annex 8 to the *REACH Regulation* in concentrations higher than 0.003% by mass, in textile products (and leather products) which can come into direct and prolonged contact with the human skin or oral cavity, and it is prohibited to market or use as a substance or in mixtures of azo dyes listed in Annex 9 to the *REACH Regulation* in concentrations greater than 0.1% by mass, where they are used for colouring textile and leather products;
- nonylphenol /CAS 25154-52-3/ and nonylphenol ethoxylate as well as marking, in pure form or in mixtures, in concentrations equal to or greater than 0.1% by mass in the processing of textile and leather products (excluding processing without release into wastewater systems and into systems with special treatment in which process water is pre-treated to fully remove the organic fraction prior to biological wastewater treatment) [5].

Additionally normative documents, both European and Polish, define safety requirements for certain product groups representing textile products, as exemplified by the provisions of:

- PN-EN 340:2006 „Protective Clothing - General Requirements”, which contains detailed requirements with respect to safety and provides for verification of information confirming the safety of the product, including toxicity, allergenicity, carcinogenicity, toxicity of reproduction and mutagenicity of materials used in protective clothing [6],
- PN-V-87000:2011 „Light Ballistic Protection - Bulletproof and Shrapnel-Proof Vests - Requirements and Test Methods”, which requires documentation by the manufacturer concerning the lack of harmful effects on the human body in respect of materials used in the construction of ballistic vests [7].

#### Regulatory perspectives relating to the safety of textile products

The European Commission was obligated in Article 25 of *Regulation (EU) No 1007/2011* to conduct a study documenting the causal relationship between

chemical substances or their mixtures used in textile products and possible allergic reactivity.

The results of these studies are the basis for the submission of legislative proposals by the European Commission, and thus the first information about the possibility of the introduction of new regulations with regard to safety requirements of textile products may appear in the fourth quarter of 2013 [1].

## ■ Labelling of textile products

### Changes in legislation on the labelling of textile products

With regard to the labelling of textile products, *Regulation (EU) No 1007/2011* contains provisions for the requirements for the labelling and marking of textile products only in regard to the composition; but at the same time for both concepts, i.e. „labelling” and „marking” it introduces definitions of their meaning. Unlike the *Regulation of the Council of Ministers of 6 April 2004 on the safety and labelling of textile products* (Journal of Laws No. 81, item 743, as amended), in effect in Poland until 8 May 2012, the provisions of *Regulation (EU) No 1007/2011* do not place the requirement that the label or marking of a textile product contain the specification of the method of caring for the product [1, 2].

Fibre names included in the list in the EU regulation are consistent with those existing in Poland until 8 May 2012 under the above-mentioned *Regulation of the Council of Ministers*, with the use of specific names contrary to the features characterising them in accordance with the description defining them being prohibited (including the root word or adjective derived from the name of the fibre) [1, 2]. The list of names of fibres constituting Annex I to *Regulation (EU) No 1007/2011* includes two tables, i.e. **Table 1** - for natural fibres and **Table 2** - for synthetic fibres.

The division of fibres adopted is quite specific, for example it distinguishes between acetate and triacetate fibres based on the percentage content of acetylated hydroxyl groups characterising them, or acrylic and modacrylic based on their characteristic percentage in acrylonitrile repeat units [1].

The sale of a textile product requires the provision of information on the composition, with the use of textile fibre names in accordance with the above list on the label or marking and in some cases in commercial documents [1].

In accordance with EU regulations, the labels or markings of textile products should be prepared in the official language or languages of the member state in whose territory the product will be sold to consumers, unless the member state concerned decides otherwise [1].

