# LEGAL MEASURES FOR CONTROLLING DANGEROUS SUBSTANCES IN TEXTILE AND GARMENT PRODUCTS: A CASE STUDY OF AROMATIC AMINES


**BY**

**MISS ORANEE KANOKSOPHIT**


**A THESIS SUBMITTED IN PARTIAL FULFILLMENT**
**OF THE REQUIREMENTS FOR THE DEGREE OF**
**MASTER OF LAWS IN BUSINESS LAWS**
**(ENGLISH PROGRAM)**
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ENTITLED

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has been approved as partial fulfillment of the requirements for
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on August 14, 2015

Chairman _____
(Professor Amnat Wongbandit, Ph.D.)

Member and Advisor _____
(Associate Professor Anan Chantara-opakorn, J.S.D.)

Member and Co-Advisor _____
(Professor Jumphot Saisoonthorn, Ph.D.)

Member _____
(Judge Nopporn Bhotirungsiyakorn)

Dean _____
(Associate Professor Narong Jaiharn)

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| Author | Miss Oranee Kanoksophit |
| Degree | Master of Laws |
| Department/Faculty/University | Business Laws (English Program)<br>Faculty of Law<br>Thammasat University |
| Thesis Advisor | Associate Professor Anan Chantara-opakorn, J.S.D. |
| Thesis Co-Advisor | Professor Jumphot Saisoonthorn, Ph.D. |
| Academic Years | 2014 |


# ABSTRACT


Aromatic amines are widely used for preparing and manufacturing of dyes using in textile and garment businesses. After the last process of manufacturing of textile and garment products, aromatic amines can be remained as a residue in finished products and may be migrated and absorbed into a human body through the skin or mouth. The International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) has classified some aromatic amines as known human carcinogens that are capable of causing cancer. Epidemiological studies have shown that the exposure to aromatic amines is strongly associated with the occurrence of bladder cancer and the abnormality of bladder such as a spectrum of lesions of the epithelium of the urinary bladder, dysuria, and painful in the lower abdomen. Moreover, aromatic amines have also been reported to exert a high level of acute and chronic toxicity causing the fatality.

At present, many countries have placed important on this matter and have restricted and controlled the use of aromatic amines by means of legal measures. However, the existing laws of Thailand are not sufficient to control the use of aromatic amines. Thus, consumers may be exposed to aromatic amines and harmed by

them. This thesis mainly focuses on the legal measures for controlling the use of aromatic amines in foreign countries including the European Union, the United States of America and the People's Republic of China in order to propose the appropriate and effective legal measures for protecting Thai consumers from aromatic amines causing cancer contaminating in textile and garment products.

By studying and investigating the legal measures for controlling aromatic amines in those foreign countries and relating Thai laws, the outcome illustrates that the proposed appropriate regime is designating the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17 of the Industrial Standards Act B.E. 2511 (1968). Thus, Thailand can prevent importation of the products which do not conform to the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007). By this means, the consumers in Thailand will be protected.

**Keywords**: Aromatic Amines, Textile and Garment, Industrial Product Standards, Hazardous Substances

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Miss Oranee Kanoksophit
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# CHAPTER 1
# INTRODUCTION

## 1.1 Background and Problems

There are many types of chemicals involving in every day of human's life. At any time, everyone has the opportunity to expose to chemicals in the air he or she breathe, foods, pharmaceuticals, cosmetics, consumer products daily used in residential homes and the industry. As a result of the usefulness and utility of chemicals, the number of the production and use of chemicals has continually increased. It can be seen that the income from the chemical business accounts for 7 percent of the total revenue of the world and accounts for 9 percent of the revenue from international trade.[1]

For textile and garment trades, they require the up-to-date trend of fashion in every season. From the early 1990s, many fashion brands have looked for methods to increase their revenues by encouraging consumers to purchase more clothes as well as buy them more frequently.[2] It is now the practice to have six to eight fashion collections compared to the traditional two to four collections a year with very short period of fashion cycles, known as "fast fashion" trend, in order to promptly response to the customers' needs and preferences. One of the main factors to bring about this fast fashion trend in textile and garment business is consumers' behavior called disposability. Some consumers will imitate some celebrities and refuse to wear the same clothes again and again. To achieve this strategy, fashion brands need

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[1] Supranee Jongdeepaisarn, *International System of Grouping Chemical Products and Labeling: Analysis the Effect to the Government*, Business and Thai Society Sectors, (2003). (สุปราณี จงดีไพศาล, **ระบบสากลการจัดกลุ่มผลิตภัณฑ์เคมีและการติดฉลาก: วิเคราะห์ผลกระทบต่อภาครัฐ ภาคธุรกิจ และภาคประชาสังคมของไทย** (กรุงเทพมหานคร: สำนักงานกองทุนสนับสนุนการวิจัย, 2546, หน้า 1.)

[2] Greenpeace International, *Toxic Threads: The Big Fashion Stitch-Up*, *available at* http://www.greenpeace.org/sweden/Global/sweden/miljogifter/dokument/2012/Toxic_Threads_The%20Big_Fashion_Stitch_Up.pdf.

increasingly short turnaround times, from design through to the finished garments, bringing the production of the more high fashion items closer to the point of sale or a store.[3]

In such compress production, different toxic chemicals and substances are used in the manufacture of textile and garment; such as Alkylated Phenol Ethoxylates (APEO), aromatic amines, phthalate, and formaldehyde. This research will emphasize on aromatic amines using to prepare dyes in the dyeing process. Aromatic amines are widely utilized as a starting material or initial substance for preparing and manufacturing of dyes, especially azo dyes. Since aromatic amines are a starting material of azo dyes, once azo dyes break down under reductive condition and cleavage of the linkage, they can release aromatic amines. After the last process of manufacturing of textile and garment products, aromatic amines released from azo dyes can be remained as a residue in finished products and may be migrated and absorbed into a human body through the skin or mouth. Some aromatic amines are safe to use, while, some tends to cause cancer in humans namely 4-aminobiphenyl, benzidine, and 2-naphthylamine, 4,4'-methylene-bis-(2-chloro-aniline), and o-toluidine.[4] Expert authorities such as the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) have classified some of these aromatic amines as known human carcinogens that are capable of causing cancer. According to the list of aromatic amines restricted to use in many countries, there are totally 24 aromatic amines widely limited and restricted to use in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, consisting of 4-aminobiphenyl; benzidine; 4-chloro-o-toluidine; 2-naphthylamine; o-aminoazotoluene; 5-nitro-o-toluidine; 4-chloroaniline; 4-methoxy-m-phenylenediamine; 4,4'-methylene dianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethoxybenzidine; 4,4'-methylenedi-o-toluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-

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[3] Ethical Fashion Forum, *Fast fashion, "value" fashion*, *available at* http://www.ethicalfashionforum.com/the-issues/fast-fashion-cheap-fashion.

[4] The International Agency for Research on Cancer (IARC), *Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs*, Volumes 1 to 42, Supplement 7 (March 1987).

(2-chloro-aniline); 4,4'-oxydianiline; 4,4'-thiodianiline; o-toluidine; 4-methyl-m-phenylenediamine; 2,4,5-trimethylaniline; o-anisidine; 4-aminoazobenzene; 2,4-xylidine; and 2,6-xylidine. They are classified into various groups according to the International Agency for Research on Cancer classifications known as the IARC Classifications; consisting of Group 1 carcinogenic to humans (meaning that there is sufficient evidence of carcinogenicity in humans) accounted for 5 substances, Group 2A probably carcinogenic to humans (meaning that there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals) accounted for 1 substance, Group 2B possibly carcinogenic to humans (meaning that there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals) accounted for 15 substances, and Group 3 not classifiable as to its carcinogenicity to humans (meaning that the evidence of carcinogenicity is inadequate in humans and limited in experimental animals) accounted for 3 substances. However, it does not mean that aromatic amines listed in Group 2A, Group 2B, and Group 3 are not a determination of non-carcinogenicity or overall safety. The European Scientific Committee on Toxicity, Ecotoxicity and Environment (CSTEE) has affirmed that the lethal dose of aromatic amines values between 250 – 2,000 mg/kg body weight so that the associated cancer risks resulting from aromatic amines listed in Group 2A, Group 2B, and Group 3 give cause for high concern. As a result, the exposure to aromatic amines listed in Group 2A, Group 2B, and Group 3 should also be minimized or eliminated.[5]

In the 1890s, the large bladder cancer cases were reported among dye workers due to aromatic amines as the culprits.[6] The investigation by the Greenpeace International has looked for either component of materials incorporated within the product, or as residues remaining from use within manufacturing processes and found

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[5] The Australian Competition and Consumer Commission, *Azo Dyes available at* https://www.productsafety.gov.au/content/index.phtml/itemId/1006626.

[6] J.V. Rodricks, *Carcinogens Calculated risks: the toxicity and human health risks of chemicals in our environment*, Chapter 7, Cambridge University Press (1992).

cancer-causing aromatic amines from the use of dyes chemicals in clothing products of many global fashion brands.[7]

As a result of the toxicity of aromatic amines, environmental protection is becoming an increasingly concern to consumers' health. It has stipulated the criteria in the use and sale of products containing aromatic amines. Now, regulation existing in certain countries restricts the use of aromatic amines as well as the sale of products containing dyes which can degrade under specific test conditions to release aromatic amines at limited concentration. In the European Union, 22 aromatic amines are restricted to use in articles that may come into direct and prolonged contact with the human skin or oral cavity. The maximum total concentration for all of the aromatic amines is limited to use at 30 mg/kg.[8] In the People's Republic of China, under the Chinese standard for textiles which is the GB 18401-2010 or the National General Safety Technical Code for Textile Products, 24 aromatic amines are restricted to use at limited concentration of 20 mg/kg in any apparel, decoration textiles and household textiles placed on the market of the People's Republic of China. With respect to the United States of America, the U.S. Environmental Protection Agency proposed a Significant New Use Rule (SNUR) on benzidine, one of aromatic amines substances. As a result, the manufacturers and importers of benzidine are required to submit a notice called a Significant New Use Notice (SNUN) to the U.S. Environmental Protection Agency at least 90 days before they manufacture or import of benzidine.

However, with strict regulations restricting the use of aromatic amines in many countries, especially developed countries, and high rate of wage causing higher cost of production, fashion companies shifted their manufacturing based on the underdeveloped or developing countries where they can irresponsibly run business without concerning to society and environment. In those countries where aromatic amines are not restricted to use, aromatic amines are freely used in dyeing processes

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[7] *supra* note 1, at 9.

[8] The Restrictions on the Manufacture, *Placing on the Market and Use of Certain Dangerous Substances*, Preparations and Articles, Regulation (EC) No 1907/2006, Appendix 8, Point 43 Azocolourants, List of Aromatic Amines and Annex XVII.

without any restricted law, regulation even policy to control the use of them. These contaminated clothes will be delivered to markets where there is no restriction. As a result, the toxicity of aromatic amines will spread out to other areas other than production base countries.

Thailand, as a developing country with high skilled labors and proper infrastructures, is a production base of textile and garment (clothing) products, both for sale in domestic market and export for sale in foreign countries. It is also one of the countries that has a large number of textiles and finished garments imported. Also, according to the import statistic of the Thai Customs Department between January to December of the year 2014, the number of imported dyes and synthetic organic coloring matter totaled 11,207,480,281 Baht. Most of the dyes and synthetic organic coloring matter imported into Thailand was from the People's Republic of China, India, and Germany respectively. The People's Republic of China imported dyes, and synthetic organic coloring matter amounted 4,934,029,942 Baht, or 44.02 percent of the total imported amount, followed by India amounted 2,211,622,199 Baht and Germany amounted 846,789,250 Baht. For dyes using aromatic amines as material, they were imported to Thailand at the total amount of 1,145,185,670 baht, for those imported from the People's Republic of China accounting for 400,972,531 baht, or 35.01 percent of total amount of dyes using aromatic amines as material imported to Thailand.[9] These show a large number of imported dyes and coloring matter for use in Thailand. In Thai legal system, there are some statutory provisions that is involving and relating to the control of aromatic amines which are hazardous substances that may cause cancer. However, the existing laws of Thailand are not sufficient to control the use or sale of dyes using aromatic amines as a starting material as well as textile and garment products containing aromatic amines. The followings are examples of existing statutory provisions relating to the control of aromatic amines:

1. Hazardous Substance Act B.E. 2535 (1992) is the main statutory law to control and manage hazardous substance. It classifies hazardous substances into 4

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[9] Thai Customs Department, *Import-Export Statistics available at* http://www.customs.go.th/wps/wcm/connect/Library+cus501th/InternetTH/11/.

types according to the needs for control; *Type 1* hazardous substance is that of which the production, import, export, or having in possession must comply with the specified criteria and procedures; *Type 2* hazardous substance is that of which the production, import, export, or having in possession must first be notified to the authority and must also comply with the specified criteria and procedures; *Type 3* hazardous substance is that of which the production, import, export, or having in possession must obtain a permit; and *Type 4* hazardous substance is that of which the production, import, export, or having in possession is prohibited. The list of hazardous substances under the control of the Hazardous Substance Act B.E. 2535 (1992) is provided in the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013). Under this Notification, there are only 2 aromatic amines, 4-aminobiphenyl and benzidine, designated as a hazardous substance *Type 3* and *Type 4*. Since there are 22 aromatic amines widely restricted to use in textile and garment industries, so another 20 aromatic amines may still be used in Thai textile and garment industries without any restriction under this law.

In addition, with respect to the Notification of Ministry of Industry on List of Hazardous Substances (No. 2) B.E. 2558 (2015), all 24 aromatic amines are classified as carcinogen substances under this Notification. They are designated as hazardous substances *Type 1* which the production, import, export, or having in possession of such substances must comply with the specified criteria and procedures. This criteria and procedure specify that the producers or importers of aromatic amines with the amount of more than 1,000 kilograms per year must notify such fact to the Department of Industrial Works within 60 days from the date of the production or import of those aromatic amines. However, the Notification (No. 2) does not impose any restriction for the producers and importers to use aromatic amines. It only requires the producers or importers to provide the notification to the Department of Industrial Works for produce and import aromatic amines. So, after submitting the notification, the producers or importers can use aromatic amines in the manufacturing of textile and garment products without any limitation and restriction. Consequently, the Hazardous Substance Act and its subordinate laws are not sufficient to control the use of aromatic amines in textile and garment products.

2. Industrial Product Standards Act B.E. 2511 (1968) regulates standards for industrial products. The list of standards is divided into different categories, such as consumer's products, engineering, food, medical science, and chemical. Under the Industrial Product Standards Act, the industrial standards may be classified into 2 categories; the industrial standards determined by the Notification of the Ministry of Industry according to Section 15 and the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the industrial standards according to Section 17. There are existing industrial standards determined by the Notification of the Ministry of Industry according to Section 15 involving to textile and garment business including the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) according to the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550). They set the requirements that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. According to Section 16, the manufacturers of textile and garment products conforming to the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) may submit the application for a license to display the standard mark on their products on their demand. Once the manufacturers are granted a license from the Thai Industrial Standards Institute, they shall have the right to exhibit the standard mark on their products. The sanction of the industrial standards according to Section 15 includes the Thai manufacturers shall not be able to export their textile and garment products, which do not conform to the industrial standards including the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007), to any foreign countries having their laws and regulations controlling or restricting the use of aromatic amines such as the European Union and the People's Republic of China. Also, although there are no specific laws and regulations controlling on aromatic amines in some countries but the manufacturers may have the liability according to the provisions of the product liability laws if their products cause damage or injury to the consumers. Moreover, in case that the manufacturers do not receive a license to display the standard mark from

the Thai Industrial Standards Institute, they shall not have the right to exhibit the standard mark on their products. As a result, the consumers may not trust the quality and standard of the products that do not display the standard mark and may decide not to buy them. It is, thus, proposed to enhance the control measure under the Industrial Product Standards Act by determining the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17. This would be the effective and appropriate solutions for controlling the use of aromatic amines which are hazardous substances in textile and garment products in Thailand.

33. Factory Act B.E. 2535 (1992) controls the operation of the factory. It stipulates the procedures and regulations for operating of the factory starting from the construction, operation, expansion and safety of factories in Thailand, and also controls the levels of industrial pollution releasing through factory activities. There is also the Notification of the Ministry of Industry No. 10 B.E. 2537 (1994) issued pursuant to the Factory Act B.E. 2535 (1992) prohibits a factory producing dyes to use benzidines, benzidine compounds, chromium and chromium compounds as raw material of its dyes and prohibits dyeing and finishing factories to use dyestuff containing benzidine, benzidine compounds, chromium and chromic compounds as components in the production process. However, benzidine is classified as one type of aromatic amines while, aromatic amines comprise of 24 substances restricted to use in textile and garment articles which may come into direct and prolonged contact with the human skin or oral cavity following to the legislations of many countries. In addition, only the factory under the definition of the Factory Act B.E. 2535 (1992) is enforced by the Notification. In case that the manufacturers are not classified as a factory according to the definition, they will not be obliged to comply with the requirements of the Notification. The consumers may still have a risk causing from another aromatic amines substances other than benzidine. Accordingly, the Factory

Act and its subordinate law are not sufficient to control the use of aromatic amines and to protect consumers from aromatic amines causing cancer.

At present, Thailand has no sufficient horizontal product safety law to deal with this problem. It is, thus, necessary to study the control measures of aromatic amines and analyze existing solutions in other countries, and investigate current Thai laws relating to the control of hazardous chemicals and propose appropriate and effective solutions for Thai society.

**1.2 Hypothesis**

Aromatic amines, proved to cause cancer in a human, are widely used in the dyeing process as a starting material or initial substance for preparing and manufacturing of dyes. They can be remained as a residue in finished textile and garment products and may be migrated and absorbed to a human body through the skin or mouth. According to epidemiological study of the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO), there are total 24 aromatic amines restricted to use in textile and garment articles which may come into direct and prolonged contact with the human skin or oral cavity. Currently, there are the industrial standards involving to textile and garment products namely the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) according to the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550), issued pursuant to Section 15 of the Industrial Product Standards Act B.E. 2511 (1968). They set a requirement that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained over 30 mg/kg in finished fabric and garment products. The sanction of the industrial standards according to Section 15 is that Thai manufacturers shall not be able to export their textile and garment products which do not conform to the industrial standards, including the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007), to any foreign countries having their laws and

regulations controlling or restricting the use of aromatic amines such as the European Union and the People's Republic of China. It is, therefore, propose to enhance the control measures under the Industrial Product Standards Act by determining the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17.

**1.3 Objectives of Study**

(a) To study and analyze measures, laws and regulations of foreign countries in regard to the control of aromatic amines shown to cause cancer used in textile and garment articles.

(b) To study and analyze related statutes of Thailand in connection with the control of using hazardous substances in textile and garment articles.

(c) To propose the appropriate solutions by adopting foreign measures, laws and regulations in order to prevent and protect Thai consumers from aromatic amines causing cancer.

**1.4 Scope of Study**

(a) Mainly focuses on the study of the measures and existing legislations available in foreign countries regarding the control of aromatic amines shown to cause cancer using in textile and garment articles.

(b) Study the foreign measures and legislations as a model to adopt appropriate and effective legislative and non-legislative solutions for textile and garment industries in Thailand.

## 1.5 Methodology

This thesis is mainly based on documentary research involving the use of texts and documents as source materials, for instance, books, publications, research, newspapers, articles, educational journals, of both government and private sectors, including domestic and international laws and information on the Internet. A survey is also carried out by interviewing governmental officials to collect facts, information and opinions.

## 1.6 Expected Results

(a) Increasing level of awareness on the harmful effect of aromatic amines shown to cause cancer, containing in textile and garment products.

(b) Understanding the policies, measures and legislations regarding the control of using hazardous substances in textile and garment articles of foreign countries.

(c) Having a proposal for adoption of appropriate legislative measures to create the control measures of using aromatic amines in textile and garment manufacturing in Thailand.

(d) Providing the policies, measures and legislations of foreign countries for Thai exporters to adopt their textile and garment products complying with the regulations of those countries in order to increase their competitiveness.

# CHAPTER 2
# INTRODUCTION TO THE MANUFACTURING AND CHEMICALS USED IN TEXTILE AND GARMENT PRODUCTS

Textile and garment have the important role playing in human's life. Everyone certainly put on clothes every day. In other words, they are everyday experiences in our life. From the childhood blanket to the wedding dress, and favorite worn-out jeans, fabric plays a major role not only in how people live but also how people feel. We also use fabric to express ourselves. We use different clothing styles, colors, materials and textures to express mood, attitude, and personality. Textile and garment also serve a practical function. They protect us from cold and heat, the rain, and the bright sun. There are many contributions that textile and garment make to our everyday lives; however, some dangerous may be resulted from them. There are many chemical substances involving in the manufacturing of textile and garment products. Some of them may cause cancer in human's health through everyday exposure.

In this chapter, the manufacturing process of textile and garment products and chemical used in each process will be briefly discussed. Then, this chapter will focus to study on the toxicity of aromatic amines, dangerous substances that harm to human's life and impact on the environment.

## 2.1 The Manufacturing of Textile and Garment Products

The supply chain of textile and garment industries starts from fiber to finished products. There are four main processes of manufacturing; yarn production, weaving or knitting, cleaning-dyeing-printing-finishing, and garments manufacturing described as follows.

The first step is yarn production. This process is to transform the natural fibers as the raw materials into yarn and thread. In order to get yarn and thread, natural fibers need to pass the spinning process. The fibers are drawn from the wheel in the spinning process, and then, the fibers are combined into a long string of yarn or

thread. They are collected on a cylindrical object called a bobbin. Next step, yarn and thread in the bobbin will be jointly transferred, through the machine, into fabric.[10]

The process of joining the individual yarns and threads together is called weaving or knitting. As a result, the fabric may classify into two types; woven fabric and knitted fabric. This fabric may be full of contamination, such as oils, wax and other components that are naturally occurring in most fibers so that it must be cleaned with several of chemicals and cleaners. Also, the fabric is discolored so it will be treated to refine the base color by bleaching and make it ready for dyeing. There are many characteristics of textile and clothing products that can satisfy consumers' demands; for example, proper fixation of color in textile and clothing products against light, perspiration and washing, both primarily and after prolonged use. Accordingly, it is necessary to ensure that the substances providing color to the fiber must have high affinity, equal color and resistance to fading.[11] Other than dyeing process, the fabrics may pass through the printing process in order to apply color to fabrics with definite patterns or designs. Moreover, to improve the quality of fabrics, manufacturers will apply the functional characteristics to fabrics by passing them to the finishing process, such as mercerizing, flame retardant, anti-wrinkle, water repellent, waterproof and antistatic finish.[12] The objective of the various finishing processes is to produce fabric more satisfactory to the consumers.[13]

Through the above processes, the fabric is ready to be manufactured as finished garments. This process starts with design or sketch, patternmaking, cutting,

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[10] Howstuffworks?, *How is fabric created? "The Manufacturing Process of Fabric"*, *available at* http://home.howstuffworks.com/home-decor/accessories/how-is-fabric-created2.htm

[11] Farah Maria Drumond Chequer, et al., Eco-Friendly Textile Dyeing and Finishing, *Textile Dyes: Dyeing Process and Environmental Impact* (2013).

[12] Textile Learner, *Introduction of Textile Finishing Process*, *available at* http://textilelearner.blogspot.com/2011/03/description-of-textile-finishing_1796.html.

[13] Inc. Encyclopædia Britannica, *Textile finishing processes Basic methods and processes*, *available at* http://global.britannica.com/EBchecked/topic/589392/textile/15902/Textile-finishing-processes.

sewing and assembling, quality control, and end of the process by packaging and delivery to customers.

### 2.2 Chemicals Used in Textile and Garment Manufacturing

Different substances are used in the manufacture of textile and garment for cleaning, dyeing as well as bringing special functions and appearance of the finished product. Chemicals are used in fiber manufacturing, bleaching, improving optical brightness and for dyeing and printing of fabrics. Some substances are used to increase absorption and to reduce shrinkage. When laundering, many of these chemicals can be rinsed out with detergents and water; however, residual levels may remain in the finished products.[14]

The samples of chemical substances using in textile and garment products, classified by each process of manufacturing,[15] are presented in Table 2.1.

**Table 2.1 : The List of Chemical Substances using in Textile and Garment Manufacturing Processes**

| Manufacturing Process | Related Chemical Substance |
|---|---|
| Yarn production | - Mineral oil (spinning oils)<br>- Polycyclic aromatic hydrocarbons (PAHs)<br>- Lubricants |

[14] The Organization for Economic Co-operation and Development (OECD), *Case Study 10: Release from the Use Phase of Textile and Leather Products* Resource Compendium of PRTR Release Estimation Techniques Part 4: Summary of Techniques for Releases from Products *available at* http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2011)7/part2&doclanguage=en.

[15] Thailand Textile Institute: THTI, **Manual on the REACH for Thai Textile Industries**, (1ed. Bangkok; 2010). (สถาบันพัฒนาอุตสาหกรรมสิ่งทอ (Thailand Textile Institute: THTI, คู่มือ REACH สำหรับอุตสาหกรรมสิ่งทอไทย (กรุงเทพมหานคร, 2553).

