

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

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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

* The article is summarized and rearranged from the thesis "Legal Measure for Controlling Dangerous Substances in Textile and Garment Products: A Case Study of Aromatic Amines" Master of Laws Program in Business Laws (English Program), Faculty of Law, Thammasat University, 2014.

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บทคัดย่อ

สารแอรโม่ติกแอมีนเป็นสารเคมีที่มีการนำมาใช้อย่างแพร่หลายในการผลิตสีย้อมสำหรับใช้ในอุตสาหกรรมสิ่งทอและเสื้อผ้าสำเร็จรูป สารแอรโม่ติกแอมีนสามารถตกค้างในผลิตภัณฑ์สิ่งทอและเสื้อผ้าสำเร็จรูป โดยที่สามารถถูกดูดซึมเข้าสู่ร่างกายมนุษย์ผ่านทางผิวหนังหรือผ่านช่องปากได้ หน่วยงานวิจัยโรคมะเร็งนานาชาติ (International Agency for Research on Cancer, IARC) ซึ่งเป็นหน่วยงานหนึ่งขององค์การอนามัยโลก (World Health Organization, WHO) ได้จัดให้สารแอรโม่ติกแอมีนบางประเภทเป็นสารเคมีที่ก่อให้เกิดมะเร็งในร่างกายมนุษย์ ผลงานวิจัยจำนวนมากพบว่า การสัมผัสกับสารแอรโม่ติกแอมีนมีความเกี่ยวข้องโดยตรงกับการเกิดมะเร็งกระเพาะปัสสาวะ รวมไปถึงการเกิดภาวะความผิดปกติต่างๆ ของกระเพาะปัสสาวะ อาทิ เยื่อบุผิวของกระเพาะปัสสาวะอักเสบ อาการปัสสาวะลำบากหรือปัสสาวะขัด และเกิดความเจ็บปวดในช่องท้อง นอกจากนี้ การได้รับสารแอรโม่ติกแอมีนในปริมาณสูงอาจทำให้ร่างกายเกิดความผิดปกติเฉียบพลัน และถึงแก่ความตายได้

ในปัจจุบัน นานาประเทศต่างให้ความสำคัญกับผลกระทบดังกล่าวของสารแอรโม่ติกแอมีนที่มีต่อร่างกายมนุษย์ จึงได้มีการจำกัดและควบคุมการใช้สารแอรโม่ติกแอมีนผ่านมาตรการทางกฎหมายรูปแบบต่างๆ อย่างไรก็ตาม จากการศึกษาพบว่า กฎหมายของประเทศไทยในปัจจุบันยังไม่เพียงพอที่จะสามารถควบคุมการใช้สารแอรโม่ติกแอมีนได้อย่างมีประสิทธิภาพ ซึ่งอาจทำให้ผู้บริโภคในประเทศไทยได้รับอันตรายจากสารแอรโม่ติกแอมีนได้ ดังนั้น วิทยานิพนธ์ฉบับนี้จึงมุ่งศึกษาเกี่ยวกับมาตรการทางกฎหมายที่ใช้ในการควบคุมสารแอรโม่ติกแอมีนในต่างประเทศ ได้แก่ สหภาพยุโรป สหรัฐอเมริกา และสาธารณรัฐประชาธิปไตยประชาชนจีน เพื่อนำเสนอมาตรการทางกฎหมายที่เหมาะสมและมีประสิทธิภาพในการคุ้มครองผู้บริโภคในประเทศไทย เพื่อไม่ให้ได้รับอันตรายจากสารแอรโม่ติกแอมีนที่ก่อให้เกิดมะเร็งซึ่งตกค้างอยู่ในผลิตภัณฑ์สิ่งทอและเสื้อผ้าสำเร็จรูป

จากการศึกษามาตรการทางกฎหมายที่ใช้ในการควบคุมสารแอรโม่ติกแอมีนในสามประเทศดังกล่าวข้างต้น ประกอบกับการศึกษาบทบัญญัติกฎหมายของไทยที่เกี่ยวข้องพบว่า มาตรการทางกฎหมายที่เหมาะสมสำหรับประเทศไทยคือ การกำหนดให้มาตรฐานผลิตภัณฑ์อุตสาหกรรม ผ้า : ความปลอดภัยจากสีและสารเคมีที่เป็นอันตราย (มอก. 2231-2550) และมาตรฐานผลิตภัณฑ์อุตสาหกรรม เสื้อผ้าสำเร็จรูป : ความปลอดภัยจากสีและสารเคมีที่เป็นอันตราย (มอก. 2346-2550) เป็นมาตรฐานผลิตภัณฑ์อุตสาหกรรมที่กำหนดให้ต้องทำผลิตภัณฑ์ผ้าและเสื้อผ้าสำเร็จรูปให้เป็นไปตามมาตรฐาน มอก. 2231-2550 และมอก. 2346-2550 ตามความในมาตรา 17 ของพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511 ด้วยมาตรการดังกล่าวนี้ ผู้บริโภคในประเทศไทยก็จะมีความปลอดภัย และได้รับความคุ้มครองจากสารแอรโม่ติกแอมีนที่ก่อให้เกิดมะเร็ง