The main differences with respect to the labelling and marking of the fibre composition of textile products available on the market include:

- the introduction, in respect of textile products consisting of many types of fibres, of the obligation to specify all types of fibre components and their percentage content in the total weight of all constituent fibres of the textile product in descending order,
- the elimination of the rule allowing for providing information about fibre constituting more than 85% of a textile product composed of multiple types of fibres, by specifying the percentage content of only this fibre, or using the term „at least 85%”,
- changing the rules for the use of the term „other fibres”, which can now be used for:
  - fibres which are not on the list of textile fibre names under EU regulations,
  - fibre constituting 5% of the total weight of the textile product (which lowers the formerly applicable level by 5%) and fibres which collectively constitute up to 15% of the total weight of the textile product (whereas previously it was sufficient to state in this manner the percentage of the total of all fibre types, the contents of which separately was less than 10% of the total weight of the textile product); while at the time of manufacture it is difficult to identify these fibres in a product which is a mixture of textile fibres, whereas just before or just after the term „other fibres” their percentage of the total weight of the product must be stated,
- introduce a requirement to inform about the presence in textile products of non-textile parts of animal origin

using the wording „contains non-textile parts of animal origin”,

- extending the range of textile products which are not subject to mandatory labelling or marking (Annex V of *Regulation (EU) No 1007/2011*) to covers for mobile phones and portable audio players with an area not exceeding 160 cm<sup>2</sup>,
- removing felts and felt hats from the list of textile products, which are not subject to mandatory labelling or marking,
- extending the range of elements that are not taken into account in the determination of the composition (Annex VII of *Regulation (EU) No 1007/2011*) to:
  - additional elastic yarn used in the cuffs of socks and the stiffening and reinforcing yarn used for the toe and heel in socks,
  - additional elastic yarn used in waist of tights and the stiffening and reinforcing yarn used for the toe and heel therein [1, 2].

The test methods listed in Annex VIII to *Regulation (EU) No 1007/2011*, used to determine the composition of textile products, make small changes compared with those applicable in Poland until 8 May 2012, under the *Regulation of the Council of Ministers*. The basic changes include:

- the introduction, for a quantitative analysis of fibre mixtures, of a general recommendation for alternative procedures that allow the dissolution of fibres remaining after the standard method, if not impossible for technical reasons,
- the replacement of the reagent in the form of kerosene, in particular methodologies, and petroleum ether, (which probably is an obvious mistake, for the Corrigendum to Directive 96/73/EC of the European Parliament and of the Council of 16 December 1996 on certain methods for quantitative analysis of binary textile fibre mixtures, published on 11 August 2007 in the OJ L 211 made the change according to which: „petroleum ether” has been replaced with: „kerosene”) [1, 2, 8].

In addition, Article 19 of *Regulation (EU) No 1007/2011* allows for specifying the composition according to harmonised standards to be introduced in the future to Annex VIII of the above-mentioned regulation, and allows laboratories respon-

sible for testing fibre mixtures for which there is no uniform analysis methods at the EU level to determine the fibre composition of such mixtures, indicating the result obtained, the method used and the accuracy in the analysis report [1].

### Requirements for including information resulting from other provisions

Normative documents, both European and Polish ones, specify the method of labelling for certain product groups representing textile products such as various types of protective clothing or bulletproof vests [6, 7], which also does not conflict with the provisions of Regulation (EU) No 1007/2011. These products are included in Annex V to the Regulation and released (under Article 17) from the requirement of labelling and marking [1].

In addition, companies planning to introduce textile products to the Polish market must also be aware of requirements concerning the information to be communicated with the products, resulting from other applicable provisions such as:

- *Act of 7 October 1999 on the Polish language* (unified text: Journal of Laws of 2011 No 43, item 224),
- *Act of 27 July 2002 on special conditions of consumer sale and amending the Civil Code* (Journal of Laws of 2002 No. 141, item 1176, as amended),
- *Act of 2 July 2004 on the freedom of economic activity* (unified text: Journal of Laws of 2007 No 155 Item 1095, as amended),

that is, above all, the obligation to use the Polish language and place information allowing for identifying the product, defining the company and its address, and the issue of maintenance instructions with the product [9 - 11].