**Table 2.1 :** (Continue)

| Manufacturing Process | Related Chemical Substance |
|---|---|
| Yarn production | - Sodium hydroxide |
| Weaving or Knitting | - Polycyclic aromatic hydrocarbons (PAHs) |
| Cleaning | - Alkylated phenol ethoxylates (APEO)<br>- 4-nonylphenol<br>- Linear alkylbenzene sulphonate (LAS)<br>- Complexing agents such as Bis(hydrogenated tallow alkyl) dimethyl ammonium chloride (DTDMAC)<br>- Phosphates<br>- Ethylene diamine tetraacetic acid (EDTA) |
| Dyeing | - Cadmium compound (Cd), Mercury compound (Hg), Arsenic compound (As), Nickel compound (Ni), Antimony compound (Sb), Lead compound (Pb), Copper compound (Cu), Cobalt compound (Co), Zinc compound (Zn), Tin compound (Sn)<br>- Aromatic amines<br>- Pentachlophenol (PCP)<br>- Chlorinated benzenes such as 1,4 dichlorobenzene<br>- Dichloro toluene |
| Printing | - Cadmium compound (Cd), Mercury compound (Hg), Arsenic compound (As), Nickel compound (Ni), Antimony compound (Sb), Lead compound (Pb), Copper compound (Cu), Cobalt compound (Co), Zinc compound (Zn), Tin compound (Sn)<br>- Aromatic amines<br>- Pentachlophenol (PCP)<br>- Chlorinated benzenes such as 1,4 dichlorobenzene |

**Table 2.1 :** (Continue)

| Manufacturing Process | Related Chemical Substance |
|---|---|
| Printing | - Dichloro toluene<br>- Formaldehyde<br>- Phthalate such as Di(2-ethylhexy) phthalate (DEHP) |
| Finishing<br>*Flame retardant* | - Polybrominated biphenyls (PBB)<br>- Polybrominated diphenylethers (PBDE)<br>- Tris-(2,3-dibromopropyl)-phosphate (TRIS)<br>- Tris-(aziridinyl)-phosphine oxide (TEPA)<br>- Hexabromocyclododecane (HBCDD)<br>- Organochloro compound (hexachlorocyclopentadiebe)<br>- Chloroparaffins<br>- Zircon complexes |
| *Anti-wrinkle* | - Formaldehyde |

There is always an environmental impact causing from the textile and garment manufacture. The impact starts with the use of pesticides during the cultivation of plants for the natural fibers, the erosion posed by the sheep farming or the emissions during the production of synthetic fiber. So, there is the environmental effect in the process of production, where thousands of different chemicals are used to reach the final stage of textile products.

This research will mainly study on aromatic amines using in the dyeing process. Aromatic amines are predominantly used as the initial chemical in the synthesis of pigments, dyes, pesticides, drugs and rubber products and are also used as a laboratory chemical. Some of them are also used in cosmetics. It is acceptable that

some aromatic amines have been shown to be carcinogenic in humans.[16] In the next part, the content will provide the detail of aromatic amines as well as the information of toxicity of aromatic amines and its impact on human health and the environment.

### 2.3 Aromatic Amines Used in Dyeing Process

In the dyeing process, dyes may be defined as substances which, when applied to a substrate, impart color to the substrate by a process that, at least temporarily, destroys any crystal structure of the colored substances. They adhere to compatible surfaces by physical adsorption, mechanical retention, the formation of a covalent bond or complexes with salts or metals, or by the solution.[17] In other word, dyes are substances that add color to textiles. They are incorporated into the fiber by chemical reaction, absorption, or dispersion.

Generally, dyes possess color because they (1) absorb light in the visible spectrum, (2) exhibit resonance of electrons, which is a stabilizing force in organic compounds, (3) have a conjugated system, i.e. a structure with double or single bonds, and (4) have at least one chromophore group (color-bearing group).[18] The part of the dyes that bring color into the articles called a chromophore. A group of chromophore is represented by the radicals following; azo (-N=N-), carbonyl (=C=O), carbon (=C=C=), carbon-nitrogen (>C= NH-CH=N-), nitroso (-NO or N-OH), nitric (-NO2 or =NO-OH) and sulfide (>The C=S, carbon-sulfur). When any one of these features is lacking from the molecular structure, the color is lost. The color of dyes depends on

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[16] The World Health Organization The International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans* Some Aromatic Amines, Organic Dyes, and Related Exposures *available at* http://monographs.iarc.fr/ENG/Monographs/vol99/mono99.pdf.

[17] Amit Bafana, Sivanesan Saravana Devi, and Tapan Chakrabarti, *Azo dyes: past, present and the future*, (2011).

[18] The World Health Organization The International Agency for Research on Cancer, *General Introduction to the Chemistry of Dyes*, Volume 99 *available at* http://monographs.iarc.fr/ENG/Monographs/vol99/mono99-7.pdf.

their ability to absorb light in the visible range of electromagnetic radiation (400 – 700 nm).

Based on method of application, dyes may be classified into direct dyes, vat dyes, sulphur dyes, reactive dyes, basic dyes, disperse dyes and acid dyes. There are several classes of dyes as follows:[19]

(1) Direct dyes

They are given this name because they color the fibers "directly" and eliminate the need for a mordant, or the chemical fixing agent that lots of dyes need. They have an affinity for a wide variety of fibers such as cotton, viscose, silk jute, linen. They do not make any permanent chemical bond with the cellulosic fibers but are attached to it via very weak hydrogen bonding. The only advantage of these dyes is that the light fastness is little better. Light fastness means the resistant capacity against fading in the light. However, this is also in few cases only. Using direct dyes release the effluent containing 5 – 20 percent of original dyestuff, plus salt and dye fixing agents.

(2) Basic dyes

Basic Dyes are cationic soluble salts of colored bases. They are applied to substrate with anionic character where electrostatic attractions are formed. Basic dyes are not used on cotton because the structures are neither planar nor large enough for sufficient substantively or affinity. Generally, basic dyes are called cationic dyes because their chromophore molecules contain a positive charge, unlike most dyes, which have either a negative charge or no net electronic charge at all. The word "basic" refers to bases, as opposed to acids. Basic dyes are powerful coloring agents. It can be applied to wool, silk, cotton and modified acrylic fibers. Basic dyes are also used in the coloration of paper.

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[19] O EcoTextiles, *Dyes – synthetic and "natural" available at* https://oecotextiles.wordpress.com/2009/09/01/dyes-synthetic-and-natural/#_ftn1.

(3) Disperse dyes

Unlike many other types of dyes, disperse dyes are far less water soluble. This means that disperse dyes, by themselves, do not dissolve easily in water. That said, disperse dyes are most commonly utilized with dye bath solutions. In order to make these dye bath solutions function properly, dispersing agents are utilized to increase the water solubility of the dye (hence the name "disperse dyes"). In addition to being used in conjunction with a dispersing agent, disperse dyes achieve the best results when the dying process takes place at high temperatures. At lower temperatures, while disperse dyes may result in uneven and less vibrant colors, at higher temperatures (around 120°C to 130°C), disperse dyes produce evenly distributed and bold colors. Due to their chemical properties and the behavior explained above, disperse dyes are commonly used to dye polyester fibers and other related materials such as nylon.

(4) Acid dyes

Acid Dyes are used to dye protein fibers such as silk, wool, angora, alpaca, mohair, feathers, and even man-made Nylon, which is chemically similar to silk. The acid part of the name comes into play because a very mild acid like household white vinegar, or odorless Citric Acid, is used to lower the pH of the dye bath so it is slightly acidic, which causes the dye to bond to the protein fibers. Acid dyes are better for protein fibers than other types of dye, as proteins respond better to mildly acidic dye baths than to alkali; they tend to stay softer, and silk keeps its sheen.

(5) Vat dyes

Vat dyes are an ancient class of dye, based on the original natural dye, Indigo, which is now produced synthetically, and its close chemical relative, historic Tyrian Purple. Both cotton and wool, as well as other fibers, can be dyed with vat dyes. These dyes need a powerful reducing agent, such as alkali, to make them soluble. As a result, they are expensive and complicated to use. Their effluent contains 5 – 20 percent of residual dyestuffs, plus reducing agents, oxidizing agents, detergents, and salts.

(6) Sulphur dyes

Most of all sulphur dyes contain sodium sulphide, which endangers to human's life. Sodium sulphide is known to alter living thing's DNA, corrode and rust sewage systems, damage treatment works and leads to high pH and unpleasant odors. Their effluent shows high percentage around 30 – 40 percent of the dyestuff plus alkalis and salt.

(7) Reactive dyes

These dyes bond directly with the fibers, rather than merely remaining as an independent chemical entity within the fiber so that they create colorfast and long-lasting shades. They can be used with cool water that will help to save energy. Reactive dyes are usually defined as "low impact dyes" because of a high rate of fixation to fibers.

Concerning to the chemical structure of the above-mentioned dyes, direct dyes, basic dyes, disperse dyes, and acid dyes contain one or more nitrogen-nitrogen double bonds (-N=N-) called "azo groups" in their chemical structure.[20] These groups of dyes can be called "azo dyes." They are commonly prepared by coupling aromatic amines with other aromatic amines. They are the largest and most resourceful class of dyes account for 60 – 70 percent of all organic dyes currently produced in the world especially produced in the People's Republic of China and India.[21] Approximately, 40,000 different dyes and pigments are used industrially presumably more than 2,000 different azo dyes are currently used, and over 70 tons of these dyes are produced annually.[22] The first azo dyes were manufactured by C. Mene in 1861 which is Aniline Yellow and by Carl Alexander Martius in 1863 which is Bismarck Brown.[23] Azo dyes are used for coloring a variety of consumer goods. They are also used

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[20] A. Püntener and C. Page, *European Ban on Certain Azo Dyes available at* http://www.tfl.com/web/files/eubanazodyes.pdf.

[21] The Organization for Economic Co-operation and Development (OECD), *OECD Trade Policy Studies, Environmental Requirements and Market Access*, (2005).

[22] Puvaneswari N., Muthukrishnan J. & Gunasekaran P., *Toxicity assessment and microbial degradation of azo dyes*, **Indian Journal of Experimental Biology**, Volume 44, p 618 – 626 (2006).

[23] Amit, *supra* note 17.

widely in substrates such as textile fibers, leather, plastics, papers, hair, mineral oils, waxes, foodstuffs, and cosmetics.[24] As aromatic amines are the initial substances for preparing azo dyes; comprising of direct dyes, basic dyes, disperse dyes, and acid dyes, once these dyes break down, they can release aromatic amines. It is acceptable that some aromatic amines have been shown to be carcinogenic in humans. After the last process of manufacturing of textile and garment products, aromatic amines can be remained as a residue in finished products and may be migrated and absorbed to the human body through the skin or mouth.

According to the import statistic of the Thai Customs Department between January, to December of the year 2014, a number of imported dyes and synthetic organic coloring matter totaled 11,207,480,281 Baht. Most of the dyes and synthetic organic coloring matter imported into Thailand was from the People's Republic of China, India, and Germany respectively. The People's Republic of China imported dyes, and synthetic organic coloring matter amounted 4,934,029,942 Baht, or 44.02 percent of the total imported amount, followed by India amounted 2,211,622,199 Baht and Germany amounted 846,789,250 Baht.[25] The number shows that most of the dyes and coloring matter using in Thailand are imported from the People's Republic of China. For direct dyes, basic dyes, disperse dyes, and acid dyes using aromatic amines as starting material, they were imported to Thailand at the total amounted of 1,145,185,670 Baht, of which they were imported from the People's Republic of China amounted 400,972,531 Baht, or 35 percent of total amount direct dyes, basic dyes, disperse dyes, and acid dyes imported to Thailand.

### 2.3.1 Aromatic Amines

Aromatic amines are widely used in dyeing industry as a starting material or initial substances for preparing and manufacturing of different types of dyes, especially for preparing and manufacturing direct dyes, basic dyes, disperse

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[24] *supra* note 5.

[25] *supra* note 8.

dyes, and acid dyes.[26] As aromatic amines take part in many chemical reactions, they are also used in many chemical industries, for example for manufacturing of petrol and diesel fuel, varnishes, and antioxidants. Besides, aromatic amines are widely used in some metal-coating multifunctional compositions for a motor, transmission, and industrial oils. Some aromatic amines find application in plastic, textile and rubber industries. They are used in the production of clothes, rubber, plastics.

Aromatic amines are the organic compound that contains one or more amino groups joined to aromatic compounds or systems. Amino groups consist of a nitrogen atom attached by single bonds to hydrogen atoms (N-H), alkyl groups, aryl groups, or a combination of these three.[27] An organic compound that contains an amino group is called an "amine." For aromatic compounds, they are originally named because of their fragrant properties. They are unsaturated hydrocarbon ring structures that exhibit special properties, including unusual stability.[28] Aromatic amines are classified as primary, secondary, or tertiary based upon the number of carbon-containing groups that are attached to the nitrogen atom. Those aromatic amine compounds that have only one group attached to the nitrogen atom are primary, while those with two or three groups attached to the nitrogen atom are secondary and tertiary, respectively.[29]

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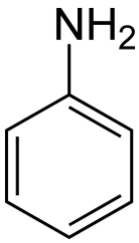
[26] Derelanko, M. & Hollinger, M., *Handbook of Toxicology*, **Informa Healthcare**, Second Edition (2001).

[27] Inforplease, *Amino Group available at* http://www.infoplease.com/encyclopedia/science/amino-group.html.

[28] Boundless Chemistry, *Properties of Aromatic Compounds available at* https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/organic-chemistry-23/aromatic-hydrocarbons-165/properties-of-aromatic-compounds-635-3608/.

[29] Houghton Mifflin Harcourt, *Introduction to Amines available at* http://www.cliffsnotes.com/sciences/chemistry/organic-chemistry-ii/amines/introduction-to-amines.

**Figure 2.1** Structure of Simplest Aromatic Amines: Aniline




The carcinogenesis literature documents innumerable studies demonstrating that administration of a considerable variety of aromatic amines to experimental animals of different species induces cancers in those animals.[30] For example, in a paper presented at an international conference held in Würzburg, Germany, in October 1992, it was reported that in one factory, all of 15 workers involved in distilling 2-naphthylamine had developed bladder cancer.[31]

Since 1971, the International Agency for Research on Cancer (IARC), the specialized cancer agency of the World Health Organization (WHO), has studied and published the "IARC Monographs on the Evaluation of Carcinogenic Risks to Humans." In this Monograph, the term "agent" refers to any entity or circumstance that is subject to assessment in a Monograph.[32] The agent is described according to the wording of one of the following categories, and the designated group is given. The categorization of an agent is a matter of scientific judgment that reflects

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[30] US National Library of Medicine National Institutes of Health, *Monocyclic Aromatic Amines as Potential Human Carcinogens: Old is New Again available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2802674/.

[31] OECD, *supra* note 16.

[32] The International Agency for Research on Cancer (IARC), *Preamble* IARC Monographs on the Evaluation of Carcinogenic Risks to Humans *available at* http://monographs.iarc.fr/ENG/Preamble/CurrentPreamble.pdf.

the strength of the evidence derived from studies in humans and experimental animals and from mechanistic and other relevant data. The agent is classified into 5 groups;[33]

(1) Group 1: Carcinogenic to humans accounted for 116 agents

This category is used when there is *sufficient evidence of carcinogenicity in humans*. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than sufficient but there is *sufficient evidence of carcinogenicity in experimental animals* and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

(2) Group 2A: Probably carcinogenic to humans accounted for 73 agents

This category is used when there is *limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals*. In some cases, an agent may be classified in this category when there is inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of limited evidence of carcinogenicity in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

(3) Group 2B: Possibly carcinogenic to humans accounted for 287 agents

This category is used for agents for which there is *limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals*. It may also be used when there is inadequate evidence of carcinogenicity in humans, but there is sufficient evidence of

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[33] The International Agency for Research on Cancer (IARC), *Agents Classified by the IARC MONOGRAPHS (last updated March 23, 2015) available at* http://monographs.iarc.fr/ENG/Classification/.

carcinogenicity in experimental animals. In some instances, an agent for which there is insufficient evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

(4) Group 3: Not classifiable as to its carcinogenicity to humans accounted for 503 agents

This category is used most commonly for agents for which the *evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals*. Exceptionally, agents for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans. Agents that do not fall into any other group are also placed in this category. An evaluation in Group 3 is not a determination of non-carcinogenicity or overall safety. It often means that further research is needed, especially when exposures are widespread, or the cancer data are consistent with differing interpretations.

(5) Group 4: Probably not carcinogenic to humans accounted for 1 agent

This category is used for agents for which there is evidence suggesting *lack of carcinogenicity in humans and in experimental animals*. In some instances, agents for which there is inadequate evidence of carcinogenicity in humans but evidence suggesting lack of carcinogenicity in experimental animals, consistently and strongly supported by a broad range of mechanistic and other relevant data, may be classified in this group.

More than 900 agents have been evaluated, of which more than 400 have been identified as carcinogenic, probably carcinogenic, or possibly carcinogenic

to humans.[34] Aromatic amines account for 12 percent of the 415 chemicals known or strongly suspected to be carcinogenic in humans.[35]

### 2.3.2 List of Aromatic Amines Restricted to Use

There are more than one hundred aromatic amines using in the industries, but only some of them have been proven to be carcinogenic to human. The list of restricted aromatic amines was first issued by the German Consumer Goods Ordinance in 1994. It introduced a prohibition on the production, import and sale of garments and fabrics in Germany dyed with dyes using aromatic amines as the initial substances. Forbidden are only those small numbers of aromatic amines. The list of restricted aromatic amines contained 20 substances, as shown in No. 1 – 20, Table 2.1, *infra*.

In 2002, the European Parliament issued the European Directive 2002/61/EC and published the list of restricted aromatic amines which shall not be used over 30 mg/kg. In this regard, 2 aromatic amines were added to the German list including o-anisidine and 4-amino azobenzene, as shown in No. 21 – 22, Table 2.1, *infra*, so that the European Union list consisted of 22 aromatic amines. This Directive restricts the use of only about 5 percent of all aromatic amines.[36]

Afterward, in 2003, the People's Republic of China has adopted a compulsory standard known as the National General Safety Technical Code for Textile Products. There are 2 aromatic amines added in the European Union list including 2,4-xylidine and 2,6-xylidine, as shown in No. 23 – 24, Table 2.1, *infra*.

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[34] The International Agency for Research on Cancer (IARC*), IARC Monographs on the Evaluation of Carcinogenic Risks to Human* at http://monographs.iarc.fr/.

[35] USA National Toxicology Program. *11th Report on Carcinogens, U.S. Department of Health and Human Services*, (2005).

[36] The Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers (ETAD), *ETAD Information on the 19th Amendment of the Restrictions on the Marketing and Use of certain azocolourants available at* http://www.etad.com/documents/Downloads/publications/etad_information_19th_amendment.pdf.

Therefore, according to the list of aromatic amines limited and restricted to use in many countries, there are totally 24 aromatic amines restricted to use in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity. The following is a list of aromatic amines, comprising of 24 substances, generally restricted in textile and garment industries around the world:

**Table 2.2 : List Aromatic Amines Restricted to Use**

| No. | CAS Registry Numbers | Substances | IARC Classification |
|---|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl | Group 1 |
| 2 | 92-87-5 | Benzidine | Group 1 |
| 3 | 95-69-2 | 4-chloro-o-toluidine | Group 2A |
| 4 | 91-59-8 | 2-naphthylamine | Group 1 |
| 5 | 97-56-3 | o-aminoazotoluene | Group 2B |
| 6 | 99-55-8 | 5-nitro-o-toluidine | Group 3 |
| 7 | 106-47-8 | 4-chloroaniline | Group 2B |
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine | Group 2B |
| 9 | 101-77-9 | 4,4'-methylenedianiline | Group 2B |
| 10 | 91-94-1 | 3,3'-dichlorobenzidine | Group 2B |
| 11 | 119-90-4 | o-dianisidine | Group 2B |
| 12 | 119-93-7 | 3,3'-dimethylbenzidine | Group 2B |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine | Group 2B |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine | Group 2B |

**Table 2.2 :** (continue)

| No. | CAS Registry Numbers | Substances | IARC Classification |
|---|---|---|---|
| 15 | 101-14-4 | 4,4'-methylene-bis-(2-chloro-aniline) | Group 1 |
| 16 | 101-80-4 | 4,4'-oxydianiline | Group 2B |
| 17 | 139-65-1 | 4,4'-thiodianiline | Group 2B |
| 18 | 95-53-4 | o-toluidine | Group 1 |
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine | Group 2B |
| 20 | 137-17-7 | 2,4,5-trimethylaniline | Group 3 |
| 21 | 90-04-0 | o-anisidine | Group 2B |
| 22 | 60-09-3 | 4-amino azobenzene | Group 2B |
| 23 | 95-68-1 | 2,4-xylidine | Group 3 |
| 24 | 87-62-7 | 2,6-xylidine | Group 2B |

Aromatic amines are classified into various groups according to the IARC classifications, including carcinogenic to humans (Group 1) accounted for 5 substances, probably carcinogenic to humans (Group 2A) accounted for 1 substance, possibly carcinogenic to humans (Group 2B) accounted for 14 substances, and not classifiable as to its carcinogenicity to humans (Group 3) accounted for 2 substances.

## 2.4 Impact of Aromatic Amines on Human Health and Environment

Aromatic amines represent one of the most important classes of industrial and environmental chemicals. However, many of them have been reported to be powerful carcinogens, mutagens, and hemotoxicants.

### 2.4.1 Impact of Aromatic Amines on Human Health

According to the IARC Monographs, there are around 40 substances, including many aromatic amines, using in dye industry which have been evaluated as being carcinogenic (Group 1), probably carcinogenic (Group 2A), or possibly carcinogenic to humans (Group 2B means when there is inadequate evidence of carcinogenicity in humans but, there is sufficient evidence of carcinogenicity in experimental animals).[37] However, only 24 substances of those substances using in dye industry are aromatic amines.

Epidemiological studies of the International Agency for Research on Cancer of the World Health Organization have shown that the exposure to aromatic amines substances listed in Group 1, consisting of 5 substances; 4-aminobiphenyl, benzidine, 2-naphthylamine, 4,4'-methylene-bis-(2-chloro-aniline), and o-toluidine, can cause bladder cancer in human, as following reports:

(1) 4-aminobiphenyl

There was reported 19 cases of bladder cancer in 171 (11.1 percent) male workers engaged in the production of 4-aminobiphenyl. The exposure took place in a chemical plant in the United States of America between 1935 and 1955. In a later follow-up study, it was reported that among 315 male workers exposed to 4-aminobiphenyl, 53 had developed bladder tumors. The interval until the development of bladder cancer varied from 15 to 35 years after beginning of the exposure.[38]

(2) Benzidine

The exposure to benzidine has been shown to produce a spectrum of lesions of the epithelium of the urinary bladder, which may precede

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[37] The International Labour Organization (ILO), *"Occupational Sources" available at* http://www.ilo.org/legacy/english/protection/safework/cis/products/safetytm/iarclist.htm.

[38] The World Health Organization The International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*, Volume 99 (2010).

appearance of cancer.[39] There was reported 47 tumors of the urinary bladder (31 carcinomas, 16 papillomas) that occurred between 1931 and 1960 in six Italian dyestuff factories among workers involved in benzidine production and utilization. Twenty of the 47 cases occurred between 1931 and 1948 among 83 Italian dyestuff workers. In 1973, a group of 25 men occupationally exposed to benzidine during its manufacture in a plant in Cincinnati, USA and 13 men (52 percent) developed transitional cell bladder carcinoma after a mean exposure of 13.6 years and an average latency (time from first exposure) of 16.6 years. The latency period of occupational bladder cancer after exposure to benzidine could be longer than 40 years.[40]

(3) 2-naphthylamine

The exposure to 2-naphthylamine either alone or when present as an impurity in other compounds, is strongly associated with the occurrence of bladder cancer.[41] Several reports from the 1960s and 1970s described cases of bladder cancer among workers exposed to 2-naphthylamine in France, Italy and Japan. It is found that the cumulative incidence of bladder cancer among British coal-tar dye workers exposed to 2-naphthylamine, and not to other aromatic amines, was 25 percent (12 cases among 48 exposed workers). In another study from Japan, 112 cases of recognized occupational bladder cancer (10.3 percent) were found among 1,085 workers employed in the synthesis and handling of 2-naphthylamine. In a group of 438 persons engaged in the production of 2-naphthylamine, in Japan, 88 persons (20 percent) developed uro-epithelial cancer.[42]

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[39] The World Health Organization The International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man,* Volume 29 (1982).

[40] *supra* note 40, p 180.

[41] The World Health Organization The International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*, Volume 4 (1974).

[42] *supra* note 40, p 376.