คำสำคัญ: แอรโม่ติกแอมีน, สิ่งทอและเสื้อผ้าสำเร็จรูป, มาตรฐานผลิตภัณฑ์อุตสาหกรรม, วัตถุอันตราย

INTRODUCTION

There are many types of chemicals involving in every day of human's life. With respect to textile and garment manufacturing, aromatic amines are widely used in the dyeing process as a starting material or initial substance for preparing and manufacturing of dyes. After the last process of manufacturing of textile and garment products, aromatic amines can remain as a residue in finished products and may be migrated and absorbed into the human body through the skin or mouth. Since they can be absorbed through the skin or mouth, consumers may absorb them by daily exposure.

Expert authorities such as the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) have classified some aromatic amines as known human carcinogens that are capable of causing cancer. Many countries have given great attention on this matter and have controlled and restricted using aromatic amines¹ in textile and garment products.

In Thai laws, there are industrial standards prescribed by the Notification of the Ministry of Industry according to Section 15 of the Industrial Product Standards Act B.E. 2511 (1968) involving textile and garment business, namely the Thai Industrial Standard for Fabrics: Safety from Harmful Dyestuffs and Chemical Substances or TIS 2231-2550 (2007) under 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) under the Notification of the Ministry of Industry No. 3765 (B.E. 2550). These standards restrict the use of 24 aromatic amines that they shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. Section 16 of the Industrial Product Standards Act B.E. 2511 (1968), the manufacturers of textile and garment products conforming to these standards may submit the application for a license to display the standard mark on their products. Once a license is granted by the Thai Industrial Standards Institute, they shall have the right to exhibit the standard mark on their products. One of the implications of the standards prescribed by Section 15 of the Industrial Product Standards Act B.E. 2511 (1968) is the Thai manufacturers who fails to comply with them may not be able to export their textile and garment products to any countries which control or restrict the use of aromatic amines such as the European Union and the People's Republic of China. Further, although some countries do not have specific laws and regulations controlling or restricting the use of aromatic amines in some countries, Thai manufacturers may expose to liability according to the product liability laws if their products cause damage or injury to the consumers in those countries. In addition, without the standard mark displaying on the products, consumers may not trust in the quality and standard of the products and may decide not to purchase them. Therefore, in order to enhance the control measure under the Industrial Product Standards Act B.E. 2511 (1968), the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) shall be made in the form of a Royal Decree issued according to Section 17 of the Industrial Product Standards Act B.E. 2511 (1968).

I. THE MANUFACTURING OF TEXTILE AND GARMENT PRODUCTS

The manufacturing of textile and garment products begins with the yarn production. In this process, the natural fibers, as the raw materials, will be transformed into yarn and thread. After that, yarn and thread will be sewed up together into a fabric by being jointly transferred through the weaving or knitting machine.² This fabric may be contaminated by many chemical substances, such as oils, waxes and other components which naturally occur in the making process of most fibers, therefore, those fibers must be cleaned with several chemicals and cleaners. Furthermore, as the fabric is colorless, it will be bleached in order to refine its based color and also to make it ready for dyeing. Other than the dyeing process, the fabrics may be passed to the printing process in order to apply color with definite patterns or designs. In addition, to improve the quality of fabric, the manufacturers

¹ 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 garment 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'-methylenedianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethoxybenzidine; 4,4'-methylenedi-o-toluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-(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.

² Howstuffworks?, *How is fabric created?* "The Manufacturing Process of Fabric", available at <http://home.howstuffworks.com/home-decor/accessories/how-is-fabric-created2.htm>

will apply the functional characteristics to the fabric by conveying them toward the finishing process, such as mercerizing, flame retardant, anti-wrinkle, water repellent, waterproof and antistatic finish.³

Through the above-mentioned processes, the fabric is ready to be manufactured as finished garments. The production process starts with design or sketch, patternmaking, cutting, sewing, assembling, doing a quality control, and ends with packing and delivering to customers.