### Prospects for legislation relating to the marking of textile products

Any new requirements of the European Union in the field of the marking and labelling of textile products will be made after 30 September 2013, following a report submitted to the European Parliament and the Council by the European Commission. The report is to be based on consultation with relevant stakeholders, including consumers, with current European and international standards in this regard, and is to be applied, among others, to:

- a) the origin labelling system, which would provide consumers with access



- to reliable information on the country of origin and any additional information allowing for full traceability of textile products, and take into account the results of changes to the regulations in relation to the country of origin;
- b) a uniform system for care labelling;
  - c) a uniform system for determining the size of the relevant textile products;
  - d) an indication of allergenic substances;
  - e) electronic labelling and other new technologies, as well as the use of language-independent symbols or codes to identify the fibres [1].

Studies conducted in recent years among Polish consumers with regard to ecological and social markings (i.e. labels containing specific qualitative characters) showed that the most noticeable is information provided in the form of labels or markings [12]. At the same time, in the application of the system of individual markings it is very important to increase consumer awareness, popularise and ensure the visibility of markings [12, 13].

### Designing new solutions in the field of textile products and their safety

When designing new solutions for textile products, both in material and design, it is important to remember that a reference only to the requirements presented above entails the risk of marketing a product with a high risk of danger to health or, in critical cases, even the life of the potential user.

The safety assessment of textile products made using nanotechnology currently introduced on a wide scale, through the use of the above-mentioned research methods (in accordance with the legal requirements described), does not provide a complete documentation of their harmlessness.

When designing new materials and final textile products, one should, of course, use, in terms of their safety verification, existing methodologies recognised as the research methods required. However, it is necessary to expand the scope of the assessment to methodology which directly determines the risk of adverse effects of substances, often newly used in this field, on the human body.

As a basis for determining the scope of the verification tests it is important to

define the potential scope of the use of final textile products and the conditions in which they will be stored, transported, and, most importantly, used (for example, the possibility of heat or open flame, leading to the formation of toxic combustion products). This will allow to define the boundary conditions of the study.

It should be noted that when defining conditions for carrying out tests that verify safety, they should be determined as close as possible to the standard conditions of use. It should also be anticipated what chemical (such as human sweat, rain, preservatives and cleaning agents) or physical factors (e.g. temperature, visible radiation or UV) interact with the material and what the indirect and direct result of such interaction is. Some substances, such as those in macromolecular form, are not potentially toxic, while under the influence of UV radiation they undergo depolymerisation to derivatives with high toxicity and have a high affinity to migrate to the human body.

Also the ageing processes that occur during the storage of products, or even materials, can affect the formation (due to degradation and also by synthesis of new chemical compounds) of potentially toxic substances.

Changes in the structure of fibres occurring under the action of physical or chemical agents at the time of normal use or cleaning agents during maintenance can also cause the migration of chemical substances which, in a new product, do not have the capacity to migrate.

It should be noted that fibre treated as a base material for the production of textile products is not always pure from a chemical point of the view. It contains a whole group of low molecular weight substances and polymers, as well as organic and inorganic compounds, whose origin can be various:

- existing in the material from which the fibre was made (e.g. catalysts and other substances supporting the polymerisation process for synthetic polymers, and naturally occurring substances in animal or vegetable raw materials),
- introduced or formed at the fibre formation level (e.g. materials aiding processing, antioxidants, dyes, optical brighteners, or resulting from exposure to high temperature or pressure),

- introduced in the manufacturing process of textile materials (such as dyes, processing aids, and means of introducing additional functional properties like antimicrobial properties).

In designing the tests, all of the above aspects should be taken into account. What is worth noting, the presence of potentially toxic fibres does not always carry a risk of adverse effects on the human body. This effect can occur only when the substance migrates in sufficient quantities into the human body - i.e. will be available to the body.