(4) 4,4'-methylene-bis-(2-chloro-aniline) or MOCA

There were reported three cases with noninvasive papillary tumors of the bladder identified in a screening study of 385 workers who had been exposed to MOCA in a chemical plant in Michigan, USA, from 1968 to 1979. In 2005, there was a test to screen for bladder cancer at MOCA-manufacturing factories in Taiwan that employed 70 workers who were directly involved in MOCA-manufacturing processes. The prevalence of positive occult blood was borderline significantly greater in male exposed workers (18 percent) than in male non-exposed workers (7 percent). Among the 70 workers who had exposure to MOCA, there was one person with suspected malignant cells on urine cytology, one person with atypical cytology combined with gross haematuria, and one simply with atypical cytology.[43]

(5) o-toluidine

From 1903 to 1955, 11 cases of bladder tumors occurred among workers at a German factory were reported as having had exposure only to o-toluidine. There was a report of bladder tumors in workers engaged in the production of o-toluidine in the the Union of Soviet Socialist Republics during the 1960s. Six cases of bladder tumors (including four carcinomas) had been found earlier, upon cystoscopic examination of 16 former workers who had worked with o-toluidines for periods ranging from 12 to 17 years. In 1972, it found 27 cases of bladder cancer occurring in individuals exposed occupationally to o-toluidine.

The toxic effects of 4-chloro-ortho-toluidine, substance in Group 2A, are either macroscopic or microscopic haematuresis. Furthermore, it causes other symptoms including decreased bladder capacity and dysuria.[44] The patients may also pain in the lower abdomen.

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[43] *supra* note 40, p 342.

[44] The World Health Organization The International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*, Volume 77 (2000).

Due to the epidemiological studies and the IARC classification, it is obvious that substances in Group 1 are the carcinogen and dangerous to human health. However, it does not mean that substances in Group 2A, Group 2B, and Group 3 are not a determination of non-carcinogenicity or overall safety. It often means that further research is needed, especially when exposures are widespread, or the cancer data are consistent with differing interpretations. The lethal dose of aromatic amines values between 250 – 2,000 mg/kg body weight, indicating that for a lethal dose many grams of aromatic amines have to be consumed in a single dose.[45] However, the European Scientific Committee on Toxicity, Ecotoxicity and Environment (CSTEE) has affirmed that the associated cancer risks give cause for concern. As a result, exposure to aromatic amines listed in Group 2A, Group 2B, and Group 3 should also be minimized or eliminated.[46]

Aromatic amines have also been reported to exert a high level of acute and chronic toxicity. Symptoms include allergy, ataxia, anaemia, methemoglobinaemia, reticulocytosis, hematuria, kidney and liver damage, and poisoning causing the fatality.[47]

In addition, the report from the Regional Information Service Center for Southeast Asia on Appropriate Technology revealed that there are many effects which will have on human's body resulting from chemical dyes and dangerous aromatic amines as follows:[48]

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[45] Food-Info, *Azo Dyes available at* http://www.food-info.net/uk/colour/azo.htm.

[46] The European Commission, *Opinion on Risk of Cancer Caused by Textiles and Leather Goods Colored with Azo-dyes available at* http://ec.europa.eu/health/scientific_committees/environmental_risks/opinions/sctee/sct_out27_en.htm.

[47] Amit, *supra* note 20.

[48] Regional Information Service Centre for Southeast Asia on Appropriate Technology (RISE-AT), *Factsheet: Poisonous Textile Dyes and Safe Alternatives available at* http://ns.ist.cmu.ac.th/riseat/documents/a_dyes.pdf.

- Vapors from dyeing solution can be sufficiently poisoned to persons inhaling those vapors. They will have a headache and dizziness;

- If the dye directly contacts with human's skin it can cause rashes;

- Persons directly consuming aromatic amines can be paralyzed limbs, damaged inner organs and caused cancer.

- Unborn babies can be affected in the womb as they can be born crippled, blind or even dead. Aromatic amines in mother's body can also pass into milk breast.

Aromatic amines can enter into human's bodies in many ways. It can be inhaled from the dye vapor and directly contacted to the skin. Certain aromatic amines can migrate from clothing, textile and garment articles. Consumers may expose to substances which can cause cancer by wearing textile and garment articles contained aromatic amines. The research shows that the risk of exposure increases with body heat, sweat or saliva.[49] Aromatic amines may be absorbed through the skin or mouth. Exposure of adult consumers to aromatic amines happens only if the dye migrates from textile or clothing, as a starting material, to their skin. Since the absorption rate of dyes through ingestion is usually higher than through the skin, so children are at a greater risk of exposure to aromatic amines.

### 2.4.2 Impact of Aromatic Amines on Environment

Among the synthetic dyes released in effluents from textile industries, dye containing aromatic amines is one of the more detrimental classes because it is highly persistent in the aquatic environment, due to its chemical

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[49] The Australian Competition and Consumer Commission, *Options to limit hazardous aromatic amines in clothing, textiles and leather articles available at* http://www.strtrade.com/media/publication/7218_AUS97_english_.pdf.

compositions, involving aromatic rings, azoic linkages, and amino groups.[50] Surplus dyes may be released in the washing process. Also, aromatic amines and heavy metals, as impurities and contaminants in the dyes, may enter the sewage water system and azo compounds be cleaved in the wastewater treatment plant aromatic amines in reductive conditions. Some chemical residues will reduce significantly after washing; however test by laundering a piece of textile sample, comparison of pre and post wash, the test results did not indicate a consistent decrease in the concentrations of hazardous aromatic amines after a single wash. In some cases, the results after a single wash were slightly higher than the pre-wash test results.[51] Due to the fact that some functional chemicals are not always tightly bound to the textile, thus, it may be washed out through laundering and consequently dispersed to the water resource or environment. Releases of aromatic amines from textiles through the washing processes may harm the aquatic environment. These aromatic amines may also release to agricultural land through sewage sludge, in the form of colored wastewater. The release of them into the environment constitutes a small proportion of water pollution, and the colored wastewaters represent a serious environmental problem and a public health concern.[52] Since they are not readily degradable under natural conditions, they are not easily removed from waste water by conventional wastewater treatment methods.[53] This can lead to acute effects on exposed organisms due to the toxicity of the dyes; phytoplankton forms abnormal coloration and reduction in photosynthesis because of the absorbance of light that enters the water.[54] This also gives the rivers intense colorations and public is greatly concerned about water quality. The presence

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[50] Bruna de Campos Ventura-Camargo and Maria Aparecida Marin-Morales, *Azo Dyes: Characterization and Toxicity– A Review*, **Textiles and Light Industrial Science and Technology (TLIST)**, Volume 2, (2013).

[51] OECD, *supra* note 15.

[52] Joshni. T. Chacko and Kalidass Subramaniam*, Enzymatic Degradation of Azo Dyes – A* **Review, International Journal of Environametal Sciences**, Volume 1, (2011) at http://www.ipublishing.co.in/jesvol1no12010/EIJES2075.pdf.

[53] Puvaneswari, *supra* note 24.

[54] Duran, N., Esposito, E., *Potential applications of oxidative enzymes and phenoloxidase-like compounds in wastewater and soil treatment: a review, Applied Catalysis B: Environmental*, Volume 28, p 83 – 99 (2000).

of unnatural colors is aesthetically unpleasant and tends to be associated with contamination. Without adequate treatment, these dyes will remain in the environment for an extended period of time.[55] The residual aromatic amines cause the problem to the biological systems as to aquatic animals and plants in the rivers consume or absorb them. It is certainly accumulated in human and animal's body when they eat those aquatic animals and plants.[56]

Some research shows that aromatic amines exhibit the very high level of eco-toxicity in aquatic organisms like daphnia, fish, and snails. 4-aminobiphenyl effects motility of Daphnia Magna, and development of zebra fish embryos. Similarly, chronic dietary exposure of the fish Gambusia affinis to benzidine and 2-aminofluorene resulted in increased cellular proliferation and apoptosis. Aromatic amines can inhibit bacterial and algal growth and activity also.[57] However, some research shows that for most of the substances less than half of the total amount was washed out. For example, 80 percent of the studied on aromatic amines, the number of washing out was less than 10 percent of the total amount. Therefore, it may conclude that it is not probably that any significant quantities will be washed out in the launderings. Chemicals used as pesticides in the cultivation of raw material for textile, such as cotton, may remain in the fabric until the final product. However, little information is available from releases of these substances related to the use phase of end products.[58]

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[55] Olukanni OD., Osuntoki , A. A., Gbenle, G.O., *Textile effluent biodegradation potentials of textile effluent-adapted and non-adapted bacteria*, **African Journal of Biotechnology**, .5,p 1980 – 1984 (2006).

[56] Regional Information Service Centre for Southeast Asia on Appropriate Technology (RISE-AT) *Trends of Textile Industries available at* http://www.ist.cmu.ac.th/riseat/nl/2001/06/article5_th.html.

[57] Amit, *supra* note 18.

[58] *Id.*

## 2.5 Conclusion

The manufacturing process of textile and garment products consists of many steps, starting from yarn production, weaving or knitting, cleaning-dyeing-printing-finishing, and garments manufacturing. Some of which has many chemicals using in the process. The information reveals that there are many dangerous chemicals involving in the manufacturing process of textile and garment products. For example, some studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer,[59] alkylated phenol ethoxylates (APEO) has shown to be toxic to aquatic creatures and disruptor of endocrine system in higher animals, and may pose a risk to humans.[60]

Aromatic amines are widely used in dyeing industry as a starting material or initial substances for preparing and manufacturing of different types of dyes, especially for preparing and manufacturing azo dyes. It is acceptable that some aromatic amines have been shown to be carcinogenic in humans. In garment and textile industry around the world, 24 aromatic amines are restricted to use due to its toxicity. However, aromatic amines are still popularly used in the dyeing process in some country having insufficient laws and regulations. After finish the manufacturing process, aromatic amines remain in some finished products. They can be absorbed through the skin or mouth; thus, consumers may be harmed by everyday exposure. Therefore, an effective solution is necessary to be discussed.

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[59] The Australian Competition and Consumer Commission, *Options to limit hazardous aromatic amines in clothing, textiles and leather articles at* http://www.strtrade.com/media/publication/7218_AUS97_english_.pdf.

[60] O Ecotextiles, *APEOs and NPEOs in textiles*, *available at* http://oecotextiles.wordpress.com/2013/01/24/apeos-and-npeos-in-textiles-2/.

# CHAPTER 3
# THE CONTROL MEASURES OF AROMATIC AMINES IN FOREIGN COUNTRIES

It is said that the economic growth of each country begins with the development of industries. Most of the industries are mainly involved with the chemical. It is necessary to create and use several of raw materials and technology in order to foster the development. As a result of the innovation, many raw materials used in the industries most are chemical materials. When using these chemical materials in the manufacturing process, they will remain as a residue, waste, toxic fume or solvents in wastewater caused pollution in the environment. The higher technology of industries means the much more use of chemicals. Upon entering to the ecosystem, they will cause toxins that affect to the health of humans, plants, animals, and environment.

Many countries have recognized the important of the problems due to the effects of aromatic amines using to prepare dyes in textile and garment industries, whether the dissemination of them into the air, water, soil, residual of their toxicity in products, or the carcinogen effect to human's health. Since the 1990s, many countries have adopted environmental standards and requirements in order to restrict the use of toxic chemicals, including a group of defined aromatic amines known to cause cancer, in the production of textiles and garments[61] which imposed by laws and regulations in several countries. The best known is the Second Amendments to the Consumer Protection Act enacted by the German government in 1994 restricting the use of aromatic amines. In 1996, Netherlands also enacted a law restricting the use of certain aromatic amines. Other countries in Europe, such as Turkey, France and the European Union have also formulated legislation concerning aromatic amines using to manufacture azo dyes. In 2010, the Toxic Substances Control Act of the United States

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[61] The Policy Research Center for Environment and Economy, *Impacts of Environmental Standards and Requirements in EU Countries on China's Textile Industry available at* http://www.iisd.org/pdf/EUtextiles.pdf.

of America released an action plan that addresses 33 dyes derived from benzidine and its derivatives.[62]

In Asia region, since 1993, India had restricting the handling of 42 benzidine-based dyes and increased to 70 more aromatic amines in 1997. While in Japan, voluntary industry standards for ensuring the safety of textile products were published on 2012.[63] This voluntary standard was developed by the Japan Textile Federation (JTF) and the Japan Leather Industry Association (JLIA). Compliance with the standard may be demonstrated by providing a certificate of analysis or self declaration. In addition, the Minister of Economy, Trade, and Industry has requested that the Ministry of Health, Labor, and Welfare, which is responsible for the Act on Control of Household Products Containing Harmful Substances, consider regulating textile products that use aromatic amines known to cause cancer. Import of textiles and garments into Japan must be accompanied by test reports, certification documentation that aromatic amines have not been used and information on the manufacturing facility.

This chapter describes existing legislations and other measures to control aromatic amines which can cause cancer using in consumer products, specifically in textiles and garments, in the European Union, the United State of America and the People's Republic of China. Each part individually concentrates on each country with its existing legislations and other measures to control using aromatic amines. We will thoroughly study and explain step by step each of these various legislations in order to provide basic information for probable recommendations to Thai laws in Chapter 4.

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[62] The Environment Canada & The Health Canada, *Aromatic Azo- and Benzidine-Based Substances* Draft Technical Background Document *available at* http://www.ec.gc.ca/ese-ees/9E759C59-55E4-45F6-893A-F819EA9CB053/Azo_Technical%20Background_EN.pdf.

[63] The Environment Canada & The Health Canada, *Risk Management Scope for Azo Disperse Dyes (including CAS 2832-40-8) available at* http://www.ec.gc.ca/ese-ees/0F6111A3-1074-47DD-BF76-6D6F88FDE4DC/RM%20Scope_Azo_Azo%20Disperse%20Dyes_EN.pdf.

### 3.1 The Control Measures of Aromatic Amines in the European Union

The European Union is a union of democratic nations in Europe in order to create jointly peace, stability and prosperity, help raises living standards and launch a single European currency, the euro. It was established with the objective to enhance the integration of economy, promote and expand cooperation in economy, social, foreign policy, security, defenses and justice as well as strengthen cooperation between the member states.[64] The European Union is currently consists of 28 member states with the approximate populations of over 500 million people, which is regarded as the largest economy in the West Coast region.[65]

There are two types of legislation in the European Union including:[66]

- A regulation is a legislative act applying and binding entirety across the European Union without the consent of any member states. A regulation is effective when announced in the Official Journal for 20 days. It has a status similar to Community Laws that all member states shall not apply their domestic law inconsistent with a regulation. For example, when the EU wanted to protect the names of agricultural products coming from certain areas such as Parma ham, the Council adopted a regulation.

- A directive is a legislative act setting out a goal which all European Union member states must achieve by draft or amend their domestic law to comply with a directive within the stipulated period of time. However, it is up to each country to decide how to draft or amend their law. For example, the case with of working time directive, which stipulates that too much overtime work is illegal. The directive

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[64] The European Union, *How the EU works available at* http://europa.eu/about-eu/index_en.htm.

[65] *Id.* at http://europa.eu/about-eu/countries/member-countries/index_en.htm.

[66] The European Union, *EU Law, Regulations, Directives and other acts available at* http://europa.eu/eu-law/decision-making/legal-acts/index_en.htm.

sets out minimum rest periods and a maximum number of working hours, but it is up to each country to devise its laws on how to implement this.

In the past, the measures to control the safety of consumer products were mostly imposed in the form of technical standards specifically imposed for each type of product. In other word, it is a product-based approach or vertical legislations.[67] However, in 1985, there had the Council Resolution 85/C 136/01 of 7 May 1985 on a new approach to technical harmonization and standards and many countries in the European Union have tended to use "New Approach" to legislate statutory provisions to control safety of consumer products. The main purpose of this Resolution is to develop and remodel technical harmonization within the European Union on a new basis by establishing "general rules" in order to provide harmonized standards and eliminate obstacles of various technical standards in each Member States.[68] The main difference between the New Approach and product-based approach is that there are no details of the minimum requirements which a product must comply. It is imposed the only broad general requirement, not in details.[69] Moreover, the New Approach deals with large families or group of products (such as machinery, construction products, toys), or horizontal risks (such as electromagnetic compatibility), as opposed to the product-based approach.[70]

There are some statutory of the European Union that is involving and relating to the control of hazardous substances or chemicals in textile and garment products, including aromatic amines, as follows:

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[67] The European Committee for Standardization, *The "New Approach," available at* http://boss.cen.eu/reference%20material/Guidancedoc/Pages/NewApproach.aspx.

[68] The European Commission*, A new approach to technical harmonization, at* http://europa.eu/legislation_summaries/internal_market/single_market_for_goods/technical_harmonisation/l21001a_en.htm.

[69] Export.gov, *What Is the EU's New Approach to Product Certification?, available at* http://www.export.gov/cemark/eg_main_017285.asp.

[70] *supra* note 68.

(1) Directive 2001/95/EC of the European Parliament and of the Council on General Product Safety (GPSD); and

(2) Regulation (EC) No. 1907/2006 relating to the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

### 3.1.1 Directive 2001/95/EC of the European Parliament and of the Council on General Product Safety (GPSD)[71]

The Directive 2001/95/EC on General Product Safety, or GPSD, has its aim to provide general requirement that only safe products shall be marketed and sold throughout the European Union, specifically on non-food consumer products including textile and garment products. The objectives of the Directive are both to protect consumers' health and safety and to guarantee the proper functioning of the internal market.[72] Thus, the GPSD is considered to be horizontal legislation which covers all types and categories of consumer products.

The Directive imposes a general safety requirement on any product put on the market that intended for consumers or likely to be used by them.[73] Textile and garment products can be considered as a product that must comply with the safety requirement of this Directive. Moreover, in order to control the safety of product under this Directive, the Directive sets control measures by defines a typical definition of "safe product." Safe product means a product that does not present any risk or only the minimum risks compatible with the product's use by concerning to the following points of each product:[74]

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[71] Full text of the Directive 2001/95/EC of the European Parliament and of the Council on General Product Safety (GPSD) *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001L0095:en:NOT.

[72] The European Commission, *The General Product Safety Directive (GPSD)*, *available at* http://ec.europa.eu/consumers/archive/safety/prod_legis/index_en.htm.

[73] Directive 2001/95/EC, art. 2(a).

[74] *supra* note 73, art. 2(b).

(1) the characteristics of the product, including composition, packaging, instructions for assembly, installation, and maintenance;

(2) the effect on other products, where it is reasonably foreseeable that it will be used with other products;

(3) the presentation, labeling, warnings of the product, instructions for its use and disposal and any indication or information regarding the product; and

(4) the categories of consumers at risk when using the product, in particular, children and the elderly.

#### 3.1.1.1 Control Measures: Post-market Measures

The GPSD requires that "products placed on the market shall be safe product"[75] which is a general requirement of the GPSD. It is considered to be the post-market measures after producing the products. In this regard, Article 3 Paragraph 2 sets a requirement and criteria for being a safe product, which reads as follows:

> "**Article 3**
>
> 2. A product shall be deemed safe, as far as the aspects covered by the relevant national legislation are concerned, when, in the absence of specific Community provisions governing the safety of the product in question, it conforms to the specific rules of national law of the Member State in whose territory the product is marketed, such rules being drawn up in conformity with the Treaty, and in particular Articles 28 and 30 thereof, and laying down the health and safety

[75] *supra* note 73, art. 1(1).

> requirements which the product must satisfy in order to be marketed.
>
> A product shall be presumed safe as far as the risks and risk categories covered by relevant national standards are concerned when it conforms to voluntary national standards transposing European standards, the references of which have been published by the Commission in the Official Journal of the European Communities in accordance with Article 4. The Member States shall publish the references of such national standards."

In such case, a product is considered to be safe once it complies with the specific safety provisions provided in European legislations. In the absence of such provisions, if it complies with the specific rules of national law of the Member State where it is being marketed or sold, it is considered as a safe product. The product is also presumed safe if it conforms to voluntary national standards of the Member States which are established in accordance with the European standards.

Nonetheless, in the case of the absence of above mentioned safety provision of the European legislations, specific national law and voluntary national standards of the Member State, Article 3 Paragraph 3 stipulates that the safety of the product shall be assessed by the following criteria:

(1) the voluntary national standards transposing relevant European standards such as the ISO international standards defined by the International Organization for Standardization (ISO);

(2) the standards of the Member State where the product is marketed or sold;

(3) the Commission recommendations setting guidelines on product safety assessment;

(4) product safety codes of good practice as regards health and safety;

(5) the current state of the art and technology; or

(6) the reasonable expectations of consumer concerning the safety of a product.

The GPSD applies in the absence of either specific safety provision of the European legislations or the specific national law of the Member State as well as voluntary national standards. Furthermore, if it is found that the existing legislations or standards are insufficient, this Directive will be applied.[76]

In conclusion, the GPSD sets a general condition that only safe product can be placed on the market. As a result, the GPSD is considered to be horizontal legislation which covers all types and categories of consumer products. This is the way to fulfill loophole of vertical legislation. Furthermore, the GPSD imposes presumption clause that any product is also presumed safe if it complies with voluntary national standards or technical standards. Therefore, the GPSD does not repeal technical standards; it promotes them.

#### 3.1.1.2 Obligations of Manufacturers and Distributors

In addition to the general requirement to put on the market only products which comply with the general safety requirement, there is another obligation for manufacturers defined in the GPSD as follows:

- manufacturers shall provide consumers the warning with relevant and necessary information in order to enable

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[76] *supra* note 73, art. 1(2) paragraph 2.

them to assess a product's inherent risks, in particular when such risks are not immediately obvious;[77]

- manufacturers shall take other appropriate measures to avoid such risks, for example, withdraw products from the market, adequately and effectively inform consumers or recall products which have already been supplied to consumers.[78]

Furthermore, distributors are also obliged to:[79]

- act with due care to help ensure compliance with the safety requirements, for example, supply products that comply with such requirements;
- monitor the safety of products placed on the market; and
- provide the necessary documents for tracing the origin of products.

### 3.1.2 Regulation (EC) No. 1907/2006 relating to the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)[80]

A regulation (EC) No. 1907/2006 relating to the Registration, Evaluation, Authorization and Restriction of Chemicals, or REACH, establishes approach and system to manage chemical substances in the European Union to unite

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[77] *supra* note 73, art. 5(1) paragraph 1.

[78] *supra* note 73, art. 5(1) paragraph 3.

[79] *supra* note 73, art. 5(2).

[80] Full text of the Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals *available at* http://old.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20140410:EN:HTML.

all chemical substances into the same one system. It is a regulation of the European Union that completely manages substances in the entire cycle of substances, starting with manufacture, import, use, and disposal. It divided the procedure of manage and control chemical substances as follows:

(1) Registration

It will be compulsory for importers and manufacturers to register in a central database chemicals otherwise if a substance is not registered it cannot be produced or placed on the European market.[81] The regulation limited the quantity of the substance which are manufactured or imported in a number of one ton or more per annum shall have to submit a registration.[82]

The registration classed into two cases; (1) substance or preparation with two or more compounds must be registered if such substance or preparation has quantity of one tonne or more per annum, and (2) substance which is a component in articles (or products) must be registered if:

- it has quantity of more than one tonne per annum and
- it is intended to release such substance under conditions of normal use. For example, garments containing a capsule of fragrance or some substance that can break out by friction at the time of wearing.

(2) Evaluation

This is the procedure to examine and evaluate hazard data, exposure information and risk of manufacture and use of substances. If a substance is suspected of causing any risk to human's health or the environment, the European Chemicals Agency (ECHA) will include this substance in a particular list and a

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[81] Regulation (EC) No. 1907/2006, art. 5.

[82] *supra* note 81, art. 6(1).

Member State will conduct and fulfill the evaluation in order to determine whether further information is required from the registrant.

Evaluation can lead to the following conclusions:

- the substance must be subject to restriction or authorization procedures; or
- the classification and labeling of the substance must be harmonized; or
- the information must be supplied to the other authorities so that they can adopt appropriate measures. For example, if, while the substance is being evaluated, information on risk management measures become available and could have an impact on the conditions of use of that substance, the information should be transmitted to the authorities responsible for this legislation.

(3) Authorization

The objective is to ensure that the risks linked with these substances are validly controlled and that these substances are replaced by other appropriate substances. This group of substances called the Substances of Very High Concern or SVHC. The list of substances required the authorization is stated in Annex XIV of the REACH.

The Agency publishes and regularly updates a list of substances ('list of candidate substances') identified as having characteristics of extremely high concern. The list of substances required the authorization was stated in the Annex XIV of the REACH. These may include the following:

- CMRs (carcinogens, mutagens and reproductive toxins);
- PBTs (persistent, bioaccumulative and toxic substances);

- vPvBs (very persistent and very bio-accumulative substances);
- some substances of concern which have irreversible serious effects on humans and the environment, such as endocrine disruptors.

(4) Restriction

The restriction was imposed to restrict the manufacture, use and sell of substances which are very high dangerous. The Annex XVII of the REACH stipulated a restriction that a restricted substance shall not be manufactured, placed on the market or used unless it complies with the conditions set for certain substances.[83]

In conclusion, REACH is a regulation of the European Union that completely manages substances in the entire cycle of substances, starting with manufacture, import, use, and disposal.

**3.1.2.1 Control Measures: Restriction the Use of Aromatic Amines**

Article 67[84] of the REACH describes how substances may be restricted. It reads as follows:

> "**Article 67** (1) A substance on its own, in a mixture or in an article, for which Annex XVII contains a restriction shall not be manufactured, placed on the market or used unless it complies with the conditions of that restriction. This shall not apply to the manufacture, placing on the market or use of a substance in scientific research and development. Annex XVII shall specify if the restriction shall not apply to product and process orientated research and development, as well as the maximum quantity exempted."