II. AROMATIC AMINES USED IN DYEING PROCESS

Different chemical substances are used in the manufacturing of textile and garment for cleaning, bleaching, dyeing, printing as well as bringing some special functions and appearances to the finished products; for example, improving the visual brightness, increasing sweat-absorption and reducing shrinkage. When the products are laundered, many of these substances can be rinsed out with detergents and water; however, residual in significant level may still remain in the finished products.⁴ This research will emphasize on aromatic amines using in the dyeing process. Aromatic amines are widely used as the initial substances for preparing and manufacturing of different types of dyes.⁵ The carcinogenesis literature documents and innumerable studies demonstrate that administration of a considerable variety of aromatic amines to experimental animals of different species induces cancers in those animals.⁶

□ LIST OF RESTRICTED OR CONTROLLED AROMATIC AMINES

There are more than one hundred aromatic amines used in the industries, but only some of them have been proven to be carcinogenic to human. There are totally 24 aromatic amines widely restricted or controlled to use in textile and garment articles. Aromatic amines may cause harm when they come into direct or prolonged contact with the human skin or oral cavity. Those aromatic amines consist of

4-aminobiphenyl; benzidine; 4-chloro-o-toluidine; 2-naphthylamine; o-aminoazotoluene; 5-nitro-otoluidine; 4-chloroaniline; 4-methoxy-m-phenylenediamine; 4,4'-methylenedianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethylbenzidine; 4,4'-methylenedio-toluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-(2-chloro-aniline); 4,4'-oxydianiline; 4,4'-thiodianiline; o-toluidine; 4-methyl-m-phenylenediamine; 2,4,5-trimethylaniline; o-anisidine; 4-amino azobenzene; 2,4-xylidine; and 2,6-xylidine.

□ IMPACT OF AROMATIC AMINES ON HUMAN HEALTH AND ENVIRONMENT

Epidemiological studies have shown that the exposure to aromatic amines, such as 2-naphthylamine; either presents alone or with the other compounds as an impurity, is strongly associated with the occurrence of bladder cancer.⁷ Exposure to benzidine has been proved to produce a spectrum of lesions of the epithelium of the urinary bladder which may precede appearance of

³ Textile Learner, *Introduction of Textile Finishing Process*, available at http://textilelearner.blogspot.com/2011/03/description-of-textile-finishing_1796.html.

⁴ 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 at [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono\(2011\)7/part2&doclanguage=en](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2011)7/part2&doclanguage=en).

⁵ Derelanko, M. & Hollinger, M., *Handbook of Toxicology*, Informa Healthcare, Second Edition (2001).

⁶ US National Library of Medicine National Institutes of Health, *Monocyclic Aromatic Amines as Potential Human Carcinogens: Old is New Again* at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2802674/>.

⁷ 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).

cancer.⁸ The toxic effects of 4-chloro-ortho-toluidine are either macroscopic or microscopic haematuria. Furthermore, aromatic amines can cause other symptoms including decreased bladder capacity and dysuria.⁹ The patients may also pain in the lower abdomen. Aromatic amines have also been reported to exert a high level of acute and chronic toxicity. The symptoms include allergy, ataxia, anaemia, methemoglobinaemia, reticulocytosis, hematuria, kidney and liver damage, and poisonously causing the fatality. Aromatic amines can migrate from textile and garment articles so that the consumers may absorb them through their skin or mouth. Many researches show that the risk of exposure to aromatic amines increases with body heat, sweat or saliva.¹⁰

Since the aromatic amines linkage is not always tightly bound to textile and garment articles, surplus dyes may be released in the laundering process. They can harm the aquatic environment and agricultural land, cause problem to the biological systems as to aquatic animals and plants, affect to the water quality, and accumulate in human and animal's body when they consume those aquatic animals and plants.

III. THE CONTROL MEASURE OF AROMATIC AMINES IN FOREIGN COUNTRIES

Many countries have recognized the important of the problems due to the effects of aromatic amines. Since the 1990s, several countries have adopted the legal measures in order to restrict or control the use of aromatic amines known to be the cause of cancer, in the production of textiles and garments.¹¹ This topic describes the existing legislations and legal measures to control aromatic amines in foreign countries including the European Union, the United States of America and the People's Republic of China.

□ THE CONTROL MEASURES OF AROMATIC AMINES IN THE EUROPEAN UNION

The Directive 2001/95/EC of the European Parliament and of the Council on General Product Safety (hereinafter referred to as GPSD) requires that "products placed on the market shall be safe product." It is considered to be the post-market measures after producing the products. In this regard, Article 3 of the GPSD¹² sets a requirement and criteria for determining if the product is safe

⁸ 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).

⁹ 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).

¹⁰ 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.