Taking this into account, the safety testing of newly developed textile materials should begin with the analysis of chemicals potentially occurring in the fibre (quality first, and only when identified - quantity), determining the possible effects of use on the availability of potentially toxic chemicals, and analysing the limiting conditions affecting the existence of such availability. It is important to remember that the conditional existence of the adverse effects of fabric (see: chemical substance from such material) depends on the occurrence of its relevant quantity directly available to the user's body (one or more times).

Most frequently selected are conditions which are the worst case scenario or the most common. In the first variant the most unfavourable conditions of use are selected, which can lead to the following: a) the formation of toxic substances, b) their migration, and c) the migration of toxic substances already present in the fibre.

However, it should be noted that the same conditions simulated may affect both the appearance of new, often toxic chemicals, as well as the disintegration of substances already existing in the fibre and susceptible to migration.

In the second case, the most adverse and most common conditions that could cause the migration of potentially toxic substances should be simulated. The disadvantage of this method is that only substances available solely under conditions of intended use are evaluated (product designed specifies them using only predictions). In this case, it is necessary to recommend the need to verify the profile of the migrating substances, each time, for each change in the conditions of use expected.

Specification of the conditions of use should be understood as defining all factors of the environment, both acting by physical means (e.g. temperature) and chemical means (e.g. human sweat), and, of course, the total impact time of such action or such factors (which usually occurs due to the synergistic nature of the effect of the above factors).

Selection of the temperature and duration of its impact usually does not cause problems. In contrast, chemical agents, usually in the form of liquids, also represent a medium for the migration of potentially toxic substances from fibres into the human body. For this reason, extraction is the most suitable for this type of test. Usually it is recommended to use extraction media, or those with properties as close as possible to natural properties (e.g. artificial sweat) or substances with extreme polar and apolar properties (therefore obtaining the widest profile of substances migrating from the fibre in the eluate).

It should be emphasised that the selection of conditions of extraction tests should be carried out with particular attention, mainly because of their potential impact on the test substance. This means that during the tests one should beware of their implementation under conditions that can lead to changes in the composition, e.g. by degradation of polymers or organic materials under the impact of high temperatures, which in the end can cause wrong results.

Identification, at an early stage, of substances possibly occurring in the fibre (often through data obtained directly from the design process or from manufacturers of chemicals used to manufacture/process the fibre) allows for the selection of an appropriate testing methodology that enables the quantitative assessment of the potentially toxic chemicals identified. Their lack in the eluate from the fibre or presence at an acceptable level (according to the available data on toxicity) allows to determine the probability of the risk of adverse effects to the human body. In the case where substances with an unknown toxicity profile are used in the manufacture/processing of fibres, (which often happens during the design process), and especially when their presence was confirmed in extraction tests, necessary tests to demonstrate the absence of toxicity must be performed (Figure 1).