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[83] *supra* note 81, art. 67(1).

[84] *supra* note 81.

In such case, a substance, or a substance in a mixture, or a substance in an article listed in Annex XVII are restricted and shall not be manufactured, placed on the market or used. However, if the restriction in Annex XVII set the conditions of using a substance, it is allowed to use under that conditions.

Considering the restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles in Annex XVII, such restrictions listed the designation of the substance, of the group of substances or of the mixture and the conditions of restriction. According to Article 67 (1), azo dyes which can break down under reductive conditions to release any of a group of defined aromatic amines are imposed as a substance in the restrictions under Annex XVII[85] which reads as follows:

> "**43. Azocolourants and Azodyes**
>
> (1) Azo dyes which, by reductive cleavage of one or more azo groups, may release one or more of the aromatic amines listed in Appendix 8, in detectable concentrations, i.e. above 30 mg/kg (0,003 % by weight) in the articles or in the dyed parts thereof, ..., shall not be used, in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, such as:
>
> - clothing, bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags;
> - footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses worn round the neck;

[85] *Id.*

- textile or leather toys and toys which include textile or leather garments;
- yarn and fabrics intended for use by the final consumer.

(2) Furthermore, the textile and leather articles referred to in paragraph 1 shall not be placed on the market unless they conform to the requirements set out in that paragraph.

(3) …"

In conclusion, the REACH restricted that aromatic amines listed in Appendix 8, *infra*, shall not be used over 30 mg/kg in textile and leather articles, including clothing, yarn and fabrics intended for use by the final consumer. As a result, the restriction covered both to yarn and fabrics, which considered as a material and finished garments. In addition, such yarn, fabrics and finished garments contained restricted aromatic amines over 30 mg/kg shall not be placed on the market.

### 3.1.2.2 Restricted Substances: 22 Aromatic Amines

The restricted aromatic amines are listed in Azocolourants in Entry 43; Appendix 8[86] consisted of 22 substances. Some substances may be called by more than one name. The CAS Registry Numbers is necessary to identify exactly a substance. According to Appendix 8, the list of aromatic amines is classified as follows:

[86] *supra* note 81, Entry 43, Appendix 8.

**Table 3.1 : Appendix 8 – List of Restricted 22 Aromatic Amines according to the Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)**

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl |
| 2 | 92-87-5 | Benzidine |
| 3 | 95-69-2 | 4-chloro-o-toluidine |
| 4 | 91-59-8 | 2-naphthylamine |
| 5 | 97-56-3 | o-aminoazotoluene |
| 6 | 99-55-8 | 5-nitro-o-toluidine |
| 7 | 106-47-8 | 4-chloroaniline |
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine |
| 9 | 101-77-9 | 4,4'-methylenedianiline |
| 10 | 91-94-1 | 3,3'-dichlorobenzidine |
| 11 | 119-90-4 | o-dianisidine |
| 12 | 119-93-7 | 3,3'-dimethylbenzidine |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine |
| 15 | 101-14-4 | 4,4'-methylene-bis-(2-chloro-aniline) |
| 16 | 101-80-4 | 4,4'-oxydianiline |
| 17 | 139-65-1 | 4,4'-thiodianiline |

**Table 3.1 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 18 | 95-53-4 | o-toluidine |
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine |
| 20 | 137-17-7 | 2,4,5-trimethylaniline |
| 21 | 90-04-0 | o-anisidine |
| 22 | 60-09-3 | 4-amino azobenzene |

## 3.2 The Control Measures of Aromatic Amines in the United States of America

### 3.2.1 Toxic Substances Control Act (TSCA)

The objective of the Toxics Substances Control Act (TSCA) is to grant the power to the U.S. Environmental Protection Agency (EPA) to regulate new commercial chemicals before they enter the market, existing chemicals when they pose an unreasonable risk to health or the environment, as well as their distribution and use.[87] The EPA shall also have the authority to create a regulatory framework to collect data on chemicals in order to evaluate, assess, mitigate, and control risks that may be posed by their manufacture, processing, and use. The TSCA provides a variety of control methods to prevent chemicals from posing the unreasonable risk.

The regulations of the TSCA may apply at any point during a chemical's life cycle. Section 8(b)[88] of the TSCA requires the EPA to gather, keep current, and publish a list of each chemical substance that is manufactured or

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[87] The United States Environmental Protection Agency (U.S. EPA), *Toxic Substances Control Act (TSCA) available at* http://www.epa.gov/agriculture/lsca.html#Summary of Toxics Substances Control Act (TSCA).

[88] Full text of the Toxics Substances Control Act, *available at* http://www.epw.senate.gov/tsca.pdf.

processed in the United States. In this regard, the EPA has established an inventory of chemical substances called the "TSCA Inventory." Substances on the TSCA Inventory are considered as "existing" chemicals in United States commerce, and substances not on the TSCA Inventory are considered as "new" chemicals. If a substance is determined to be a new chemical substance for TSCA purposes, it is subject to TSCA Section 5(a)(1)[89] which is Premanufacture Notice (PMN) requirements. If a chemical is not already in the inventory and has not been excluded by TSCA, the PMN must be submitted to the EPA before manufacture or import. The PMN must identify the chemical and provide available information on health and environmental effects. If available data are not sufficient to evaluate the chemical's effects, the EPA can impose restrictions pending the development of information on its health and environmental impacts. The EPA can also publish a Significant New Use Rule (SNUR) of chemicals based on factors such as the projected volume and use of the chemical. As there is always have new chemicals entering the United States commerce, the number of chemicals on the Inventory changes. Today, chemical substances accounted for more than 84,000 chemical substances are on the Inventory.[90]

Moreover, the EPA can ban manufacture or distribution in commerce, limit use, require labeling, or place other restrictions on chemicals that pose unreasonable risks.[91]

#### 3.2.1.1 Control Measures: Significant New Use Rule (SNUR)

Section 5(a)(2)[92] of TSCA authorizes the EPA to determine that a use of a chemical substance is a "significant new use," which reads as follows:

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[89] *Id.*

[90] The United States Environmental Protection Agency (U.S. EPA), *Basic Information available at* http://www.epa.gov/opptintr/existingchemicals/pubs/tscainventory/basic.html#what.

[91] *supra* note 88, s 6.

[92] *supra* note 88.

"**Section 5. Manufacturing and Progressing Notices.**

(a) IN GENERAL. –

(1) …

(2) A determination by the Administrator that a use of a chemical substance is a significant new use with respect to which notification is required under paragraph (1) shall be made by a rule promulgated after a consideration of all relevant factors, including:

(A) the projected volume of manufacturing and processing of a chemical substance,

(B) the extent to which a use changes the type or form of exposure of human beings or the environment to a chemical substance,

(C) the extent to which a use increases the magnitude and duration of exposure of human beings or the environment to a chemical substance, and

(D) the reasonably anticipated manner and methods of manufacturing, processing, distribution in commerce, and disposal of a chemical substance."

In such case, the EPA must make this determination by rule after considering all relevant factors, including those listed in Section 5(a)(2). Once the EPA determines that a use of a chemical substance is a significant new use, it is required persons to submit a Significant New Use Notice (SNUN) to the EPA at least 90 days before they manufacture (including import) or process the chemical substance for that use, stated in Section 5(a)(1)(B)[93] which reads as follows:

"**Section 5. Manufacturing and Progressing Notices.**

(a) IN GENERAL. –

(1) Except as provided in subsection (h), no person may:

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[93] *Id.*

(A) …

(B) manufacture or process any chemical substance for a use which the Administrator has determined, in accordance with paragraph (2), is a significant new use, unless such person submits to the Administrator, at least 90 days before such manufacture or processing, a notice, in accordance with subsection (d), of such person's intention to manufacture or process such substance and such person complies with any applicable requirement of subsection (b).

(2) …"

The general provisions for the SNUR are found in Title 40 of the Code of Federal Regulations (40 CFR), Part 721, subpart A and the list of chemical substances under the SNUR is found in subpart E. Section 721.5[94] of the 40 CFR, subpart A defines that a person who must submit the SNUN including a person who intends to manufacture, import, or process for commercial purposes a chemical substance identified in a specific section in subpart E, and intends to:

(1) engage in a significant new use of the substance identified in that section, or

(2) distribute the substance in commerce.

#### 3.2.1.2 Significant New Use of Chemical Substances: 33 Benzidine-based Chemical Substances

The EPA concerned with the potential for exposure to benzidine-based dyes so that promulgating benzidines-based dyes as chemical substances in the SNUR will provide the EPA the opportunity to review and control, as appropriate, before any use of them.

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[94] Full text of the Code of Federal Regulations, *available at* https://www.law.cornell.edu/cfr/text/40/part-721.

The final SNUR is adding 9 benzidine-based chemical substances to a preexisting SNUR. The previous SNUR already covers 24 benzidine-based chemical substances. As a result, now, there are totally 33 benzidine-based chemical substances under the SNUR.[95] The list of benzidine-based chemical substances subjected to reporting under the provision for the SNUR is classified as follows:[96]

**Table 3.2 : List of 33 Benzidine-based Chemical Substances according to Section 721.1660, Subpart E, Title 40 of the Code of Federal Regulations**

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-87-5 | Benzidine |
| 2 | 117-33-9 | 1,3-Naphthalenedisulfonic acid |
| 3 | 65150-87-0 | 1,3,6-Naphthalenetrisulfonic acid |
| 4 | 68214-82-4 | 2,7-Naphthalenedisulfonic acid |
| 5 | 72379-45-4 | 2,7-Naphthalenedisulfonic acid |
| 6 | Accession No. 21808 | 2,7-Naphthalenedisulfonic acid |
| 7 | Accession No. 24921 | 4-(Substituted naphthalenyl)azo diphenylylazo-substituted carbopolycycle azo benzenesulfonic acid |

[95] Regulations.gov, *Significant New Use Rules: Benzidine-Based Chemical Substances; Di-n-pentyl Phthalate (DnPP); and Alkanes, C12-13, CHLORO* *at* http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2010-0573-0078.

[96] *supra* note 94, s 721.1660.

**Table 3.2 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 8 | Accession No. 26256 | 4-(Substituted phenyl)azo biphenylyl azo-substituted carbopolycycloazo benzenesulfonic acid |
| 9 | Accession No. 26267 | 4-(Substituted phenyl)azo biphenylyl azo-substituted carbopolycycle azo benzenesulfonic acid |
| 10 | Accession No. 26701 | Phenylazoaminohydroxynaphthalenylazobiphenylazo substituted benzene sodium sulfonate |
| 11 | 531-85-1 | [1,1′-Biphenyl]-4,4′-diamine, dihydrochloride |
| 12 | 573-58-0 | 1- Naphthalenesulfonic acid, 3,3′-[[1,1′-biphenyl]-4,4′-diylbis(azo)]bis[4-amino- |
| 13 | 1937-37-7 | 2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4′-[(2,4-diaminophenyl) azo][1,1′-biphenyl]-4- yl]azo]-5-hydroxy-6-(phenylazo)- |
| 14 | 2302-97-8 | 1-Naphthalenesulfonic acid, 8,8′-[[1,1′-biphenyl]-4,4′-diylbis(azo)]bis[7-hydroxy- |
| 15 | 2429-73-4 | 2,7-Naphthalenedisulfonic acid, 5-amino-3-[[4′-[(7-amino-1-hydroxy-3-sulfo-2-naphthalenyl)azo][1,1′-biphenyl]-4-yl]azo]-4-hydroxy- |

**Table 3.2 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 16 | 2429-79-0 | 5-[[4′-[(1-amino-4-sulfo-2-naphthalenyl) azo][1,1′-biphenyl]-4-yl]azo]-2- hydroxy- |
| 17 | 2429-81-4 | 5-[[4′-[[2,6-diamino-3-[[8-hydroxy-3,6-disulfo-7-[(4-sulfo-1-naphthalenyl)azo]-2- naphthalenyl]azo]-5-methylphenyl] azo][1,1′- biphenyl]-4-yl]azo]-2-hydroxy- |
| 18 | 2429-82-5 | 5-[[4′-[(7-amino-1-hydroxy-3-sulfo-2-naphthalenyl) azo][1,1′-biphenyl]-4-yl]azo]-2-hydroxy- |
| 19 | 2429-83-6 | 2,7-Naphthalenedisulfonic acid, 4-amino-3-[[4′-[(2,4-diamino-5-methylphenyl)azo][1,1′-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)- |
| 20 | 2429-84-7 | 5-[[4′-[(2-amino-8-hydroxy-6-sulfo-1-naphthalenyl)azo][1,1′-biphenyl]-4-yl]azo]-2-hydroxy- |
| 21 | 2586-58-5 | 5-[[4′-[[2,6-diamino-3-methyl-5-[(4-sulfophenyl)azo]phenyl]azo][1,1′-biphenyl]-4- yl]azo]-2-hydroxy |
| 22 | 2602-46-2 | 2,7-Naphthalenedisulfonic acid, 3,3′-[[1,1′-biphenyl]-4,4′-diylbis(azo)]bis[5-amino-4-hydroxy- |

**Table 3.2 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 23 | 2893-80-3 | 5-[[4′-[[2,4-dihydroxy-3-[(4-sulfophenyl) azo]phenyl]azo][1,1′-biphenyl]-4- yl]azo]-2-hydroxy- |
| 24 | 3530-19-6 | 1,3-Naphthalenedisulfonic acid, 8-[[4′-[(4-ethoxyphenyl)azo][1,1′-biphenyl]-4-yl]azo]-7-hydroxy- |
| 25 | 3567-65-5 | 1,3-Naphthalenedisulfonic acid, 7-hydroxy-8-[[4′-[[4-[[(4-methylphenyl) sulfonyl]oxy]phenyl]azo][1,1′-biphenyl]-4-yl]azo]- |
| 26 | 3626-28-6 | 2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-3-[[4′-[(4-hydroxyphenyl)azo][1,1′- biphenyl]-4-yl]azo]-6-(phenylazo)- |
| 27 | 3811-71-0 | 5-[[4′-[[2,4-diamino-5-[(4-sulfophenyl) azo]phenyl]azo][1,1′ biphenyl]-4-yl]azo]-2-hydroxy- |
| 28 | 4335-09-5 | 2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-6-[[4′-[(4-hydroxyphenyl)azo][1,1′-biphenyl]-4-yl]azo]-3-[(4-nitrophenyl)azo]- |
| 29 | 6358-80-1 | 2,7-Naphthalenedisulfonic acid, 4-amino-5-hydroxy-3-[[4′-[[4-hydroxy-2-[(2- methylphenyl)amino]phenyl]azo] [1,1′- biphenyl]-4-yl]azo]-6-[(4-sulfophenyl) azo]- |

**Table 3.2 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 30 | 6360-29-8 | 5-[[4′-[[4-[(4-amino-7-sulfo-1-naphthalenyl)azo]-6-sulfo-1-naphthalenyl]azo][1,1′-biphenyl]-4-yl] azo]-2- hydroxy- |
| 31 | 6360-54-9 | 5-[[4′-[[2,6-diamino-3-methyl-5-[(4-sulfophenyl)azo]phenyl] azo][1,1′-biphenyl]-4-yl]azo]-2- hydroxy-3-methyl- |
| 32 | 8014-91-3 | 3,3′-[(3,7-disulfo-1,5-naphthalenediyl) bis [azo(6-hydroxy-3,1-phenylene) azo[6(or7)-sulfo-4,1-naphthalenediyl] azo[1,1′-biphenyl]-4,4′-diylazo]]bis[6-hydroxy- |
| 33 | 16071-86-6 | Cuprate(2-), [5-[[4′-[[2,6-dihydroxy-3-[(2-hydroxy-5-sulfophenyl)azo]phenyl] azo][1,1′- biphenyl]-4-yl]azo]-2-hydroxybenzoato(4-)]- |

### 3.2.2 Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65)

The Safe Drinking Water and Toxic Enforcement Act of 1986, generally known as “Proposition 65,” requires the State, specifically the Governor, to publish a list of chemicals, referred to as “listed chemical,” known to cause cancer, birth defects or other reproductive harm.[97] This list must be updated at least once a

[97] Safe Drinking Water and Toxic Enforcement Act, s 25249.8 (a).

year. Since it was first published in 1987, currently, it has grown to comprise more than 800 chemicals.[98]

There are two regulatory measures of Proposition 65. The first is to prohibit businesses from knowingly discharging listed substances into drinking water sources, or onto land where the substances can pass into drinking water sources.[99] The second is to prohibit businesses from knowingly exposing individuals to listed substances without providing a clear and reasonable warning.[100] If the exposure level of the listed chemical is low enough to pose no significant risk, it is not required to provide the warning.

Clear and reasonable requirement under this law may divide into three types including (1) consumer products warnings; (2) occupational exposure warnings; and (3) environmental exposure warnings. We will specifically study on the consumer products warnings.

Proposition 65 affects all the products sold or distributed in California, including textiles and clothing for adults and children, hard goods, toys, childish products, and electrical products. In its simplest form, as it concerns to consumer products, Proposition 65 can be considered as a consumer "right to know" law that notifies consumers about some hazardous substances contained in a product or its packaging.[101]

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[98] The Office of Environment Health Hazard Assessment (OEHHA), *Current Proposition 65 List (last updated 6 June 2014) available at* http://oehha.ca.gov/prop65/prop65_list/files/P65single060614.pdf.

[99] *supra* note 97, s 25249.5.

[100] *supra* note 97, s. 25249.6.

[101] Bureau Veritas, *California Proposition 65 for Consumer ProductsA Proactive Approach to Chemical Risks and Brand Protection*, *available at* http://www.bureauveritas.com/wps/wcm/connect/bv_com/group/services+sheet/california-proposition-65-for-consumer-products_1753?presentationtemplate=bv_master_v2/Services_sheet_full_story_presentation_v2.

### 3.2.2.1 Control Measures: Clear and Reasonable Warning

Section 25249.6[102] of the Proposition 65 describes control measures of dangerous substances, including aromatic amines which can cause cancer, contained in textile and garment products by imposed responsibility for businesses involving lists chemical to provide clear and reasonable warning to any individual which reads as follows:

> "**§ 25249.6. *Required Warning Before Exposure To Chemicals Known to Cause Cancer Or Reproductive Toxicity*** No person in the course of doing business shall knowingly and intentionally expose any individual to a chemical known to the state to cause cancer or reproductive toxicity without first giving clear and reasonable warning to such individual, …"

For the implementation this statute, Title 27 of the California Code of Regulations imposed to provide more details in Article 6 Clear and Reasonable Warnings, Section 25601[103] which reads as follows:

> "**§ 25601 *Clear and Reasonable Warnings*** Whenever a clear and reasonable warning is required under Section 25249.6 of the Act, the method employed to transmit the warning must be reasonably calculated, considering the alternative methods available under the circumstances, to make the warning message available to the individual prior to exposure. The message must clearly communicate that the chemical in question is known to

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[102] Full text of the Safe Drinking Water and Toxic Enforcement Act of 1986, *available at* http://oehha.ca.gov/prop65/law/P65law72003.html.

[103] Full text of Title 27 of the California Code of Regulations *available at* http://www.oehha.ca.gov/prop65/law/pdf_zip/AllProp65RegssList.pdf.

> the state to cause cancer, or birth defects or other reproductive harm…"

In such case, businesses that produce, use, release or otherwise engage in activities involving a listed chemical known to the state to cause cancer are required to warn a person before "knowingly and intentionally" exposing that person to a listed chemical. The warning given must be "clear and reasonable." This means that the warning must: (1) clearly make known that the chemical involved is known to cause cancer or birth defects or other reproductive harm and (2) be given in the way that consumers will effectively reach it before they are exposed.

However, there is some exemption of providing such warning. Some chemicals may be considered to have no significant risk if daily exposures to such chemicals do not exceed the level set by the Office of Environmental Health Hazard Assessment (OEHHA).[104] The OEHHA adopts "No Significant Risk Levels (NSRL)," or safe harbor level, which is levels of exposure that except the warning requirement, for many listed chemicals. Businesses that cause exposures greater than the safe harbor level must provide warnings. Also, if there is no safe harbor level, businesses would be required to provide a warning.

**Content of Warnings**

For consumer products that contain a chemical known to the state to cause cancer, the warning message must include the following text:[105]

> "WARNING: This product contains a chemical known to the State of California to cause cancer."

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[104] *supra* note 103, s 25705.

[105] *supra* note 103, s. 25705.

The law regulates that the manufacturer, producer, or packager of the consumer product shall provide warning materials such as signs, notices, menu stickers, or labels, rather than the retail seller.[106]

#### 3.2.2.2 List of Chemicals Known to Cause Cancer or Reproductive Toxicity: 21 Aromatic Amines

Section 25249.8[107] of the Proposition 65 requires that the Governor to revise and republish at least once per year of the list of chemicals known to the State to cause cancer or reproductive toxicity. There are around 500 chemicals listed as chemicals known to cause cancer. Some of them are aromatic amines which can cause cancer. Only the chemicals which are on the listed chemical determined by the State are required to provide clear and reasonable warnings.

**Table 3.3 : List of 21 Carcinogenic Aromatic Amines according to the Safe Drinking Water and Toxic Enforcement Act of 1986 and the No Significant Risk Levels (NSRL) of each Substance[108]**

| No. | CAS Numbers | Substances | NSRL (microgram/day) |
|---|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl | 0.03 |
| 2 | 92-87-5 | Benzidine | 0.001 |
| 3 | 95-69-2 | 4-chloro-o-toluidine | 3 |
| 4 | 91-59-8 | 2-naphthylamine | 0.4 |

[106] *supra* note 103, s. 25603.

[107] *supr*a note 102.

[108] The Office of Environmental Health Hazard Assessment (OEHHA), *The current safe harbor level available at* http://www.oehha.ca.gov/prop65/pdf/safeharbor081513.pdf.

**Table 3.3 :** (Continue)

| No. | CAS Numbers | Substances | NSRL (microgram/day) |
|---|---|---|---|
| 5 | 97-56-3 | o-aminoazotoluene | 0.2 |
| 6 | 106-47-8 | 4-chloroaniline | 1.5 |
| 7 | 615-05-4 | 4-methoxy-m-phenylenediamine | 30 |
| 8 | 101-77-9 | 4,4'-methylenedianiline | 0.4 |
| 9 | 91-94-1 | 3,3'-dichlorobenzidine | 0.6 |
| 10 | 119-90-4 | o-dianisidine | 0.15 |
| 11 | 119-93-7 | 3,3’-dimethylbenzidine | 0.044 |
| 12 | 838-88-0 | 4,4'-methylenedi-o-toluidine | 0.8 |
| 13 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine | 5 |
| 14 | 101-14-4 | 4,4'-methylene-bis-(2-chloro-aniline) | 0.5 |
| 15 | 101-80-4 | 4,4'-oxydianiline | 5 |
| 16 | 139-65-1 | 4,4'-thiodianiline | 0.05 |
| 17 | 95-53-4 | o-toluidine | 4 |
| 18 | 95-80-7 | 4-methyl-m-phenylenediamine | 0.2 |
| 19 | 90-04-0 | o-anisidine | 5 |
| 20 | 60-09-3 | 4-amino azobenzene | - |
| 21 | 87-62-7 | 2,6-xylidine | 110 |

## 3.3 The Control Measures of Aromatic Amines in the People's Republic of China

### 3.3.1 National General Safety Technical Code for Textile Products (GB 18401-2010)

In order to control the hazardous substances in textile products, improve textile quality as well as ensure consumer's basic safety and health and enforce the general safety for textiles and clothing, the People's Republic of China has adopted a compulsory standard known as the National General Safety Technical Code for Textile Products or GB 18401-2003 on 27 November 2003. It became effective on 1 January 2005. Afterward, this National General Safety Technical Code for Textile Products was amended to the new revision as GB 18401-2010 published on 14 January 2010 and became effective on 1 August 2011.

GB 18401-2010 is a safety standard for textile and garment industry. It determines technical safety requirements, testing methods, rules of inspection, and guide for implementation and supervision for textile products manufactured, imported and sold in China's market. This standard imposes the mandatory requirements. If products fail to comply with any of the requirements, they are not allowed to be manufactured, sold or imported into China's market.[109]

There are many requirements set for the safety specifications of textile products, such as the concentration of formaldehyde, pH value, colorfastness, and aromatic amines. In this research, we will mainly study on control measures of aromatic amines.

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[109] The International Trade Centre (ITC), *The Chinese Market for Clothing at* http://www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Sectors/Food_and_agri_business/Cotton/AssetPDF/China%20final%20technical%20document%20for%20print1.pdf.

The standard classifies all textile products into three categories:[110]

- Category A: Textile products for infants means textile products that are worn or used by infants at below 36 months of age,[111]

- Category B: Textile products with direct contact to skin means textile products with large areas in direct contact with human skin when worn or used,[112]

- Category C: Textile products without direct contact to skin means textile products with little or no area in direct contact with human skin when worn or used,[113]

### 3.3.2 Control Measures: Forbidden to Use Aromatic Amines

Clause 5.1[114] of GB 18401-2010 set the compulsory requirement for textile products manufactured, sold or imported into China regarding the control of aromatic amines which specified, without any conditions, that aromatic amines, listed in Appendix C are forbidden to use with a limit concentration at 20 mg/kg in all three categories of textile products manufactured, sold or imported to China, which reads as follows:

> "**5. Requirements**
>
> 5.1 General technical safety specifications for textile products are sorted into three categories: A, B and C categories – see *Table 1*.