¹¹ The Policy Research Center for Environment and Economy, *Impacts of Environmental Standards and Requirements in EU Countries on China's Textile Industry at* <http://www.iisd.org/pdf/EUtextiles.pdf>.

¹² GPSD, 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 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

that 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 the voluntary national standards of the Member States which are established in accordance with the European standards.

In conclusion, the GPSD sets a general requirement that only safe product can be placed on the market with the presumption clause that it is also presumed safe if it complies with voluntary national standards or technical standards. As a result, the GPSD is considered to be horizontal legislation which covers all types and categories of the consumer products.

The Regulation (EC) No. 1907/2006 relating to the Registration, Evaluation, Authorization and Restriction of Chemicals (hereinafter referred to as REACH) describes how substances may be restricted. Article 67 of the REACH¹³ states that a substance, or a substance in a mixture, or a substance in an article listed in Annex XVII of the REACH shall not be manufactured, placed on the market or used. Under Annex XVII of the REACH,¹⁴ 22 aromatic amines listed in Appendix 8¹⁵ 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.

□ **THE CONTROL MEASURES OF AROMATIC AMINES IN THE UNITED STATES OF AMERICA**

The Toxics Substances Control Act (hereinafter referred to as TSCA) authorizes the U.S. Environmental Protection Agency (hereinafter referred to as EPA) to determinate that a use of any

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.

¹³ REACH, 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.

¹⁴ REACH, Annex XVII, 43. Azocolourants and Azodyes

1. Azodyes 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;
- 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.

¹⁵ Aromatic amines listed in Appendix 8 consisting of 4-aminobiphenyl; benzidine; 4-chloro-o-toluidine; 2-naphthylamine; o-amino azotoluene; 5-nitro-otoluidine; 4-chloroaniline; 4-methoxy-m-phenylenediamine; 4,4'-methylenedianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethoxy benzidine; 4,4'-methylenedi-otoluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-(2-chloro-aniline); 4,4'-oxydianiline; 4,4'-thiodianiline; o-toluidine; 4-methyl-m-phenylenediamine; 2,4,5-trimethylaniline; o-anisidine; and 4-amino azobenzene.

chemical substances is a significant new use. Then, under Section 5(a)(1)(B) of the TSCA,¹⁶ it is required the manufacturers to submit a Significant New Use Notice (SNUN) to the EPA at least 90 days before they produce and import those chemical substances. Since benzidine is one of aromatic amines listed as a significant new use, the manufacturers must submit a SNUN to the EPA at least 90 days before they produce and import benzidine.

The Safe Drinking Water and Toxic Enforcement Act of 1986 (hereinafter referred to as Proposition 65) defines the control measures of aromatic amines contained in textile and garment products in Section 25249.6 of the Proposition 65¹⁷ by imposing the responsibility for any businesses involving them to provide clear and reasonable warning to individuals. The warning must: (1) clearly make known that aromatic amines are known to cause cancer; and (2) be given in the way that consumers will effectively reach it before they are exposed to aromatic amines.

□ **THE CONTROL MEASURES OF AROMATIC AMINES IN THE PEOPLE'S REPUBLIC OF CHINA**

The National General Safety Technical Code for Textile Products (hereinafter referred to as GB 18401-2010) is a safety standard for textile and garment industry. The GB 18401-2010 sets the compulsory requirement that 24 aromatic amines, listed in Appendix C¹⁸ are forbidden to use with a limited concentration of 20 mg/kg in textile products. Furthermore, Article 14¹⁹ of the Standardization Law regulates that every unit, both juristic person, and individual, must comply with the GB 18401-2010. It shall be forbidden to manufacture, sell or import textile products that do not conform to the requirements of the GB 18401-2010 which is a compulsory standard.

IV. THE CONTROL MEASURE OF AROMATIC AMINES IN THAI LAWS

In Thailand, there is some legislation 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

¹⁶ TSCA, Section 5. Manufacturing and Progressing Notices.

(a) IN GENERAL. –

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

(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).

¹⁷ Proposition 65, § 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, ...

¹⁸ The forbidden aromatic amines are listed in Table C.1, Appendix C consisting of 4-aminobiphenyl; benzidine; 4-chloro-o-toluidine; 2-naphthylamine; o-amino azotoluene; 5-nitro-otoluidine; 4-chloroaniline; 4-methoxy-m-phenylenediamine; 4,4'-methylenedianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethoxybenzidine; 4,4'-methylenedi-otoluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-(2-chloro-aniline); 4,4'-oxydianiline; 4,4'-thiodianiline; o-toluidine; 4-methyl-m-phenylenediamine; 2,4,5-trimethylaniline; o-anisidine; 4-amino azobenzene; 2,4-xylylidine; and 2,6-xylylidine.