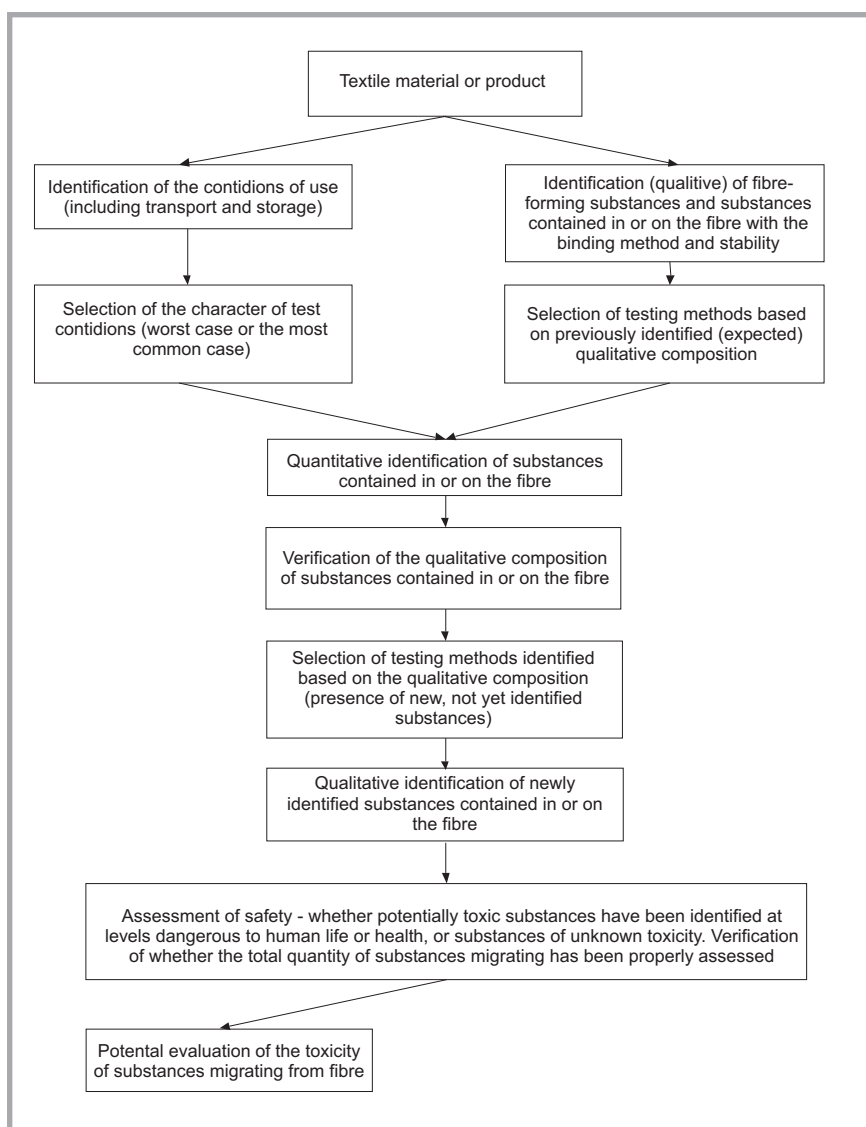


Figure 1. Procedure proposed for identifying the safety of textile materials.

## Summary

The following conclusions can be drawn from the analysis of changes in legislation on the safety and labelling of textile products:

1. The introduction of legal regulation in the form of *Regulation (EU) No 1007/2011* combines rules previously existing in several acts, then transposed into national law, and provides a guarantee of uniform rules in all EU member states with regard to the names of textile fibres and related labelling and marking of the fibre composition of textile products.
2. The lack of requirements for safety and indicating the method of the maintenance of textile products in provisions dedicated exclusively for this group of products should not pose a risk to consumers. Their interests are protected in other legislation dis-

cussed in “**Safety requirements under other provisions**” and “**Requirements for including information resulting from other provisions**”. At the same time the lack of a requirement to include information about the method of maintenance directly on the textile product, in particular clothing, may cause some inconvenience to the end user needing this information, not only at the stage of making a decision to purchase a product but also in the implementation of the various maintenance processes.

3. The appearance of the requirement of the application of *Regulation (EU) No 1007/2011* and the repeal of the *Regulation of the Council of Ministers of 6 April 2004 on the safety and labelling of textile products* (Journal of Laws No. 81, item 743, as amended) is associated with the need to review and

update documents describing textile products.

4. Design processes for new textile products should be carried out, especially in regard to the verification of aspects of their safety, according to well-defined rules in reference to, which should be particularly emphasised, a rationally chosen testing methodology. Irrational and, in a way, "automatic" assignment of the test range only in reference to current standardised tests can often lead to wrong conclusions. From the point of view of the rationality of the testing processes carried out it is extremely important to define the conditions of the planned future use of textile products and assign such steps of the safety verification process to best reflect them.



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Received 20.09.2012 Received 02.07.2013

# XIII International Izmir Textile and Apparel Symposium

2-5 April 2014 Antalya, Turkey

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