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[110] GB18401-2010, Clause 4.1.

[111] *supra* note 110, Clause 3.3.

[112] *supra* note 110, Clause 3.4.

[113] *supra* note 110, Clause 3.5.

[114] Full text of the National General Safety Technical Code for Textile Products (GB18401-2010) *available at* http://www.puntofocal.gov.ar/notific_otros_miembros/chn20r1s1_t.pdf.

Table 1

| Item | A | B | C |
|---|---|---|---|
| Aromatic amines[c] (mg/kg) | Forbidden | | |

[c] Please see Appendix C for the list of aromatic amines, limit value: 20 mg/kg."

Not only imposed the duty to comply with standards, Article 24[115] of the Regulations for the Implementation of the Standardization Law of the People's Republic of China also set the method of disclosure that the products that are complied with the safety standards shall provide the codes, serial numbers and names of such standards on the products, the packaging or written in the technical manuals, which reads as follows:

> "**Article 24** Enterprises may go by the national, trade and local standards or enterprise standards in production. The codes, serial numbers and names of the standards should be marked on their products, or written in the technical manuals or on the packages."

Furthermore, Article 14[116] of the Standardization Law regulated that every unit, both juristic persons, and individuals, must comply with national standards if the law stated that such standards are compulsory. It shall be forbidden to manufacture, sell or import products that do not conform to the requirements of compulsory standards. It is stipulated as follows:

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[115] Full text of the Regulations for the Implementation of the Standardization Law of the People's Republic of China *available at* http://english.aqsiq.gov.cn/LawsandRegulations/allenglish/200708/t20070817_36197.htm.

[116] *Id.*

> "**Article 14** Compulsory standards must be complied with. It shall be prohibited to produce, sell or import products that are not up to the compulsory standards. With regard to voluntary standards, the State shall encourage their adoption by enterprises on an optional basis."

Also, Article 23[117] of the implementation of the Standardization law also regulated about this compulsory standard, which reads as follows:

> "**Article 23** Any units and individuals that are engaged in scientific research, production and operation must strictly implement compulsory standards. The products which do not measure up to compulsory standards may not be allowed to be produced, marketed or imported."

Generally, with the exception of certain safety equipment and home furnishing textiles, there are no certification requirements, or the China Compulsory Certification (CCC) mark, for textile and clothing products imported for sale in China. However, products found to be noncompliant with GB 18401-2010 can be taken off from the market or stopped at Customs.[118]

### 3.3.3 Forbidden Substances: 24 Aromatic Amines

The forbidden aromatic amines are listed in Table C.1, Appendix C[119] consisted of 24 substances. The list of forbidden aromatic amines is classified as follows:

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[117] *Id.*

[118] The Office of Textiles and Apparel (OTEXA) U.S. Department of Commerce, *Market Reports/Tariffs Textiles, Apparel, Footwear and Travel Goods China available at* http://web.ita.doc.gov/tacgi/overseasnew.nsf/alldata/China.

[119] *supra* note 115, Table C.1, Appendix C.

**Table 3.4 : Appendix C - List of Forbidden 24 Aromatic Amines according to the National General Safety Technical Code for Textile Products (GB 18401-2003)**

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl |
| 2 | 92-87-5 | Benzidine |
| 3 | 95-69-2 | 4-chloro-o-toluidine |
| 4 | 91-59-8 | 2-naphthylamine |
| 5 | 97-56-3 | o-aminoazotoluene |
| 6 | 99-55-8 | 5-nitro-o-toluidine |
| 7 | 106-47-8 | 4-chloroaniline |
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine |
| 9 | 101-77-9 | 4,4'-methylenedianiline |
| 10 | 91-94-1 | 3,3'-dichlorobenzidine |
| 11 | 119-90-4 | o-dianisidine |
| 12 | 119-93-7 | 3,3'-dimethylbenzidine |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine |
| 15 | 101-14-4 | 4,4'-methylene-bis-(2-chloro-aniline) |
| 16 | 101-80-4 | 4,4'-oxydianiline |
| 17 | 139-65-1 | 4,4'-thiodianiline |
| 18 | 95-53-4 | o-toluidine |

**Table 3.4 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine |
| 20 | 137-17-7 | 2,4,5-trimethylaniline |
| 21 | 90-04-0 | o-anisidine |
| 22 | 60-09-3 | 4-amino azobenzene |
| 23 | 95-68-1 | 2,4-xylidine |
| 24 | 87-62-7 | 2,6-xylidine |

### 3.4 Conclusion

Through this chapter, we learned that three countries have paid attention to the control of aromatic amines which can cause cancer using in textile and garment products. Since 2001, the European Union imposed restriction to the use of aromatic amines with the limited concentration at not over 30 mg/kg, through a Regulation (EC) No. 1907/2006 applying and binding entirety across the European Union without the consent of any Member States. There is also the general safety requirement for non-food consumer products set by a Directive 2001/95/EC on General Product Safety which applies in case of the absence or insufficiency of the existing specific legislations or standards concerning to product safety.

The United States of America, although it is not prohibited to use aromatic amines or benzidines-based chemical substances in the United States of America but the TSCA requires persons who intend to manufacture (including import) or process these chemical substances for an activity that is designated as a significant new use to notify the U.S. Environment Protection Agency at least 90 days before commencing such manufacture or processing. Moreover, the requirement of clear and reasonable warning under the Proposition 65 aims to alert consumers to the presence of toxic

substances contained in products that they might purchase in California. Consumers can decide on their own if they want to purchase or use those products. In other word, it is not prohibited to use aromatic amines causing cancer in any type of products.

For the People's Republic of China set the control measures through a national standard GB 18401-2010, which is a compulsory requirement by forbidden the use of aromatic amines with the limit value at 20 mg/kg.

Each of the three solutions has its characteristics with different advantages and disadvantages. These will help us analyze current provisions under Thai toxic substance laws and recommend some solutions to address the problem to control aromatic amines that can cause cancer.

# CHAPTER 4
# ANALYSIS OF THAI LAWS AND ALTERNATIVE SOLUTIONS

From the study of the control measure of aromatic amines which can cause cancer in the European Union, the United States of America, and the People's Republic of China, the awareness controlling of aromatic amines in these countries is very high. Having realized their existing provisions and control measures of each country, we are now going to study current Thai laws.

In Thailand, there is some statutory provision that is involving and relating to the control of hazardous chemicals in textile and garment products such as the Hazardous Substance Act B.E. 2535 (1992), the Industrial Product Standards Act B.E. 2511 (1968) and the Factory Act B.E. 2535 (1992). There is also some provision regarding labeling of consumer products stipulated in the Consumer Protection Act B.E. 2522 (1979).

This chapter will analyze those four laws. As well as, by referring to the features and characteristics of existing measures in the European Union, the United States of America, and the People's Republic of China, the probable solutions for the controlling of aromatic amines causing cancer in Thailand need to be discussed.

## 4.1 Existing Provisions

There is some provision that is involving and relating to the control of hazardous substances or chemicals in textile and garment products as follows:

### 4.1.1 The Hazardous Substance Act B.E. 2535 (1992)

#### 4.1.1.1 Control Measures of the Hazardous Substance

The Hazardous Substance Act B.E. 2535 (1992) is the fundamental provision to control and manage hazardous substance. The control of the hazardous substances is defined in Chapter 2 of the Act, as following details:

In order to control hazardous substances, Section 18[120] classifies hazardous substances into 4 types according to the needs for control. It reads as follows:

> "**Section 18** The hazardous substance is classified according to the needs for control as follows:
>
> (1) Type 1 hazardous substance is that of which the production, import, export, or having in possession must comply with the specified criteria and procedures;
>
> (2) Type 2 hazardous substance is that of which the production, import, export, or having in possession must first be notified to the authority and must also comply with the specified criteria and procedures;
>
> (3) Type 3 hazardous substance is that of which the production, import, export, or having in possession must obtain a permit; and
>
> (4) Type 4 hazardous substance is that of which the production, import, export, or having in possession is prohibited."

Furthermore, Section 18 Paragraph 2[121] also states the role of the Government sectors to control hazardous substance, which reads as follows:

> "**Section 18** …
> For the purpose of prevention and suppressed hazard that may be inflicted upon human, animal, plant,

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[120] Full text of the Hazardous Substance Act B.E. 2535 (2002) *available at* http://www2.diw.go.th/Haz_o/hazard/lawsnew/Factory%20Act.mht.

[121] *Id.*

> property or environment, the Minister of Industry, with the opinions of the Hazardous Substance Committee, shall have the power to publish in the Government Gazette designating the names or qualifications of hazardous substance, type of hazardous substance, period of enforcement and responsible agencies for the control of such hazardous substance."

In such case, by the virtue of Section 18 Paragraph 2, the Minister of Industry, with the opinions of the Committee on Hazardous Substance issues the list of hazardous substances provided in the **Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013)**.[122] According to this Ministerial Notification, Article 4 defines the authorities that shall be responsible for control of hazardous substance to be in compliance with the Hazardous Substance Act consist of:

(1) Department of Agriculture shall be responsible for control of hazardous substances in List 1, annexed to this Notification;

(2) Department of Fisheries shall be responsible for control of hazardous substances in List 2, annexed to this Notification;

(3) Department of Livestock Development shall be responsible for control of hazardous substances in List 3, annexed to this Notification;

(4) Food and Drug Administration shall be responsible for control of hazardous substances in List 4, annexed to this Notification;

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[122] Full text of the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013) *available at* http://web.krisdika.go.th/data/law/law2/%c703/%c703-2e-2556-a0005.pdf.

(5) Department of Industrial Works shall be responsible for control of hazardous substances in List 5, annexed to this Notification; and

(6) Department of Energy Business shall be responsible for control of hazardous substances in List 6, annexed to this Notification.

#### 4.1.1.2 List of Aromatic Amines Controlled by the Notification of Ministry of Industry on List of Hazardous Substances

According to the list of hazardous substance controlled by the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013), there are totally 6 lists of hazardous substance; List 1, List 2, List3, List 4, List 5, and List 6, which are responsible by each of 6 different authorities. There are 2 aromatic amines designated as a substance under the control of the Department of Agriculture (List 1), the Food and Drug Administration (List 4) and the Department of Industrial Works (List 5), as follows:

(1) 4-aminobiphenyl (CAS Number 92-67-1)

It is designated as a hazardous substance *Type 4* (the production, import, export, or having in possession is prohibited) which is responsible by the Department of Agriculture and the Food and Drug Administration; and a hazardous substance *Type 3* (the production, import, export, or having in possession must obtain a permit) which is responsible by the Department of Industrial Works.

(2) Benzidine (CAS Number 92-87-5)

It is designated as a hazardous substance *Type 4* (the production, import, export, or having in possession is prohibited) which is responsible by the Department of Agriculture and the Food and Drug Administration; and a hazardous substance *Type 3* (the production, import, export, or having in possession must obtain a permit) which is responsible by the Department of Industrial Works.

However, at present, the latest list of hazardous substances was amended as the **Notification of Ministry of Industry on List of Hazardous Substances (No. 2) B.E. 2558 (2015)**.[123] It was entered into force on the day following the date of its publication in the Royal Thai Government Gazette (dated February 19, 2015) or became in effective since February 20, 2015.

Concerning to hazardous substances which are under the control of the Department of Industrial Works according to the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013), there are 5 sub-lists of substance in List 5, including List 5.1 Controlled Substances, List 5.2 Chemical Wastes, List 5.3 Used Electrical and Electronic Appliance, List 5.4 Others Substances, and List 5.5 Chemical Weapons. Article 4 of the Notification of Ministry of Industry on List of Hazardous Substances (No. 2) B.E. 2558 (2015) defines to add List 5.6 regarding Group of Substance Controlled on its Property as new list of hazardous substances which is under responsibility of the Department of Industrial Works. It reads as follows:

> "**Article 4** The List 5.6 regarding Group of Substance Controlled on its Property, annexed to this Notification shall be added to List 5, which is in the responsibility of the Department of Industrial Works, of the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013) dated August 28, 2013."

In this regard, other than substances in List 5.1 to List 5.5, the Department of Industrial Works shall be responsible for control of hazardous substances in List 5.6 regarding Group of Substance Controlled on its Property which consists of 10 types of substances, as following substances:

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[123] Full text of the Notification of Ministry of Industry on List of Hazardous Substances (No. 2) B.E. 2558 (2015) *available at* http://www.diw.go.th/hawk/news/%E0%B8%89.2%202558.pdf.

**Table 4.1 : List of Hazardous Substances Annexed to the Notification of the Ministry of Industry on Hazardous Substances (No. 2) B.E. 2558 (2015): List 5.6 – Group of Substance Controlled on its Property**

| No. | Name of Hazardous Substance | Type of Hazardous Substance | Condition |
|---|---|---|---|
| 1 | Explosive | 1 | Only substance or mixture which there is no authorities responsible for controlling the production or import. The criteria and procedure shall be specified by the Ministry of Industry. |
| 2 | Flammable Substance | 1 | |
| 3 | Oxidizing Agent or Peroxide | 1 | |
| 4 | Toxic Substance | 1 | |
| 5 | Mutagen | 1 | |
| 6 | Corrosive | 1 | |
| 7 | Irritant | 1 | |
| 8 | Carcinogen | 1 | |
| 9 | Toxic Substance to Reproductive Organ | 1 | |
| 10 | Environmentally Hazardous Substance | 1 | |

All of hazardous substances provided in List 5.6 above are designated in *Type 1* which the production, import, export, or having in possession of such substances must comply with the specified criteria and procedures. In order to specify the criteria and procedure to control hazardous substances defined in List 5.6, the Minister of Industry, with the opinions of the Committee on Hazardous substance, issues the **Notification of Ministry of Industry on Notification of the Fact regarding the Production or Import of Hazardous Substance Defined in List 5.6 which is in the responsibility of the Department of Industrial Works B.E. 2558**

**(2015)**.[124] Article 2 prescribes about such criteria and procedure for the producer or importer, which reads as follows:

> "**Article 2** The producer or importer of the hazardous substance with its quantity amounted of more than 1,000 kilograms per year shall notify such fact according to Form WorAor./AorGor. 20 annexed to this Notification.
>
> The notification referred in Paragraph 1 shall be done only once, through the computer network system of the Department of Industrial Works or other means specified by the Department of Industrial Works, within 60 days from the date of the production or import of such hazardous substance."

In such case, the producer or importer of 10 hazardous substances provided in List 5.6, including explosive, flammable substance, oxidizing agent or peroxide, toxic substance, mutagen, corrosive, irritant, carcinogen, toxic substance to reproductive organ and environmentally hazardous substance, with the quantity amounted of more than 1,000 kilograms per year shall notify the Department of Industrial Works within 60 days from the date of the production or import of such hazardous substances.

#### 4.1.1.3 Analysis

As it shown in Chapter 4.1.1.2, *supra*, that there are only 2 aromatic amines designated as a substance *Type 3* and *Type 4* under the control of the Hazardous Substance Act, including 4-aminobiphenyl designated as a hazardous

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[124] Full text of the Notification of Ministry of Industry on Notification of the Fact regarding the Production or Import of Hazardous Substance Defined in List 5.6 which is in the responsibility of the Department of Industrial Works B.E. 2558 (2015) *available at* http://www.diw.go.th/hawk/news/%E0%B8%9A%E0%B8%8A%205.6.pdf.

substance *Type 4* (the production, import, export, or having in possession is prohibited) which is responsible by the Department of Agriculture and the Food and Drug Administration; and a hazardous substance *Type 3* (the production, import, export, or having in possession must obtain a permit) which is responsible by the Department of Industrial Works, as well as, benzidine designated as a hazardous substance *Type 4* (the production, import, export, or having in possession is prohibited) which is responsible by the Department of Agriculture and the Food and Drug Administration; and a hazardous substance *Type 3* (the production, import, export, or having in possession must obtain a permit) which is responsible by the Department of Industrial Works. However, it is widely acceptable in textile and garment industry around the world that there are 24 aromatic amines restricted to use due to their carcinogen. It is obvious that the list of hazardous substances under the control of the Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013) does not cover and prohibit to use all kinds of aromatic amines substances which can cause cancer. As a result, other 22 aromatic amines substances may still be used in Thai textile and garment industries without any of the control measures.

Concerning to the Notification of the Ministry of Industry on Hazardous Substances (No. 2) B.E. 2558 (2015), hazardous substances in List 5.6 in regard to Group of Substance Controlled on its Property which consists of 10 types of substances, all of 24 aromatic amines causing cancer may be classified into carcinogen substances designated as hazardous substance *Type 1*. So, the producer or importer of any of 24 aromatic amines with their quantity amounted of more than 1,000 kilogram per year shall notify the Department of Industrial Works within 60 days from the date of the production or import of such substances. However, this control measure does not restrict to use aromatic amines substance. It merely requires the producer or importer to provide the notification for produce and import carcinogen substances group. After submitting the notification, the producer or importer can use aromatic amines substances in the manufacturing of textile and garment products without any limitation and requirement.

Considering the control measure of hazardous substances under Section 18 of the Hazardous Substance Act, in case that dangerous aromatic amines are designated as hazardous substances *Type 3* which the production, import, export, or having in possession of these aromatic amines must obtain a permit, such permission is regulated only for the purpose of controlling substance itself. It does not aim to control whether the application of a substance or the consumer product or articles contained any of hazardous substance. Therefore, after granted the permission to produce, import, export or possess aromatic amines, textile and garment manufacturers can independently decide to use them in the production of their products without any prior permission from the authority. Once the fabrics containing aromatic amines are ready to sell, garment producers can buy and possess them as a material for manufacture finished clothing without asking for any permission. Importers can also freely import textile and garment products containing aromatic amines into Thailand. Thus, consumers, both adults, and children, will probably wear these contaminated clothes without awareness of carcinogenicity of aromatic amines. In case of designating all of 24 aromatic amines as hazardous substances *Type 4* means the production, import, export, or having in possession of such aromatic amines is prohibited. In this regard, having in the procession shall mean to use aromatic amines substances as well. As a result, any persons who manufacture textile and garment products shall prohibit using all 24 aromatic amines substances, without any conditions.

As it is found in the IARC Classification, 24 aromatic amines substances are classified into various groups, including carcinogenic to humans (Group 1) accounted for 5 substances, probably carcinogenic to humans (Group 2A) accounted for 1 substance, possibly carcinogenic to humans (Group 2B) accounted for 15 substances, and not classifiable as to its carcinogenicity to humans (Group 3) accounted for 3 substances. It is obvious that substances in Group 1 are carcinogen and dangerous to human health. However, it does not mean that substances in Group 2A, Group 2B, and Group 3 are not a determination of non-carcinogenicity or overall safety. The European Scientific Committee on Toxicity, Ecotoxicity and Environment (CSTEE) has affirmed that the associated cancer risks give cause for concern. The

lethal dose of aromatic amines values between 250 – 2,000 mg/kg body weight. As a result, exposure to aromatic amines listed in Group 2A, Group 2B, and Group 3 should also be minimized or eliminated. In other words, it is said that some aromatic amines can be used without harmful under the limited concentration. Also, aromatic amines may be absorbed into human skin through everyday exposure, so they are probable allowed to use in another products which are not direct contact to human skin. Thus, in the author's opinion, to prohibit the production, import, export, or having in possession of aromatic amines, including using aromatic amines in manufacturing process, may not be the effective and appropriate solution.

### 4.1.2 The Industrial Product Standards Act B.E. 2511 (1968)

#### 4.1.2.1 The Theory of Hierarchy of Law

In Thai legal system, there are many sources of enacted law or written law classifying by the legislators consisting of the legislative, the executive, or the independent organization.[125]

(1) Law Enacted by the Legislative or Par Exallence

This type of laws, the Act, is enacted by the Legislative. As a result, the Act is considered to be a truly law. This is because the Act is enacted by the legislators which directly act as a lawmaker. According to the Constitution of the Kingdom of Thailand (Interim) B.E. 2557 (2014), Section 14[126] states that the King has the power to enact an Act by and with the advice and consent of the National Legislative Assembly. A bill may be introduced by not less than twenty five members of the National Legislative Assembly, the Council of Ministers or the

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[125] Preedee Kasemsap, *Civil Law : General Principles*, (Bangkok; 1983). (ปรีดี เกษมทรัพย์, **กฎหมายแพ่ง : หลักทั่วไป** (กรุงเทพมหานคร: คณะนิติศาสตร์ มหาวิทยาลัยธรรมศาสตร์, 2526, หน้า 19.)

[126] Full text of the Constitution of the Kingdom of Thailand (Interim) B.E. 2557 (2014) *available at* http://www.ratchakitcha.soc.go.th/DATA/PDF/2557/A/055/1.PDF.

National Reform Council. Under Section 15,[127] the Prime Minister shall present the bill or Organic Law bill approved by the National Legislative Assembly to the King for His signature within twenty days as from the date of receiving such bill from the National Legislative Assembly and the bill shall come into force as an Act or Organic Act upon its publication in the Government Gazette. If the King refuses His assent to the bill or Organic Law bill either returns it to the National Legislative Assembly or does not return it within ninety days, the National Legislative Assembly must reconsider such bill. If the National Legislative Assembly resolves to reaffirm the bill by the votes of not less than two-thirds of the total number of existing members, the Prime Minister shall present such bill to the King for His signature once again. If the King does not sign and return the bill within thirty days, the prime Minister shall cause the bill to be promulgated as an Act or Organic Act in the Government Gazette as if the King had signed it.

(2) Law Enacted by the Executive or Delegated Legislation

In principle, as the Legislative acts as the direct legislators, the Executive shall not have the power as legislators. Under the separation of powers which is a basic principle of the democracy system, it is necessary to separate the powers into three divisions; the legislative powers, the executive powers, and the judiciary powers. The intent is to prevent the concentration of power and provide for checks and balances.[128] However, due to the necessity, the Constitution allows and grants the power to the Executive to enact a law for some instance. This is a reason why this type of law may be called the delegated legislation.[129] Law enacted by the Executive can be classified into two types including the Royal Ordinance and the Subordinate Legislation. The Executive is granted the power to enact a Subordinate Law from the Legislative with the rule, method, and condition as

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[127] *Id.*

[128] Somyot Chueathai, *General Principles of Laws, Explanation of Civil Law* (Bangkok; 2013). (สมยศ เชื้อไทย, **ความรู้กฎหมายทั่วไป คำอธิบายกฎหมายแพ่ง** (กรุงเทพมหานคร: สำนักพิมพ์วิญญูชน, 2556, หน้า 80.)

[129] *supra* note 126.

stipulated in the Act. Generally, the enactment of the Subordinate Law shall refer to the power of its organic law which is the Act or the Royal Ordinance. Consequently, the Subordinate Law cannot define any rights, duties, or liabilities by itself. Also, the Executive cannot enact any Subordinate Law in contrast with its organic law. The Subordinate Law comprises of the Royal Decree, the Ministerial Regulation, the Ministerial Notification, and other regulations. This thesis will mainly focus to study on a Royal Decree and a Ministerial Notification.

- A Royal Decree may be classified into two types; (1) a Royal Decree enacted by the delegation of the power of the Constitution,[130] and (2) a Royal Decree enacted by the delegation of the power of the Act or the Royal Ordinance. As a Royal Decree is enacted by referring to the law in the higher level, it is necessary that a Royal Decree must not contrary to the Constitution, the Act or the Royal Ordinance.[131] The Act and the Royal Ordinance contain the main principles while the Royal Decree may contain the detail of law.

- A Ministerial Notification is promulgated by the Minister of the Ministry and is issued pursuant to the Act. It is not required to be granted the consent of the Council of the Ministers for issuing a Ministerial Notification. However, a Ministerial Notification is required to be published in the Government Gazette otherwise it shall not come into force as a law.

In conclusion, both a Royal Decree and a Ministerial Notification are the Subordinate Legislation enacted by the Executive without the

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[130] Constitution of the Kingdom of Thailand (Interim) B.E. 2557 (2014), Section 22 The King has the prerogative to issue a Royal Decree which is not contrary to the law.

[131] *supra* note 126, p 35.

consideration of the Legislative. However, considering the hierarchy of law, a Royal Decree is in the higher level than a Ministerial Notification.

According to the Industrial Standards Act B.E. 2511 (1968), the industrial standards may be classified into 2 categories consisting of the industrial standards determined by the Notification of the Ministry of Industry according to Section 15 and the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards according to Section 17. Under Section 15, the Minister may determine the standards for industrial products by promulgating the Ministerial Notification and publishing the in Government Gazette. For the industrial standards under Section 17, the Industrial Standards Act B.E. 2511 (1968) provides the delegation of the power to enact a Royal Decree in order to determine any particular kind of the industrial products to be conform to the industrial standards.

#### 4.1.2.2 Types of the Industrial Standards according to the Industrial Standards Act B.E. 2511 (1968)

According to the Industrial Product Standards Act B.E. 2511 (1968), the industrial standards may be classified into 2 categories consisting of the industrial standards determined by the Notification of the Ministry of Industry according to Section 15 and the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards according to Section 17, as follows:

(1) <u>The Industrial Standards Determined by the Notification of the Ministry of Industry according to Section 15</u>

The Industrial Product Standards Act provides the power to the Minister to determine, amend, and revoke the standards for industrial products according to the recommendation of the Council. In this regard, Section 15[132] states the

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[132] Full text of the Industrial Product Standards Act B.E. 2511 (1968) *available at* http://www.tisi.go.th/eng/index.php?option=com_content&view=article&id=20&Itemid=6%20.

method to determine, amend and revoke the standards that they shall be published in the Government Gazette, which reads as follows:

> "**Section 15** For the benefit of industrial promotion, the Minister may determine, amend and revoke standards for industrial products according the recommendation of the Council.
>
> The determination, amendment and revocation under Paragraph 1 shall be published in the Government Gazette."

The Minister herein means the Minister of Industry and the Council means the Industrial Product Standards Council. Practically, the standard for industrial products according to Section 15 are notified by the Notification of the Ministry of Industry issued pursuant to the Industrial Product Standards Act. The standard shall be named as the Thai Industrial Standard or TIS and followed by the number of the standard and the year of issuing.

In such case, Section 16[133] allows any person, who manufactures his products complying with any of the industrial standards determined by the Notification of the Minister of Industry according to Section 15, to have the authorization to display the standard mark on his products, which reads as follows:

> "**Section 16** Subject to Section 25, any person who manufactures industrial products complying with a standard which has already been determined by the Minister may display the standard mark on his industrial products only after inspection by a competent official and having received a license from the Council.

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[133] *Id.*

> The application for a license, the inspection and the issue of a license shall be in accordance with the rules and procedures prescribed in the Ministerial Regulation."

The sanction of the industrial standards according to Section 15 includes the Thai manufacturers shall not be able to export their products, which do not conform to any of the existing industrial standards, to any foreign countries having their laws and regulations controlling the quality or standard of those type of products. Also, in some countries, although there are no specific laws and regulations controlling on specific products but the manufacturers may have the liability according to the provisions of the product liability laws if their products cause damage or injury to the consumers.

In addition, according to Section 16, the manufacturers who produce their products conforming to the requirements of the industrial standards determined by the Notification of the Ministry of Industry may submit the application for a license to display the standard mark on their products on their demand. Once the manufacturers are granted a license from the Thai Industrial Standards Institute, they shall have the right to exhibit the standard mark on their products. After granted the license from the Industrial Product Standards Council, the licensees shall have the right to exhibit the Standard Mark on their products. In case that the manufacturers do not receive a license to display the standard mark from the Thai Industrial Standards Institute, they shall not have the right to exhibit the standard mark on their products. As a result, the consumers may not trust in the quality and standard of the products which do not display the standard mark and may decide not to buy them.

According to Section 31,[134] if the licensees do not receive a license, they shall not have the right to use the Standard Mark. Also, Section 32[135]

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[134] Industrial Product Standards Act, s 31 No person other than the licensee under section 16, section 20 or section 21 shall use the standard mark.

prohibits the imitation of the Standard Mark so as to mislead the public. Besides, under Section 35,[136] the licensees under Section 16 shall have the right to exhibit the Standard Mark only on the products which are in conformity with the industrial standard. In case that the licensees display the Standard Mark on the industrial products which do not conform with the standards, the licensees shall have the liability according to Section 54,[137] which reads as follows:

> "**Section 54** Any licensee who violates Section 35 shall be liable to:
> (1) in the case of a licensee under Section 16, imprisonment for a term not exceeding three months or to a fine not exceeding twenty thousand Baht or to both;
> (2) …"

In such case, the licensees under Section 16 who exhibit the Standard Mark on the products which do not conform to the industrial standards shall be liable to the imprisonment for a term not exceeding 3 months or to fine not exceeding 20,000 Both or both.

(2) The Industrial Standards Determined by a Royal Decree that any Particular Kind of the Industrial Products shall Conform to the Standards according to Section 17

The industrial standards according to Section 15 have the purpose to increase the efficiency of the production and quality of the products sold and marketed in Thailand. This can help to create a competitiveness and opportunity

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[135] Industrial Product Standards Act, s 32 No person shall imitate the standard mark so as to mislead the public.

[136] Industrial Product Standards Act, s 35 No licensee under section 16, section 20 or section 21 shall display the standard mark on the industrial products which do not conform with the standard.

[137] *supra* note 126.

for Thai entrepreneurs. Besides, the consumers will have more opportunity to consume good quality products with reasonable prices. However, in some case, the standards as specified in Section 15 may not sufficient to protect the public from harmfulness. As a result, for the purpose of ensuring safety or preventing harmful effect which may be fall the public, the industry or economy of the country, any industrial products shall be required to conform to the standard specified by the Notification of the Ministry of Industry according to Section 15. Section 17[138] states the method, which reads as follows:

> "**Section 17** For the purpose of ensuring safety or preventing harmful effect which may be fall the public, the industry or economy of the country, any particular kind of industrial products which shall conform to a standard may be determined.
>
> The determination under Paragraph 1 shall be made by a Royal Decree and the date of its coming into force shall not be less than sixty days from the date of its publication in the Government Gazette."

In this regard, Section 20[139] and Section 21[140] also prescribe duty of the manufacturers and importers, who produce or import any of the industrial products which are required by a Royal Decree to conform to the standard determined by the Notification of the Ministry of Industry according to Section 15, to provide evidence to a competent official for inspection and receive a license from the Industrial Product Standards Council. They read as follows:

> "**Section 20** … any person who manufactures industrial products which are required by a Royal Decree to conform to the standard must produce an

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[138] *Id*.

[139] *Id*

[140] *Id.*

> evidence to a competent official for inspection and receive a license from the Council.
>
> The application for a license, the inspection and the issue of a license shall be in accordance with the rules and procedure prescribed in the Ministerial Regulation."

> "**Section 21** … any person who imports the industrial products import for sale in Thailand, which are required by a Royal Decree to conform with the standard, must produce an evidence to a competent official for inspection and receive a license from the Council.
>
> The application for a license, the inspection and the issue of a license shall be in accordance with the rules and procedure prescribed in the Ministerial Regulation."

Consequently, under Section 20 and Section 21, the manufacturer and importer of any industrial product required by a Royal Decree to conform with the standard as specified in Section 17 must receive a license from the Industrial Product Standards Council. In addition, Section 29[141] also prescribes the mandatory duty of the manufacturer under Section 20 and the importer under Section 21 who receives the license that they are required to manufacture or import their product in conformity with the standard. This provision defines the manufacturer and importer as the licensee. It reads as follows:

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[141] *Id.*

> "**Section 29** The licensee under Section 20 or Section 21 shall manufacture the industrial products in conformity with the standard thereof or import industrial products which are in conformity with the standard thereof, as the case may be."

In such case, the manufacturer and importer are required by law to produce and import their products complying with the determined standards. If their industrial products are not required by a Royal Decree to conform with the standard as specified in Section 17, the manufacturer and importer are not required by law to control, produce, and import their product in conformity with the industrial standard issued by the Notification of the Ministry of Industry. Now, there are 100 compulsory standards determined under this law.[142]

Due to its compulsiveness, Section 48[143] and Section 51[144] prescribe the liability for any person who fails to comply with Section 20 or Section 21 and Section 29, which read as follows:

> "**Section 48** Any person who fails to comply with Section 20 or Section 21 shall be liable to imprisonment for a term which is not exceeding two years or to a fine not exceeding one hundred thousand Baht or to both."

> "**Section 51** Any licensee who fails to comply with section 29 shall be liable to imprisonment for a term which is not exceeding two years or to a fine not exceeding one hundred thousand Baht or to both."

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[142] The Thai Industrial Standards Institute, *List of Compulsory Standards available at* http://app.tisi.go.th/standard/comp_tha.html.

[143] *supra* note 125.

[144] *Id.*

In such case, under Section 48, if any manufacturers or importers of the industrial products as stipulated in Section 20 and the industrial product import for sale in Thailand as stipulated in Section 21, which are required by the Royal Decree to conform to the standards, fail to produce an evidence to a competent official for inspection and do not receive a compulsory or mandatory certificate from the Industrial Product Standards Council, they shall be liable to imprisonment for a term which is not exceeding 2 years or to a fine not exceeding 100,000 Baht or to both. Moreover, under Section 29, if any manufacturers or importers, who receive a compulsory license from the Industrial Product Standards Council of the industrial products as stipulated in Section 20 and the industrial product import for sale in Thailand as specified in Section 21, fail to manufacture or import the industrial products in conformity with the standard thereof, they shall be liable to imprisonment for a term which is not exceeding 2 years or to a fine not exceeding 100,000 Baht or to both.

After granted the license for the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards according to Section 17, the licensees shall have the right to exhibit the Standard Mark on their products. According to Section 31,[145] if the licensees do not receive a license, they shall not have the right to use the Standard Mark. Also, Section 32[146] prohibits the imitation of the Standard Mark so as to mislead the public. Besides, under Section 35,[147] the licensees under Section 20 and Section 21 shall have the right to exhibit the Standard Mark only on the products which are in conformity with the standards. In case that the licensees display the Standard Mark on the industrial products which do not conform with the standards, the licensees shall have the liability according to Section 54,[148] which reads as follows:

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[145] *supra* note 128.

[146] *supra* note 129.

[147] *supra* note 130.

[148] *supra* note 125.

> "**Section 54** Any licensee who violates Section 35 shall be liable to:
> (1) …
> (2) in the case of a licensee under Section 20 or Section 21, imprisonment for a term not exceeding two years or to a fine not exceeding one hundred thousand Baht or to both."

#### 4.1.2.3 Industrial Product Standards License

In order to promote the accuracy, transparency, fairness, and effectiveness of the operation of the Thai Industrial Standards Institute in accordance with the international practice, the Industrial Product Standards Council defines a principle for the inspection of licensing. In other words, the Industrial Product Standards Council has the power to grant a license for the manufacturer and importer of the industrial products. The industrial product standards license can be classified into 2 categories; a license to exhibit the standard mark on industrial products according to Section 16 and a license to manufacture or import for sale of industrial products which are required by a Royal Decree to conform with the standard according to Section 20 and Section 21.[149]

From the interview with the officials at the Thai Industrial Standards Institute revealed that the Industrial Product Standards Act does not obviously define that the industrial standards can be classified into how many types. However, practically, the Thai Industrial Standards Institute classifies the industrial standards into 2 types consisting of;[150]

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[149] The Thai Industrial Standards Institute (TISI), *Criteria for Product Licenses Manual available at* http://www.tisi.go.th/images/stories/pdf/licensee_manual.pdf.

[150] From an interview with Phitsinee Pradubploy, an official at Legal and Litigation Group 1, Legal Bureau, Thai Industrial Standards Institute.

(1) The Industrial Standard Defined by Section 15 in the Form of the Notification of the Ministry of Industry, or the General Standard

This type of the industrial standard can be called the "general standard." As the law does not oblige any persons to comply with the requirement of the general standard, so this type of standard is the voluntary requirement for manufacturers. The manufacturers can decide whether to produce their products in conformity with the standards defined by Section 15 or not. In case that the manufacturer produces his products in conformity with any of the existing industrial standard issued by the Notification of the Ministry of Industry, such manufacturer may apply for the Application for a License to Exhibit the Standard Mark on Industrial Products (Form Mor.Aor. 1), in order to be granted this type of license to exhibit the Standard Mark on his product, according to the provision of Section 16.

(2) The Industrial Standard to Manufacture or Import of Industrial Products which are Required by a Royal Decree under Section 17 to Conform with the Standard, or the Compulsory Standard

This type of the industrial standard can be called the "compulsory standard." As the law requires the manufacturers and importers who produce or import of the industrial products which are required by a Royal Decree under Section 17 to conform with the standard, so this type of standard is the compulsory requirement for the manufacturers and importers. They are required to apply for the Application for a License to Manufacture the Industrial Product which are Required by a Royal Decree to Conform with the Standard (Form Mor.Aor. 3) or the Application for a License to Import for Sale in Thailand of the Industrial Product which are Required by a Royal Decree to Conform with the Standard (Form Mor.Aor. 5), in order to be granted this type of license for manufacture or import their products, as the case may be. In this regard, the manufacturers and importers are required by Section 29 to manufacture the industrial products in conformity with the standard thereof or import industrial products in conformity with the standard thereof, as the case may be.

Moreover, after received these licenses, the competent official shall have the power to inspect the industrial products or the manufacturing thereof whether or not they conform with the industrial standards, according to Section 44,[151] which reads as follows:

> "**Section 44** In the performance of his duties, a competent official shall have the power:
> (1) to enter premises where the industrial products are manufactured, kept or sold during the time between sunrise and sunset or during the office hours, or a vehicle carrying industrial products, for the purpose of inspection of the industrial products or the manufacturing thereof whether or not they conform with this Act, and to take reasonable quantities of the industrial products, materials used or having reasonable ground to believe that they will be used in the manufacture thereof as samples for further inspection;
> (2) to enter premises or any other place during the time between sunrise and sunset or during the office hours, or any vehicle where there is a reasonable ground to suspect that this Act is not complied with or is violated, and to take reasonable quantities of the industrial products, materials used or having reasonable ground to believe that they will be used in the manufacture thereof as samples for further inspection;
> (3) to seize or attach industrial products in the case where there is a reasonable ground to believe that;

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[151] *Id.*

(a) they do not conform with Section 16, …, Section 20;

(b) …; or

(c) they are industrial products on which the standard mark is used or displayed in violation of Section 31, Section 32 or Section 35."

From the interview with the officials at the Thai Industrial Standards Institute,[152] according to Section 44, a competent official shall have the power to seize or attach the industrial products in the case where there is a reasonable ground to believe that they do not conform with Section 16 or Section 20, or they are the industrial products on which the standard mark is used or displayed in violation of Section 31, Section 32 or Section 35. According to Section 46, for the industrial products which have been seized or attached by the competent official, in the case where the licensee under Section 16 violates Section 35 or in the case of failing to comply with Section 16 and thereby violating Section 31, the Industrial Product Standards Council shall have the power to order that such industrial products must be modified or improved to be in conformity with the standard, or may order that the standard mark must be removed from or taken out of such industrial products. If the standard mark cannot be removed from or taken out of the industrial products, the Industrial Product Standards Council may order to destroy such industrial products. For the case of failing to comply with Section 20 or Section 21, the Industrial Product Standards Council may order to destroy the industrial products. In case of imports, the Industrial Product Standards Council may order to send back the industrial products; if they are not sent back, the Industrial Product Standards Council may order that the industrial products must be destroyed or that they be withheld for the manufacturer or importer to apply for a license or permit.

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[152] From an interview with Chatchai Kongsaktrakul, an official at the Certification of Foreign Standard and Product Licensing Group, Quality Management Bureau, Thai Industrial Standards Institute.

From the above explanations providing information about the industrial standards determined by the Notification of the Ministry of Industry according to Section 15 and the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards according to Section 17, there are some differences between them. For the industrial standards determined by the Notification of the Ministry of Industry according to Section 15, the products that fall into this category are not required to manufacture or import to comply with the requirements of such standards. As a result, the manufacturers and importers of products for sale in Thailand can choose whether to comply with the standards or not. It is said that any persons may submit the application for this type of license on their demand. After granted the license from the Industrial Product Standards Council, the manufacturers and importers shall have the right to exhibit the Standards Mark on their products. In addition, there is no legal liability for any person who fails to comply with this type of standards. On the other hand, for the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards according to Section 17, the manufacturers who produce any products, which are required by a Royal Decree to conform to the industrial standards under Section 20, must submit the application for the license to produce products. Also, the importers of products for sale in Thailand, which are required by a Royal Decree to conform to the standard under Section 21, must submit the application for the license to import products for sale in Thailand. Accordingly, the manufacturers and importers shall be manufactured or imported and sold their products only in conformity with the requirements of such industrial standards. In other words, they are required by law to manufacture or import the industrial products complying with the industrial standards. In addition, there is also having legal liability for any person who fails to comply with this type of standards.

Although voluntary standards are not required by law as well as have no legal liability for any person who fails to comply with them, the importance of voluntary standards has grown in recent years, contributing to higher growth rates in the international trade, than achieved in many more traditional markets. There are

many factors favoring the growth of the voluntary standards, one of the most important factor is, among others, the emergence of a conscious consumer, who demands more product information and the globalization of supply chains.[153]

Compliance with voluntary standards can potentially benefit manufacturers and importers in many ways. The implementation of the safety and quality requirements for the voluntary certification induces the manufacturers and importers to develop and improve their management and monitoring systems, increase productivity as well as have a better access to credit. Access to credit is fundamental to pre-finance certification of costs and investments.[154] Conformity with the voluntary standards leads to lower costs by reducing redundancy, minimizing errors and decreasing time to market.[155] It might also facilitate stronger integration in global value chains providing opportunities to improve manufacturing processing, product quality and the supply capacity of the industry. The voluntary standards also make cross-border interoperability possible, ensuring that products manufactured in one country can be sold and used in another. These could increase the ability of manufacturers and importers to compete in both domestic and foreign markets. As voluntary standards are not required by law, they would be considered to be a safety floor from which to manufacture products. In other words, the manufacturers and importers should always consider finding ways to build safety and quality into their products and go above and beyond the standards.[156]

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[153] International Centre for Trade and Sustainable Development, Private voluntary standards: The instruments for a lasting trade policy in Africa? *available at* http://www.ictsd.org/bridges-news/bridges-africa/news/private-voluntary-standards-the-instruments-for-a-lasting-trade

[154] The International Trade Centre, *Voluntary standards in developing Countries: The potential of voluntary standards and their role in international trade available at* http://www.tradeforum.org/Voluntary-Standards-in-Developing-Countries-The-Potential-of-Voluntary-Standards-and-their-Role-in-International-Trade/.

[155] Standards Boost Business, *Value of Standards for Consumers available at* http://www.standardsboostbusiness.org/consumers.aspx.

[156] The United States Consumer Product Safety Commission, *Voluntary Standards available at* http://www.cpsc.gov/en/Regulations-Laws--Standards/Voluntary-Standards/Voluntary-Standards/.

As it is found in some country like the United States of America, the voluntary standards may be used as a tool for the consumer protection measures.[157] The voluntary standards usually contain technical, specific and complex requirements based on the consideration of other related manufacturers and specific safety experts. The concept of referring standards in regulations or legislations can help the government sectors to establish a regulation quickly and save time and money that would otherwise be spent studying, researching and development on the technical information in order to create suitable regulations. Referencing voluntary standards in legislations is an effective means of using the consensus standards system to benefit government, industry and consumers, who will certainly get the highest benefits.

While some manufacturers and importers see that the voluntary and compulsory standards are obstacles even barriers for their businesses, many who have pursued them see them as an opportunity to improve the quality and increase values of their products. Thus, the cost of implementing these standards should not be considered as an expense but as an investment in modern and competitive business. It is, therefore, important for the government sectors to create an appropriate environment favoring better implementation of these standards.

#### 4.1.2.4 The Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) according to the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550)

Practically, the industrial standards are notified in the form of the Notification of the Ministry of Industry issued under the Industrial Product Standards Act. There are 2 industrial standards involving to clothing business

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[157] The Society for Standards Professionals, *The Benefits of Using Voluntary Standards in the Regulatory Process available at* http://www.ses-standards.org/?65.

including the Thai Industrial Standard for Fabrics or TIS 2231-2550 (2007) and Thai Industrial Standard for Garments or TIS 2346-2550 (2007). At present, under Section 17, a Royal Decree does not define fabric and garment products required to be manufactured or imported in accordance with the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007). As a result, the manufacturer and importer do not have the obligation according to Section 20, Section 21 and Section 29. In other words, it is voluntary for manufacturer and importer whether to conform to them or not.

(1) Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007)

This standard was notified by the Notification of the Ministry of Industry No. 3332 (B.E. 2548) issued pursuant to the Industrial Product Standards Act B.E. 2511. There are two amendments to this standard including the Notification of the Ministry of Industry No. 3436 (B.E. 2548) and the Notification of the Ministry of Industry No. 3764 (B.E. 2550). Now, the TIS 2231-2548 (2005) is amended to the TIS 2231-2550 (2007). Type of fabrics under the standard includes woven, knitted or crocheted fabrics and non-woven. Each fabric may classify by its usage as follows:[158]

(1) Category 1: fabrics for infant products;

(2) Category 2: fabrics for clothes or products in direct contact with skin;

(3) Category 3: fabrics for clothes or products not in direct contact with skin; and

(4) Category 4: fabrics for decoration or accessories.

It specifies quality of fabrics in many dimensions including safety from harmful dyestuffs and chemical substances, i.e. aromatic amines

[158] TIS 2231-2548 (2005), Clause 3 Types and Categories.

derived from azo colorants, formaldehyde content, heavy metal particle, acidity-alkalinity and colorfastness; includes packaging, marking, and labeling, sampling and criteria for conformity.

Clause 4.3[159] of the Ministerial Notification No. 3764 sets the safety standard concerning to the control of aromatic amines derived from azo dyes that all four categories of products shall contain aromatic amines at the limit concentration not over 30 mg/kg.

The list of controlled 24 aromatic amines is stated in Appendix A of the Ministerial Notification No. 3332 is classified as follows:

**Table 4.2 : Appendix A - List of Controlled 24 Aromatic Amines according to the Notification of the Ministry of Industry No. 3332 (B.E. 2548)**

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl |
| 2 | 92-87-5 | Benzidine |
| 3 | 95-69-2 | 4-chloro-o-toluidine |
| 4 | 91-59-8 | 2-naphthylamine |
| 5 | 97-56-3 | o-aminoazotoluene |
| 6 | 99-55-8 | 5-nitro-o-toluidine |
| 7 | 106-47-8 | 4-chloroaniline |

[159] Full text of the Ministerial Notification No. 3765, B.E. 2550 (2007) Issued under the Industrial product Standards Act B.E.2511 (1968): Amendment No.2 to Mandatory Standard TIS 2231-2548 (2005) Fabrics: Safety from Harmful Dyestuffs and Chemical Substances (Thai language) *available at* http://www.ratchakitcha.soc.go.th/DATA/PDF/2550/E/177/8.PDF.

**Table 4.2 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine |
| 9 | 101-77-9 | 4,4'-methylenedianiline |
| 10 | 91-94-1 | 3,3'-dichlorobenzidine |
| 11 | 119-90-4 | o-dianisidine |
| 12 | 119-93-7 | 3,3'-dimethylbenzidine |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine |
| 15 | 101-14-4 | 4,4'-methylene-bis-(2-chloro-aniline) |
| 16 | 101-80-4 | 4,4'-oxydianiline |
| 17 | 139-65-1 | 4,4'-thiodianiline |
| 18 | 95-53-4 | o-toluidine |
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine |
| 20 | 137-17-7 | 2,4,5-trimethylaniline |
| 21 | 90-04-0 | o-anisidine |
| 22 | 60-09-3 | 4-amino azobenzene |
| 23 | 95-68-1 | 2,4-xylidine |
| 24 | 87-62-7 | 2,6-xylidine |

(2) Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007)

This standard was notified by the Notification of the Ministry of Industry No. 3765 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511. Type of garments under the standard includes woven, knitted or crocheted fabrics and non-woven. Each type may classify by its usage as follows:[160]

(1) Category 1: garments, clothes and other products made by fabrics for infant e.g. infant pajamas, diapers, gloves, socks, hat;

(2) Category 2: garments and clothes for male, female and child which in direct contact with skin e.g. underwear, shirts, shorts, trousers, dress, gloves, stocking; and

(3) Category 3: garment and clothes for male, female and infant which not in direct contact with skin e.g. suits, jackets, sweaters, scarves.

Clause 4.3[161] of the Notification of the Ministry of Industry No. 3765 (B.E. 2550) sets the safety standard for garments concerning to the control of aromatic amines in the same manner with the Notification of the Ministry of Industry No. 3764 (B.E. 2550), or it set the standards for controlling the use of aromatic amines in fabrics and garments that should not be over 30 mg/kg in finished

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[160] TIS 2346-2550 (2007), Clause 3 Types and Categories.

[161] Full text of the Ministerial Notification No. 3764, B.E. 2550 (2007) Issued under the Industrial product Standards Act B.E.2511 (1968): Mandatory Standard TIS 2346-2550 (2007) Garments: Safety from Harmful Dyestuffs and Chemical Substances (Thai language) *available at* http://www.ratchakitcha.soc.go.th/DATA/PDF/2550/E/177/11.PDF.

products. The list of controlled 24 aromatic amines is stated in Appendix A of the Ministerial Notification No. 3765 is classified as follows:

**Table 4.3 : Appendix A - List of Controlled 24 Aromatic Amines according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550)**

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl |
| 2 | 92-87-5 | Benzidine |
| 3 | 95-69-2 | 4-chloro-o-toluidine |
| 4 | 91-59-8 | 2-naphthylamine |
| 5 | 97-56-3 | o-aminoazotoluene |
| 6 | 99-55-8 | 5-nitro-o-toluidine |
| 7 | 106-47-8 | 4-chloroaniline |
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine |
| 9 | 101-77-9 | 4,4'-methylenedianiline |
| 10 | 91-94-1 | 3,3’-dichlorobenzidine |
| 11 | 119-90-4 | o-dianisidine |
| 12 | 119-93-7 | 3,3’-dimethylbenzidine |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine |
| 15 | 101-14-4 | 4,4’-methylene-bis-(2-chloro-aniline) |
| 16 | 101-80-4 | 4,4'-oxydianiline |

**Table 4.3 :** (Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 17 | 139-65-1 | 4,4'-thiodianiline |
| 18 | 95-53-4 | o-toluidine |
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine |
| 20 | 137-17-7 | 2,4,5-trimethylaniline |
| 21 | 90-04-0 | o-anisidine |
| 22 | 60-09-3 | 4-amino azobenzene |
| 23 | 95-68-1 | 2,4-xylidine |
| 24 | 87-62-7 | 2,6-xylidine |

**4.1.2.5 Analysis**

In case that the manufacturer decides to produce fabrics and garments complying with the standards, after inspection by a competent official and having received a license, he will granted the right to display the Standard Mark on his products. The Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) according to the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550) are determined pursuant to Section 15. As a result, under Section 16, the manufacturers of textile and garment products conforming to the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) may submit the application for a license to display the standard mark on their products on their demand. Once the manufacturers are granted a license from the Thai Industrial Standards Institute, they shall have the right to exhibit the standard mark on their products. However, the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical

Substances or TIS 2231-2550 (2004) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) controlling the use of harmful color and chemicals, specifically on aromatic amines, in those finished products are not imposed as a compulsory requirements under Section 17. This means the manufacturer and importer are not required to receive a license before produce or import their products under Section 20 and Section 21. Also, they are not obliged by Section 29 to manufacture or import the products in conformity with the standards. As such, compliance with the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) are not legally required by law. In case that the manufacturer produces his products in conformity with the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007), such manufacturer may apply for the application to the Industrial Product Standards Institute in order to be granted a license to exhibit the Standard Mark on his product. The database of the Thai Industrial Standards Institute shows that there are only 3 licensees[162] who granted a license of the TIS 2231-2550 (2007) and 1 licensee[163] who granted a license of the TIS 2346-2550 (2007).

In case that designating the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17, the manufacturer and importer are required to receive a license before produce or import their products. After having received the license, they will be granted the right to display the standard mark on their products showing

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[162] The Thai Industrial Standards Institute, *Detail of the Licensee, Fabrics : safety from harmful dyestuffs and chemical substances (TIS 2231-2548)*, *available at* http://164.115.25.114/detail.aspx?data=1&Code=%E0%B8%A1%E0%B8%AD%E0%B8%812231-2548.

[163] The Thai Industrial Standards Institute, *Detail of the Licensee, Garments : safety from harmful dyestuffs and chemical substances (TIS 2346-2550)*, *available at* http://164.115.25.114/detail.aspx?data=1&Code=%E0%B8%A1%E0%B8%AD%E0%B8%812346-2550.

that the products are manufactured conforming to the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007). In this connection, the manufacturers and importers are required by Section 29 to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007) thereof or import fabric and garment products in conformity with the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007) thereof, as the case may be.

In addition, as the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) are determined by the Notification of the Ministry of Industry issued pursuant to Section 15 of the Industrial Product Standards Act B.E. 2511 (1968), they are determined by the Industry Minister which is the Administration. According to Section 16, the manufacturers of textile and garment products conforming to the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) may submit the application for a license to display the standard mark on their products on their demand. Once the manufacturers are granted a license from the Thai Industrial Standards Institute, they shall have the right to exhibit the standard mark on their products. In case of violating the Notification of the Ministry of Industry, there shall have the sanction according to the Industrial Product Standards Act B.E. 2511 (1968). The sanction of the industrial standards according to Section 15 includes the Thai manufacturers shall not be able to export their textile and garment products, which do not conform to the industrial standards including the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007), to any foreign countries having their laws and regulations controlling or restricting the use of aromatic amines such as the European Union and the People's Republic of China. Further, although there are no specific laws and regulations controlling on aromatic amines in some countries but the manufacturers may have the liability according to the provisions of the product liability laws if their products cause damage or injury to the consumers. Moreover, in case that the manufacturers do not receive a license to display the standard mark from the Thai Industrial Standards Institute, they shall not have the right to exhibit the standard mark on their products.[164] As a result, the consumers may not trust in the quality and

[164] *supra* note 135.

standard of the products which do not display the standard mark and may decide not to buy them. On the other hand, as the Royal Decree has the higher level than the Notification of the Ministry of Industry. In case of designating the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17, the manufacturers shall be required to produce their products only in conformity with the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007). Last but not least, by adoption of the Royal Decree to the aforesaid mentioned effect, Thailand can prevent importation of the products which do not conform to the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007). By this means, the consumers in Thailand will be protected.

Therefore, from the above analysis, in the author's opinion, to determine the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17 would be the effective and appropriate solutions for controlling the use of aromatic amines which are considered as hazardous substances in textile and garment products. Accordingly, the manufacturer and importer shall be required to manufacture and import fabric and garment products only in conformity with the requirement of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007). In regard to the controlling of aromatic amines, the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) set a requirement that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. This would be the effective and appropriate solutions for controlling the use of aromatic amines which are hazardous substances in textile and garment products in Thailand.

### 4.1.3 The Factory Act B.E. 2535 (1992)

The construction and operation of a factory in Thailand is strictly regulated by the Factory Act B.E. 2535 (1992) which stipulates the regulations for the construction, operation, expansion and safety of factories in Thailand, and also controls the levels of industrial pollution released through factory activities.

According to Section 5[165] of the Factory Act, "Factory" means a building, place, or vehicle which uses a machine from five horse powers or an equivalent thereof or more or which employs seven workers or more with or without any machine for manufacturing, producing, assembling, filling, repairing, maintaining, testing, improving, altering, transporting, keeping, or destroying anything in accordance with the type or kind of factory as provided for in a Ministerial Rule.

#### 4.1.3.1 Supervision of the Factory: Ban on Establishment or Expansion of a Factory Producing Benzidine Based Dyes and Chromic Compounds Based Dyes, and on Using the Dyes in Dyeing and Finishing Industry

Chapter 2 of the Factory Act prescribes the power of the authorities to supervise of the factory. In this regard, for the purposes of economy, conservation of environment, security, safety of the country or of the public, Section 32[166] states that the Minister of Industry, upon approval of the Cabinet, shall have the power to adopt, upon publication in the Government Gazette, which reads as follows:

> "**Section 32** For the purposes of economy, conservation of environment, security, safety of the country or of the public, the Minister of Industry, upon approval of the Cabinet, shall have the power to adopt, upon publication in the Government Gazette, the following matters:

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[165] Full text of the Factory Act B.E. 2535 (2002) *available at* http://web.krisdika.go.th/data/law/law2/%c332/%c332-20-2535-001.pdf.

[166] *Id.*

(1) To adopt a number and sizes of each type or kind of factory to be established or expanded or to refuse the establishment or expansion thereof in any area.

(2) To adopt the kinds, quality, ratio of the raw materials, sources of raw materials and/or factors or kinds of energy to be used or produced in the factory.

(3) To adopt the kinds or quality of the products manufactured in the factory to be established or expanded.

(4) To adopt the application of the produce of the factory to be established or expanded to certain types of industry or the exportation of all or part of tile produces."

In 1994, the Ministry of Industry realizes that dyes used in dying process in the form of carcinogenic substance and heavy metal that cannot be disposed of or completely degraded are benzidine based dyes and chromic compounds based dyes. Certainly, allowing an establishment or expansion of a factory producing or using these two types of dyes may potentially cause environmental problem and may part harm to health of workers and people that uses public reservoir contaminated with effluent from dyeing and finishing industry. By the virtue of Section 32 (1) and (2), the Ministry of Industry issued the **Notification of the Ministry of Industry No. 10 B.E. 2537 (1994) issued pursuant to the Factory Act B.E. 2535 (1992)**[167] in order to ban on establishment or expansion of a factory producing benzidine based dyes and chromic compounds based dyes, and on using the

[167] Full text of the Ministerial Notification No. 10, B.E. 2537 (1994) Issued under the Factory Act B.E. 2535 (1992) regarding Ban on Establishment or Expansion of a Factory Producing Benzidine Based Dyes and Chromic Compounds Based Dyes, and on Using the Dyes in Dyeing and Finishing Industry (Thai language) *available at* http://www.ratchakitcha.soc.go.th/DATA/PDF/2537/E/028/7.PDF.

dyes in dyeing and finishing industry. The Ministerial Notification No. 10 B.E. 2537 (1994) consists of 3 Articles. It reads as follows:

> "**Article 1** Establishment or expansion of a factory producing benzidine based dyes and chromic compounds based dyes is prohibited in all area in the Kingdom.
>
> **Article 2** A factory producing dyes shall not use benzidine, benzidine compounds, chromium, and chromic compounds as raw material.
>
> **Article 3** A factory with dyeing and finishing business shall not use dyes having benzidine, benzidine compounds, chromium, and chromic compounds as components in the production process."

In such case, the establishment or expansion of a factory producing benzidine based dyes and chromic compounds based dyes is prohibited in all area in Thailand. Also, any factory producing dyes shall not use benzidine, benzidine compounds, chromium, and chromic compounds as raw material. In addition, a factory with dyeing and finishing business shall not use dyes having benzidine, benzidine compounds, chromium, and chromic compounds as components in its production process.

#### 4.1.3.2 Analysis

The Notification of the Ministry of Industry No. 10 B.E. 2537 (1994) issued pursuant to the Factory Act B.E. 2535 (1992) prohibits a factory producing dyes to use benzidine, benzidine compounds, chromium and chromium compounds as raw material for its dyes and prohibits dyeing and finishing factories to use dyestuff containing benzidine, benzidine compounds, chromium and chromic compounds as components in the production process. This can help to decrease using of benzidine (CAS Number 92-87-5), one of 22 aromatic amines, which can cause

cancer, restricted to use in textile and garment articles which may come into direct and prolonged contact with the human skin or oral cavity following to the legislations of many countries, in a factory producing dyestuff. The dyes produced and marketed from such factory will be safe from benzidine. Then, it seems that there are only dyes free from benzidine sale in the market. As a result, dyeing and finishing businesses are also prohibited to use dyes free from benzidine for dyeing and finishing process in their factories. Textiles and fabrics produced in those dyeing and finishing factories will be safe materials for manufacturing finished garments or clothes in a manufacturing factory. Once these finished garments and clothes are launched into the market, consumers will certainly have more opportunity to buy and wear clothing which is free from benzidine substance. However, the prohibitions under the Notification of the Ministry of Industry No. 10 B.E. 2537 (1994) do not restrict on all types of aromatic amines which can cause cancer. Benzidine is classified as one type of aromatic amines, while, aromatic amines which can cause cancer consisting of 22 substances following to the International Agency for Research on Cancer (IARC) Classification which are generally restricted to use in textile and garment industries around the world.

Nonetheless, there is the limitation of the control measures under the Factory Act B.E. 2535 (1992) and the Notification of the Ministry of Industry No. 10 B.E. 2537 (1994). Only the factory according to the definition defined in Section 5 of the Factory Act B.E. 2535 (1992); reads that a building, place, or vehicle which uses a machine from five horse powers or an equivalent thereof or more or which employs seven workers or more with or without any machine for manufacturing, producing, assembling, filling, repairing, maintaining, testing, improving, altering, transporting, keeping, or destroying anything in accordance with the type or kind of factory as provided for in a Ministerial Rule, is enforced by the Notification. In case that the manufacturers of textile and garment products are not classified as a factory according to such definition, they will not be obliged to comply with the requirements of the Notification. The consumers may still have a risk causing from another aromatic amines substances. Accordingly, the Factory Act B.E. 2535

(1992) and its subordinate law are not sufficient to control the use of aromatic amines and to protect consumers from aromatic amines causing cancer in a human.

### 4.1.4 The Consumer Protection Act B.E. 2522 (1979)

#### 4.1.4.1 Consumer Protection against Labeling

Under the Consumer Protection Act, the consumer has the right to receive correct and sufficient information and description as to the quality of products or services, or the right to know.[168] In order to provide information of the product for consumers, Section 30[169] of the Consumer Protection Act sets the principles for labeling of the product. It reads as follows:

> "**Section 30** Products which are manufactured for sale by the factories under the law on factories and products which are ordered or imported into the Kingdom for sale shall be a label-controlled product.
>
> The provisions of Paragraph one shall not apply to the products prescribed by the Committee on Labels by publishing in the Government Gazette.
>
> In the case where it appears that products which may be harmful to health or cause physical or mental harm because of the use or the nature of such products or the products regularly used by the public and the

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[168] Section 4 The consumer has the following right of protection:

(1) the right to receive correct and sufficient information and description as to the quality of goods or services;

(2) the right to enjoy freedom in the choice of goods or service;

(3) the right to expect safety in the use of goods or services;

(3 bis) the right to receive a fair contract;

(4) the right to have the injury considered and compensated in accordance with the laws on such matters or with the provision of this Act.

[169] Full text of the Consumer Protection Act B.E. 2522 (1979) *available at* http://web.krisdika.go.th/data/law/law2/%a434/%a434-20-9999-update.pdf.

> requirement of labels on such products will be beneficial to the consumers so that they may be aware of the material facts concerning such products, the Committee on Labels shall have the power to declare such products to be a label-controlled products by publishing in the Government Gazette."

In such case, the existing law on factories is the Factory Act B.E. 2535 (1992). Factory in this regard means a building, place, or vehicle which uses a machine from five horse powers or an equivalent thereof or more or which employs seven workers or more with or without any machine for manufacturing, producing, assembling, filling, repairing, maintaining, testing, improving, altering, transporting, keeping, or destroying anything in accordance with the type or kind of factory as provided for in a Ministerial Rule. For a label-controlled product referred to in Section 30 Paragraph 1, the label shall consist of the description defined in Section 31[170], which reads as follows:

> "**Section 31** The label of label-controlled products shall be of the following descriptions:
>
> (1) it shall contain truthful statements and have no other statements which may include misunderstanding as to the material facts concerning such goods;
>
> (2) it shall contain the following statements;
>
> - the name or trademark of the manufacturer or the importer for sale, as the case may be;
> - the place of manufacturing or the place of operating import business, as the case may be;

[170] *Id.*

- the statements which indicate what the products are; in the case of imported products, the name of the manufacturing country shall be specified;

(3) it shall contain necessary statements such as price, quantity, usage, recommendation, caution and an expiry date in the case of products which can be expired or in other instances to protect the consumer rights; provided that, such protection shall be made in accordance with the rules and conditions prescribed by the Committee on Labels by publishing in the Government Gazette."

Moreover, the information required to declare on the label is also provided in the Announcement of the Committee on Labels B.E. 2541 (1998). Article 2[171] of the Announcement defines the list of description provided in a label-controlled product, which reads as follows:

"**Article 2** The label of a label-controlled product shall contain the following information:

(1) product category or type of product which indicate what the product is, in the case of imported product, the name of the manufacturing country shall be specified;

(2) the name or trademark registered in Thailand of the manufacturer for sale in the Kingdom;

(3) the name or trademark registered in Thailand of the importer for sale in the Kingdom;

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[171] Full text of the Announcement of the Committee on Labels B.E. 2541 (1998) *available at* http://web.krisdika.go.th/data/law/law2/%a434/%a434-2e-2541-a0002.pdf.

(4) the place of manufacturing or the place of operating import business, as the case may be;

(5) size or dimension or quantity or weight of a product, as the case may be;

(6) instruction of usage which can identify what a product use for, such as use for cleaning wood floor or tile floor, plastic ware or earthenware;

(7) suggestion for use or not to use in order to provide accurate usability to consumers, such as never use a sharp weapon to remove frost;

(8) warning (if any);

(9) manufacturing date or expiring date (if any);

(10) price specifying in Thai Baht and other currency may be further indicated."

In such case, however, the Announcement of the Committee on Labels B.E. 2541 (1998) shall not be used with the products prescribed by the Committee on Labels to be a label-controlled product by publishing the Announcement of the Committee in the Government Gazette under Section 30 Paragraph 3. This Announcement may prescribe details and conditions to label the products which are suitable for each type of product. Accordingly, consumers will receive correct and sufficient information and description of the products so that they will be able to decide to purchase such product. This is the way to promote the consumer's right to know.

**4.1.4.2 Analysis**

Generally, textile and garment products manufactured for sale by the factories under the law on factories, or the Factory Act B.E. 2535 (1992), and

are ordered or imported into Thailand for sale shall be control the labeling under Section 30 Paragraph 1. However, concerning to the list of descriptions required to place on a label under Section 31, the descriptions may not sufficient to provide information about carcinogen of aromatic amines to consumers. Furthermore, considering the Announcement of the Committee on Labels under Section 30 Paragraph 3, there is no specific announcement to declare textile and garment products containing aromatic amines as a label-controlled product required the warning label that these substances are carcinogen and may cause cancer to consumers. In addition, if textile and garment products are not manufactured by any persons but the factory as defined in the Factory Act B.E. 2535 (1992), the products are not considered as a label-controlled product.

As a result, without the label providing sufficient information about carcinogen of aromatic amines containing in textile and garment products, consumers will certainly not realize this fact and will take a risk causing from aromatic amines contaminating in textile and garment products.

**4.2 Proposed Alternative Solutions**

In Chapter 3, three different control measures of three countries are discussed: the restriction to the use of aromatic amines at the limited concentration of 30 mg/kg in finished products and the general safety requirement of the European Union, the requirement to notice the EPA in any activity relating to chemical substances listed in the SNUR and the requirement of clear and reasonable warning of the United States of America, and compulsory national standard to forbid the use of aromatic amines at the limited concentration of 20 mg/kg in finished products in the People's Republic of China. All aims at preventing consumers from aromatic amines, chemicals that are known to cause cancer; although, there are some differences in detail. Therefore, it is necessary to consider that which measure is the most appropriate one to Thai law system.

In regard to the restriction of the European Union, Article 67 (1) of the REACH sets the requirement that 22 aromatic amines listed in Appendix 8 shall not

be used over 30 mg/kg in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, including clothing bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags, footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses, textile or leather toys and toys which include textile or leather garments, yarn and fabrics intended for use by the final consumer. It is seen that the restriction does not impose only on textile and garment products for wearing, but it also expand to impose on any textile and garment products which may come into direct and prolonged contact with the human skin or oral cavity. As the REACH is a regulation of the European Union so that the entirety of the member states of the European Union must be applied and bound by the REACH without the consent of any member states. Moreover, with respect to the control measure in the Chinese safety standards, GB 18401-2010 imposes that 24 aromatic amines, listed in Appendix C are forbidden to use with a limit concentration at 20 mg/kg in all three categories of textile products manufactured, sold or imported to China. Three categories of products include textile products that are worn or used by infants at below 36 months of age, textile products with large areas in direct contact with human skin when worn or used, and textile products without direct contact to skin or textile products with little or no area in direct contact with human skin when worn or used. The Chinese standard sets the requirements in the same manner with the Thai industrial standard in regard to textile and garment products. For harmonization of Thai laws system to the international system, currently, as Thailand has the Notification of the Ministry of Industry No. 3764 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Fabrics or TIS 2231-2548 (2005) and the Notification of the Ministry of Industry No. 3765 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Garments or TIS 2346-2550 (2007) which they meet the control measures of the European Union and the People's Republic of China, it is advisable that to apply the European Union regulation concerning the restriction to use aromatic amines at limited concentration in finished products as a model law would be the most appropriate mechanism in Thai laws systems.

For the control measures of the United States of America, the U.S. Environmental Protection Agency (EPA) must make the determination by rule after considering all relevant factors, including those listed in Section 5(a)(2) of the Toxic Substances Control Act (TSCA). Once the EPA determines that a use of any chemical substance is a significant new use, it is required persons to submit a Significant New Use Notice (SNUN) to the EPA at least 90 days before they manufacture (including import) or process the chemical substance for that use. Under this law, it does not prohibit to use aromatic amines. It merely requires the manufacturers and importers to inform the EPA at least 90 days prior the manufacture or import of benzidine-based chemical substances. The US approach, therefore, would not be the successful solutions to control aromatic amines which can cause cancer in textile and garment products in the Thai society.

Where the Thai laws do not stipulate sufficient particular provisions to control textile and garment products sold, marketed and imported into Thailand from aromatic amines which can cause cancer, a new provision and amendment should be advised.

**4.2.1 Designating the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the Industrial Standards which are Required by a Royal Decree to Manufacture Fabric and Garment products in Conformity with the Requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007)**

Currently, Thailand has the Notification of the Ministry of Industry No. 3764 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Fabrics or TIS 2231-2550 (2007) and the Notification of the Ministry of Industry No. 3765 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Garments or TIS 2346-2550 (2007). In regard to the controlling of aromatic amines, the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) set a

requirement that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. However, fabric and garment products are not required by a Royal Decree to conform to the TIS 2346-2550 (2007) and TIS 2346-2550 (2007) according to Section 17. In case that designating the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17, the manufacturer and importer are required to receive a license before produce or import their products. After having received the license, they will be granted the right to display the standard mark on their products showing that the products are manufactured or imported conforming to the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007). In this connection, the manufacturers and importers are required by Section 29 to manufacture fabric and garment products in conformity with the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007) thereof or import fabric and garment products in conformity with the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007) thereof, as the case may be. Moreover, as it appears that some manufacturer of textile and clothing, especially for export, has already complied with the code of conduct or standards of foreign customers that hazardous aromatic amines must not be used.[172] Consequently, it is possible for Thai textile and garment industries to manufacture textile and garment products in the same standard and quality with products for export.

It is, thus, necessary to propose to designate the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17. This would help to address the problems of textile and garment products containing aromatic amines which can cause cancer by providing

[172] From an interview with Charoen Charoenwatanasuksom, a managing director of textile and garment manufacturer.

compulsory requirements for manufacturers and importers to control the use of aromatic amines in textile and garment products manufactured or imported for sale in Thailand.

### 4.2.2 Consumer Protection against Labeling

Section 4 of the Consumer Protection Act B.E. 2522 (1979) states the "right to know" as one of the consumer's rights of protection. The consumers have the right to receive correct and adequate information in the choice of goods or services. Labeling measures should provide the important information to consumers. Concerning to the list of descriptions providing the information of the products required to place on a label under Section 31, the descriptions may not sufficient to provide information about carcinogen of aromatic amines to consumers. Furthermore, considering the Announcement of the Committee on Labels under Section 30 Paragraph 3, there is no specific announcement to declare textile and garment products containing aromatic amines as a label-controlled product required the warning label that these substances are carcinogen and may cause cancer to consumers. In addition, the label-controlled product measure enforces with products manufactured for sale by the factory as defined in the Factory Act B.E. 2535 (1992). If textile and garment products are manufactured by any persons other than the factory, the products may not be controlled as a label-controlled product. However, it is found that Thai consumers lack of appropriate information to declare about carcinogenic substances contain in textile and garment products. They should have enough information to decide whether to take the risks from such carcinogen substances or not. The consumers should be informed that textile and garment products contain aromatic amines causing cancer. Without the label providing sufficient information about carcinogen of aromatic amines containing in textile and garment products, consumers will certainly not realize this fact and will take a risk causing from aromatic amines contaminating in textile and garment products.

Therefore, it is advisable that textile and garment products containing aromatic amines should proposed to be a label-controlled product under the Announcement of the Committee on Labels. The label should provide information warning the consumers that aromatic amines substances are carcinogenic and may

cause cancer to consumers. The content of label to declare textile and garment products containing aromatic amines can be "This product contains chemical known to cause cancer at the concentration which is not over the limitation of 30 mg/kg." Moreover, other than textile and garment products, this can extend to use in other types of products containing any substances that can cause cancer. Furthermore, in case where the manufacturer or importer produces or imports their products complying with the TIS 2231-2548 (2005) or the TIS 2346-2550 (2007), they should provide the label placed on the products that such products conform to the TIS 2231-2548 (2005) or the TIS 2346-2550 (2007) as well. In the author's point of view, the labeling placed on textile and garment products is the alternative solution helping to maintain consumer's rights and protect them from dangerous aromatic amines in textile and garment products.

#### 4.2.3 General Safety Requirement

In general, as it has been found in Thai legal system that the measure to control quality, safety and other requirements for one product are imposed by means of mandatory or voluntary industrial standards. These standards are developed by the Thai Industrial Standards Institute following the government policy in order to promote consumer's protection, enhance competitiveness in the global market as well as protect and preserve environment and natural resources.[173] However, the standards focus to control the industrial products used in business and industry, rather than consumer products used by individuals or households for private consumption, such as textile, garment and clothing products. Furthermore, under the mandatory standards, manufacturers are obliged to produce their products conforming to the standard while they are not required to comply with the voluntary one. These seem only the industrial standard measure may not sufficient to control the quality and safety of every type of products in the market. Moreover, concerning the consumer protection and product safety control aspects, there is a statutory to impose the liability of manufacturers, importers and sellers for damages caused by the unsafe products which have been sold to the consumers, no matter whether such damages are

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[173] Thai Industrial Standards Institute (TISI), *Standardization Activities*, *available at* http://www.tisi.go.th/eng/index.php/item/2.

intentionally or negligently caused by them.[174] However, there are neither specific statutory directly imposed to require manufacturers to place only safe products on the market nor requirement for distributors to act with due care to help to ensure the safety of products.

It is, thus, advised to propose a subordinate law regarding the consumer protection, by using a concept of the general safety requirement according to the GPSD of the European Union as a model law, providing general requirement concentrated on safety of consumer products. It should be imposed the general requirement that "only safe products can be placed on the market" with the presumption that "any products conforming to existing or coming future industrial or technical standards are also considered to be safe." In such case, this general requirement can be considered as horizontal legislation which covers all types and categories of consumer products in the market. At the same time, this general requirement also promotes the industrial standards system. This is one of the ways to fulfill loophole of industrial standards which are considered to be a vertical legislation. Other than the industrial standards that are specified only for some type of products, in any case where there is no industrial standard, this law will be a general provision for control safety of products sold in the market and will apply in the event of the insufficiency of the industrial standards. This will effectively decrease the weakness of the industrial standard measure.

Moreover, since the industrial standards usually contain technical and complex requirements based on the consideration of other manufacturers and specific safety experts, the concept of referring the industrial standards in regulations or legislations can help the government sectors to establish a regulation quickly and save time and money that would otherwise be spent studying, researching and development on the technical information in order to establish suitable regulations for

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[174] Section 5 of the Product Liability Act B.E. 2551 (2008) states that "All entrepreneurs shall be jointly liable for damages occurring to the damaged party from an unsafe product sold to the consumer. This shall apply to intentional damages or damages arising from the negligence of the entrepreneurs."

each industry. It is an alternative choice to permits detailed technical requirements to be embodied in the text of regulations simply by referencing a standard or the relevant parts of a standard. In the consumers' perspectives, the increasing complexity of production processes, as well as environmental and social challenges calls for transparent and compelling guidelines at the global level. As it appears that some manufacturer of textile and clothing, especially for exporting to the European Union, has already complied with the code of conduct or industrial standards of foreign customers defined that hazardous aromatic amines must not be used. From some of the manufacturer's aspect, the industrial standards provide many advantages to improve the situation of the manufacturer. They are a key factor in gaining better access to markets. Implementing these industrial standards allows producers to gain better access to markets and improves competitiveness.[175] Consequently, it is possible for Thai textile and garment industries to manufacture products to the same standard and quality of products for export.

In conclusion, other than the general safety requirement, it is also necessary to promote industrial or technical standard for consumer products in order to form complete system to protect consumers from textile and garment products containing aromatic amines.

### 4.2.4 Post-market Measure: Product Recall Measure

A product recall can help to protect the consumer when there is a reasonable ground to believe that any of such product is dangerous. It is a preventive measure preventing consumers before they are injured as a result of harmful products. When a safety problem in a consumer product is identified, manufacturers or government sectors may determine that the product needs to be recalled. This measure must be carried out as quickly as possible so as to encompass damages of consumers.

Since manufacturers are in the best position to know any defects and dangers of their products, as well as they certainly, by their business chains, know so

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[175] *supra* note 159.

well about the number of their products placed in the market and the number of product which had been sold to consumers. In some cases, they also know a person with whom the products had been supplied. Consequently, the effective recall measure should be carried out voluntarily by them. However, practically, the voluntary recall may not be undertaken, or it may be performed ineffectively. This is because to carry out the recall measure may constitute with high cost, which includes the actual amount of repair, the cost of contacting the consumers, the cost of delivery, and the cost of recovering the product.[176] As a result, when voluntary recall seems to be ineffective, the competent authority should be empowered to monitor the voluntary recall so as to ensure the effectiveness of this measure.

In this regard, it is required to revise the Consumer Protection Act B.E. 2522. The Office of the Consumer Protection Board (OCPB) has proposed the Consumer Protection Act B.E. 2522 (Third Amendment B.E. 2556) in order to grant the power of mandatory recall to the OCPB. According to Section 36[177] of the Consumer Protection Act B.E. 2522 (1979), when there is a reasonable cause to suspect that any products may be harmful to the consumers, the Consumer Protection Board may order the businessman to have such products tested or verified. If the businessman does not proceed to test or verify the products or delays in so doing without justification, the Consumer Protection Board may arrange for the verification at the expenses of the businessman. If the result of the test or verification appears to be that such products may be harmful to consumers and the harmfulness which may be caused by such products cannot be prevented by means of the requirement of the labeling under Section 30 or under any other manners, the Consumer Protection Board shall have the power to:

(1) prohibit the sale of such products;

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[176] Pakorn Nilprapunt, *Product Recall Measure: Australia and the United States available at* http://www.lawreform.go.th/lawreform/index.php?option=com_content&task=view&id=246&Itemid=11.

[177] *supra* note 151.

(2) order the businessman to recall of such products from the market or consumers who bought such products;

(3) order the businessman to modify, reform or improve such products to be safe for consumers, as well as change the new products or compensate the price of the products sold by consumers;

(4) order the businessman as the importer to send such products out of Thailand;

(5) order the businessman to destroy such products; and

(6) order the businessman to declare the information about the harmfulness of such products to consumers.

In conclusion, when any products have been tested or verified that they are dangerous to consumers and such harmfulness cannot be prevented by other means, the Consumer Protection Board shall have the power to order businessmen to recall harmful or dangerous products from market or consumers. It is said that product recall measure is an effective method of removing or correcting products that are in violation of laws or standards.

### 4.2.5 Non-legislative Solutions

#### 4.2.5.1 Promoting to Use Alternative Dyes

Dyeing cloth is one of our oldest industries; people used natural products found around them to change the color of the fibers used to make their cloth – things like leaves, berries, or roots. However, the use of natural dyes on a commercial scale has almost disappeared (except for resurgence in the craft market) in favor of the newer synthetic dyes. Today, the world's dyestuffs industry produces

around 500,000 tons of synthetic dyes each year.[178] It is come a long way since William Henry Perkins discovered mauve in 1856 which is the first synthetic dye. Since then, the production of synthetic chemical dyestuffs has become big business, but, unfortunately the production and use of these synthetic dyes is one of the world's most polluting industries.

Dyes are compounds that can be dissolved in solvents, usually water. The process of dyeing textile and garment uses a considerable quantity of water. According to the information revealed by the United States Environmental Protection Agency; it takes an average of 5 – 35 gallons of water for every pound of finished fabric. That may calculate into 125 – 875 gallons of water to dye 25 yards of fabric, which will be enough to cover only one sofa.[179]

The fibers absorbed the dyes in solution. The process of transferring the dye from the water to the fiber is called exhaustion or "fixation rate," with 100 percent exhaustion meaning there is no dye left in the dye bath solution. Most conventional dyes have an exhaustion rate of 80 percent, meaning the dyestuff which is not affixed to the fiber is flushed into the rivers with the spent process water. Each year the global textile industry discharges 40,000 – 50,000 tons of dye into our rivers, and more than 200,000 tons of salt.[180]

Fiber-reactive dyes are one of proposed low-impact dyes in textile and garment industry. They were first used commercially in 1956.[181] They are a synthetic dye that chemically bonds directly to the clothing fiber molecules. The

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[178] OpenLearn, *The Birth of (Synthetic) Dyeing available at* http://www.open.edu/openlearn/history-the-arts/history/history-science-technology-and-medicine/history-science/the-birth-synthetic-dyeing.

[179] *supra* note 21.

[180] *Id.*

[181] OrganicClothing.blogs.com, *Dyes and Chemical Sensitivities available at* http://organicclothing.blogs.com/my_weblog/2005/10/dyes_and_chemic.html.

fixation or absorption rate of low-impact dyes is at least 70 percent,[182] creating less waste water drain and, therefore, a lower impact on the environment. They contain no heavy metals or other known toxic substances, and they meet all European Union criteria, including Oeko-Tex, for being an eco-friendly pigment.

Other than fiber-reactive dyes which are synthetic dyes, natural dyes should be proposed to use. Natural dyes are dyes or colorants derived from plants, invertebrates, or minerals. There are many pros of natural dyes. They are environmental friendly and safe for human's health. It is also easy to find raw materials for being used as dyes such as branch, leaf stalk, gourami, root, and flower, with very cheap price comparing to chemicals. The followings are some natural plants in Thailand which can be used as dyes:[183]

**Table 4.4 : Natural Plants in Thailand which can be Used as Dyes**

| Plants | Parts Giving Color | Color |
|---|---|---|
| Jackfruit | Root and heartwood | Yellow |
| Mango | Peel | Yellow |
| Curcuma Longa | Rootstock | Yellow |
| Pterocarpus macrocarpus | Tunic, rootstock | Brown |
| Teak | Young leaf | Red |
| Safflower | Flower | Reddish ,yellow, red |
| Indigo | Leaf | Dark blue, blue, green |
| Pomegranate | Peel of fruit | Green |

[182] Aboynamedsue, *Ecodictionary: Dyes (Low Impact)*, *available at* http://www.aboynamedsue.co/about/ecodictionary/.

[183] Arun Moneing, *Sustainability of Natural Dye Usage in a Cloth Dyeing Group at Ban Tan Sub-district, Hod District, Chiang Mai Province*, Maejo University (2002).

There are many dyes using in textile and garment industry. Some of them are safe while some are dangerous for human's health and environment. As manufacturers who have expertise in their businesses, they have advantage about manufacturing over consumers. Accordingly, they should do more research and study to use safe alternative dyes.

#### 4.2.5.2 Other Voluntary Standards

Nowadays, consumers are more concerning to the protection of the environment resulting in the behavior on the awareness of environmental issues and the popularity of environmental friendly and safety products. Many countries have launched voluntary environmental standards for many various types of products, including textile and garment products. In order to satisfy consumers' needs, manufacturers have to improve and develop their products quality in order to meet these criteria. Some information shows that there are more than 100 ecolabels on textiles among global countries.[184] The followings are the sample of international voluntary standards for textile and garment products.

(1) Oeko-Tex[185]

Since the 1990s, the Oeko-Tex Standard was introduced in response to serve the demand of society that needs textiles and garments which are harmless to health. The Oeko-Tex aims to set the standard for textile products to pass the laboratory testing for dangerous and harmful substances before they are marketed and sold to consumers. After the testing, a label "Confidence in Textiles" will be placed on such products that give confidence to consumers.

The testing of Oeko-Tex standards is voluntary. Testing for dangerous and harmful substances under the Oeko-Tex includes; pH value;

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[184] Ecolabel Index, *The global directory of ecolabels*, *available at* http://www.ecolabelindex.com/ecolabels/?st=category,textiles#E.

[185] OEKO-TEX® Association, *OEKO-TEX® Standard 100*, *available at* https://www.oeko-tex.com/en/manufacturers/concept/oeko_tex_standard_100/oeko_tex_standard_100.xhtml.

formaldehyde; heavy metal such as lead, cobalt, nickel, mercury; pesticides; phthalates; chemical residues; and carcinogenic colorants.

(2) EU Ecolabel[186]

The EU Ecolabel helps consumers to choose products and services that decreased the impact on the environment throughout their life cycle, from the raw material through to the manufacturing, use, and disposal. It is a voluntary label showing that manufacturers are in a good practice of promoting the natural conservation which consumers can be trusted.

The European Commission set criteria for the award of the EU Ecolabel for textile products in the EU Commission 2014/350/EU.[187] The EU Ecolabel on textile and garment products guarantees;[188] a limited use of substances harmful to the environment; limited substances harmful to health; reduced water and air pollution; textile shrink resistance during washing and drying; and color resistance to perspiration, washing, wet and dry rubbing and light exposure.

**4.3 Conclusion**

The current Thai laws are not sufficient to control the use of aromatic amines which can cause cancer in textile and garment products. From a study of the European, the US, and Chinese approaches, the appropriate regimes are the general requirement for control safety of consumer products sold in the market under the EU Directive on General Product Safety together with the clear and reasonable warning system under US Safe Drinking Water and Toxic Enforcement Act law.

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[186] The European Commission, *The EU Ecolabel*, *available at* http://ec.europa.eu/environment/ecolabel/index_en.htm.

[187] 2014/350/EU: Commission Decision of 5 June 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products, full text available at http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1403869165475&uri=OJ:JOL_2014_174_R_0015.

[188] The European Commission, *Fact Sheet: The EU Ecolabel for Textiles at* http://ec.europa.eu/environment/ecolabel/documents/factsheet_textiles.pdf.

In addition to the foreign approaches, to build complete system for controlling aromatic amines, designating fabric and garment products as the industrial products which are required by a Royal Decree to conform with the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) is also necessary to be advised.

Moreover, the product recall measure is an effective method of removing or correcting products that are in violation of laws or standards so that it is also the appropriated regimes. It is advised in this thesis that Thailand may adopt the same concept with some different details to set the control measures of using aromatic amines in textile and garment products in its society.

# CHAPTER 5
# CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusion

The studies and researches show that some aromatic amines have been shown to cause a bladder cancer in humans and should not be used in textile and garment products that prolong and direct contact with human's skin. They can be absorbed through the skin or mouth, in other words, consumers may absorb them by everyday exposure. Clothes are one of the four requisites, and it cannot deny that everyone have to wear clothes every day. Just imagine that consumers are wearing a shirt containing aromatic amines which prolonged contact to their skin at least eight hours a day for their lifespan, how much concentration of aromatic amines that may cause cancer accumulated in their body?

Toxic effluents containing aromatic amines shown to cause cancer are discharged from various industries, and they adversely affect water resources, soil fertility, aquatic organisms and ecosystem integrity. These toxic effluents pose toxicity such as lethal effect, genotoxicity, mutagenicity and carcinogenicity to aquatic organisms including fish, algae, bacteria as well as animals. They are not readily degradable under natural conditions and are typically not removed from wastewater by conventional waste water treatment systems.

Since the 1990s, many countries have placed important on this matter and have prohibited using aromatic amines in textile and garment products in limited concentrations. Some studies show that there are alternative chemical substances or dyes which manufacturers can use instead of aromatic amines, without losing their profits or increasing their cost of using alternative chemical substances or dyes. According to the list of aromatic amines widely restricted to use in many countries, there are totally 24 aromatic amines restricted and limited to use in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity.

In order to prevent and protect Thai consumers from consuming textile and garment articles containing aromatic amines causing cancer, awareness, and appropriate solutions are, therefore, certainly and urgently required in practice. As highlighted earlier, there are various legislative approaches in response to the control of using aromatic amines in textile and garment products in foreign countries. It is necessary to meticulously study those to seek the suitable system for Thai law and find other alternatives for Thailand.

In Thailand, we have the Notification of the Ministry of Industry No. 3764 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Fabrics or TIS 2231-2550 (2007) and the Notification of the Ministry of Industry No. 3765 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Garments or TIS 2346-2550 (2007). The TIS 2231-2550 (2007) and TIS 2346-2550 (2007) set a requirement that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. However, fabric and garment products are not designated as the industrial products which are required by a Royal Decree to conform to the TIS 2231-2550 (2007) and TIS 2346-2550 (2007). This means the Thai manufacturers shall not be able to export their textile and garment products, which do not conform to the industrial standards including the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007), to any foreign countries having their laws and regulations controlling or restricting the use of aromatic amines such as the European Union and the People's Republic of China. Also, although there are no specific laws and regulations controlling on aromatic amines in some countries but the manufacturers may have the liability according to the provisions of the product liability laws if their products cause damage or injury to the consumers. Moreover, in case that the manufacturers do not receive a license to display the standard mark from the Thai Industrial Standards Institute, they shall not have the right to exhibit the standard mark on their products. As a result, the consumers may not trust in the quality and standard of the products which do not display the standard mark and may decide not to buy them. It is, thus, propose to designate the Thai Industrial Standard

for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17. Moreover, it is found that Thai consumers lack of appropriate information to declare about carcinogenic substances contain in textile and garment products. It is advisable that textile and garment products containing aromatic amines should proposed to be a label-controlled product. The label should provide sufficient information warning the consumers that aromatic amines substances are carcinogenic and may cause cancer to consumers. In addition, there are neither specific statutory directly imposed to require manufacturers to place only safe products on the market nor requirement for distributors to act with due care to help to ensure the safety of products. So, it is necessary to propose a subordinate law regarding the consumer protection, by using a concept of the general safety requirement according to the GPSD as a model law, providing general requirement concentrated on safety of consumer products. In any case where there is no industrial standard, this law will be a general provision for control safety of products sold in the market and will apply in the event of the insufficiency of the industrial standards.

## 5.2 Recommendations

A study on control measure of aromatic amines, chemicals that are known to cause cancer, in foreign countries shows that all aims to prevent consumers from exposure to aromatic amines in textile and garment products. There are three distinct solutions; the general safety requirement and the restriction to the use of aromatic amines of the European Union, the requirement to notify the EPA at least 90 days before commencing an activity that is involving to chemical substances listed in the SNUR and the requirement of clear and reasonable warning of the United States of America, and compulsory product standard to forbid the use of aromatic amines in the People's Republic of China.

After thoroughly studying all three schemes with Thai legal backgrounds, the most appropriate mechanism, from the author's opinion, is designating the TIS 2231-2550 (2007) according to the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the TIS 2346-2550 (2007) according to the Notification of the Ministry of Industry No. 3765 (B.E. 2550) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17. It is also necessary to propose textile and garment products containing aromatic amines to be a label-controlled product. The label should provide sufficient information warning the consumers that aromatic amines substances are carcinogenic and may cause cancer to consumers. Moreover, a subordinate law in regard to the consumer protection providing general requirement concentrated on the safety of consumer products, for generally uses with all types of consumer products, is also necessary to be advised. Even though there are many legislations relating to the control of aromatic amines, it should not have more than one legislative to enforce with the same issues. The reason is that the redundancy between many legislatives may increase the cost of both the Government sectors and private sectors who must comply with the laws. As any regulation is likely to permit using aromatic amines within an acceptable level, a safety standard may be more appropriate than a permanent ban. In this connection, the following criteria are recommended here below:

(1) Since Thailand has already had the Notification of the Ministry of Industry No. 3764 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Fabrics or TIS 2231-2550 (2007) and the Notification of the Ministry of Industry No. 3765 (B.E. 2550) issued pursuant to the Industrial Product Standards Act B.E. 2511 in regard to the Thai Industrial Standard for Garments or TIS 2346-2550 (2007), the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) set a requirement that 24 aromatic amines which are widely restricted to use in textile and garment industries shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. The list of controlled aromatic amines shall consist of:

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 1 | 92-67-1 | 4-aminobiphenyl |
| 2 | 92-87-5 | Benzidine |
| 3 | 95-69-2 | 4-chloro-o-toluidine |
| 4 | 91-59-8 | 2-naphthylamine |
| 5 | 97-56-3 | o-aminoazotoluene |
| 6 | 99-55-8 | 5-nitro-o-toluidine |
| 7 | 106-47-8 | 4-chloroaniline |
| 8 | 615-05-4 | 4-methoxy-m-phenylenediamine |
| 9 | 101-77-9 | 4,4'-methylenedianiline |
| 10 | 91-94-1 | 3,3’-dichlorobenzidine |
| 11 | 119-90-4 | o-dianisidine |
| 12 | 119-93-7 | 3,3’-dimethylbenzidine |
| 13 | 838-88-0 | 4,4'-methylenedi-o-toluidine |
| 14 | 120-71-8 | 6-methoxy-m-toluidine p-cresidine |
| 15 | 101-14-4 | 4,4’-methylene-bis-(2-chloro-aniline) |
| 16 | 101-80-4 | 4,4'-oxydianiline |
| 17 | 139-65-1 | 4,4'-thiodianiline |
| 18 | 95-53-4 | o-toluidine |
| 19 | 95-80-7 | 4-methyl-m-phenylenediamine |
| 20 | 137-17-7 | 2,4,5-trimethylaniline |

(Continue)

| No. | CAS Registry Numbers | Substances |
|---|---|---|
| 21 | 90-04-0 | o-anisidine |
| 22 | 60-09-3 | 4-amino azobenzene |
| 23 | 95-68-1 | 2,4-xylidine |
| 24 | 87-62-7 | 2,6-xylidine |

It should propose to designate the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) and the Thai Industrial Standard for Garments: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2346-2550 (2007) to be the industrial standards which are required by a Royal Decree to manufacture fabric and garment products in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007), according to Section 17 of the Industrial Product Standards Act B.E. 2511.

(2) Propose the subordinate law, such as the draft of the announcement of the Committee on Labels to declare that textile and garment products containing aromatic amines are a label-controlled product required the labeling that these substances are carcinogen and may cause cancer to human, which may read as follows:

"The Announcement of the Committee on Labels No. … (B.E. …)
to Regulate Textile and Garment Products Containing Aromatic Amines
as a Label-controlled Goods

As it appears that many manufacturers in textile and garment businesses have been produced textile and garments products by using azo dyes which can break down during use, under reductive conditions, and release chemicals called aromatic amines. The studies and

researches of the World Health Organization and other institutes provided that some aromatic amines are known or suspected human carcinogens which are capable of causing cancer if used carelessly. Consequently, to regulate that textile and garment products containing aromatic amines are required to display instruction and information in a label will provide a benefit for consumers to use safety products. Thus, textile and garment products containing aromatic amines shall be regulate as a label-controlled goods.

Therefore, the Committee on Labels declares the announcement prescribed as follows.

1. In this announcement, "textile and garment products containing aromatic amines" means fabrics, textiles, garments, clothes, and other products made by fabrics for male, female and infant which are in direct and not in direct contact as well as prolonged contact with skin that contained aromatic amines at the maximum concentration not over 30 mg/kg in finished products, such as:

- clothing, bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags;
- footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses worn round the neck;
- textile or leather toys and toys which include textile or leather garments; and
- yarn and fabrics intended for use by the final consumer.

2. Textile and garment products containing aromatic amines are a label-controlled goods.

3. A label of the label-controlled goods under Clause 2 shall conform to Clause 1 to Clause 3 of the Announcement of the

Committee on Labels on Characters of a Label-controlled Goods B.E. 2541 (1998) dated 23 September 1998 and shall provide the following details in such label:

(1) This product contains aromatic amines known to cause cancer.
(2) The concentration of aromatic amines is not over the limitation of 30 mg/kg."

(3) A subordinate law providing general requirement for both manufacturers and distributors, concentrated to control the safety of consumer products, should be proposed to the Consumer Protection Board, which may have essential content as follows:

"(1) Manufacturers shall be obliged to place only safe products on the market.

(2) A safe product shall comprise one of the following requirements:

1. A product conforms to the specific legislation imposed for such product, or mandatory or voluntary industrial standards following the Industrial Product Standards law;

2. In case of the absence or insufficiency of the specific legislations and mandatory or voluntary industrial standards, a safe product shall be assessed by taking into account the following criteria:

(a) foreign standards or international standards, with the approval, rule and condition of the Industrial Product Standards Council;

(b) the orders or recommendations of the Consumer Protection Board;

(c) the current state of the art and technology;

(d) reasonable consumer expectations concerning safety.

(3) Distributors shall be required to act with due care to help to ensure compliance with the requirements of a safe product, such as by not supplying products which they know or should have presumed, on the basis of the information in their possession and as professionals, do not comply with those requirements."

(4) Said proposed subordinate laws may increase the costs of Thai textile and garment industries. Thus, in order to promote their competition in the market, it should propose that Thai Government may determine measures help to decrease textile and garment industries' costs, such as grant the financial incentives for any manufacturers who comply with those laws. The financial incentives may include startups assistance in financing and reduction or exemption of tax rates and promoting the access to markets. The Government may set up a center institution to provide information, especially technical information, knowledge sharing and the suggestion of capabilities and management development, technology and innovation for textile and garment businesses. In addition, the Government may help to promote the products which comply with the industrial standards in order to increase the distribution channel for Thai textile and garment businesses.

The product recall measure is also one of the alternative and effective methods of removing or correcting products that are in violation of laws or standards so that it is also the appropriated regimes. Furthermore, there are recommended non-legislative solutions. The first one is to promote the use of alternative dyes, such as fiber-reactive dyes and natural dyes. They contain no heavy metals or other known toxic substances, and they meet all European Union criteria, including Oeko-Tex, for being an eco-friendly pigment. The second one is to comply with voluntary standards including Oeko-Tex and EU Ecolabel.

With these legislative and non-legislative solutions, the textile and garment industries will be effectively controlled to use aromatic amines. As a result, consumers will have more opportunity to wear safety clothes and accessories without taking a risk from products containing aromatic amines which prolonged contact with skin and may cause cancer.

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# BIOGRAPHY

| | |
|---|---|
| Name | Miss Oranee Kanoksophit |
| Date of Birth | February 21, 1988 |
| Educational Attainment | Bachelor of Laws (Business Laws),<br>Chulalongkorn University |
| Work Position | Assistant Manager, Legal Division<br>AIRA Securities Public Company Limited |
| Work Experiences | Present: Assistant Manager, Legal Division<br>AIRA Securities Public Company Limited<br>2010 – 2014: Legal Counsel<br>People's Garment Public Company Limited |