¹⁹ Standardization Law, 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 a legislation regarding the labeling of consumer products stipulated in the Consumer Protection Act B.E. 2522 (1979).

□ **HAZARDOUS SUBSTANCES ACT B.E. 2535 (1992)**

The list of hazardous substances is provided in the **Notification of Ministry of Industry on List of Hazardous Substances B.E. 2556 (2013)**. There are totally 6 lists of the hazardous substances; List 1 to List 6. Under this Notification, 4-aminobiphenyl (CAS Number 92-67-1) and benzidine (CAS Number 92-87-5) are designated as a hazardous substance *Type 3* and *Type 4*. At present, the latest list of hazardous substances is amended by the **Notification of Ministry of Industry on List of Hazardous Substances (No. 2) B.E. 2558 (2015)**. Its objective is to add List 5.6 regarding Group of Substance Controlled on its Property as new list of hazardous substances which is under the responsibility of the Department of Industrial Works. The substances in List 5.6 consist of 10 types of substances including: Explosive, Flammable Substance, Oxidizing Agent or Peroxide, Toxic Substance, Mutagen, Corrosive, Irritant, Carcinogen, Toxic Substance to Reproductive Organ, and Environmentally Hazardous Substance. 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. Aromatic amines can be considered as carcinogen substances in List 5.6. The criteria and procedure are specified by 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)** that the producers or importers of hazardous substances under List 5.6, including aromatic amines, with the quantity 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, as the researches show that aromatic amines can be used without any harmful under the limited concentration²⁰ and they may be absorbed into human skin only through daily exposure, therefore, they are probably allowed to use in other products which are not directly contact with human skin. Thus, in the author's opinion, to prohibit the production, import, export, or having in possession of aromatic amines may not be the effective and appropriate solution.

□ **INDUSTRIAL PRODUCT STANDARDS ACT B.E. 2511 (1968)**

According to the Industrial Product Standards Act B.E. 2511 (1968), the industrial standards may be classified into two categories consisting of the industrial standards prescribed by the Notification of the Ministry of Industry under Section 15 and the industrial standards determined by a Royal Decree that any particular kind of the industrial products shall conform with the standards under Section 17. There are two industrial standards involving textile and garment business namely the Thai Industrial Standard for Fabrics or TIS 2231-2550 (2007)²¹ and Thai Industrial Standard for Garments or TIS 2346-2550 (2007) prescribed by the Notification of the Ministry of Industry under Section 15. They set the requirements for controlling the use of aromatic amines in fabric and garment products that 24 aromatic amines shall not be contained in finished fabric and garment products at the concentration over 30 mg/kg. The list of controlled 24 aromatic amines is stated in Appendix A²² of

²⁰ The Australian Competition and Consumer Commission, *Azo Dyes at* <https://www.productsafety.gov.au/content/index.phtml/itemId/1006626>.

²¹ This standard was notified by the Ministerial Notification No. 3332 of the Ministry of Industry. There are two amendments of this standard namely the Ministerial Notification No. 3436 and No. 3764. Now, the TIS 2231-2548 (2005) is amended to the TIS 2231-2550 (2007).

²² The controlled aromatic amines are listed in Appendix A consisting of 4-aminobiphenyl; benzidine; 4-chloro-o-toluidine; 2-naphthylamine; o-amino azotoluene; 5-nitro-otoluidine; 4-chloroaniline; 4-methoxy-m-phenylenediamine; 4,4'-methylenedianiline; 3,3'-dichlorobenzidine; o-dianisidine; 3,3'-dimethoxy benzidine; 4,4'-methylenedi-otoluidine; 6-methoxy-m-toluidine p-cresidine; 4,4'-methylene-bis-(2-chloro-aniline); 4,4'-oxydianiline; 4,4'-thiodianiline; o-toluidine; 4-methyl-m-

the Notification of the Ministry of Industry No. 3332 and the Notification of the Ministry of Industry No. 3765.

According to Section 16, the manufacturers of textile and garment products conforming to these standards may submit the application for a license to display the standard mark on their products. Once a license is granted by 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, they shall have the sanction according to the Industrial Product Standards Act B.E. 2511 (1968). One of the implications of the standards prescribed by Section 15 of the Industrial Product Standards Act B.E. 2511 (1968) is the Thai manufacturers who fails to comply with them may not be able to export their textile and garment products to any countries which control or restrict the use of aromatic amines such as the European Union and the People's Republic of China. Further, although some countries do not have specific laws and regulations controlling or restricting the use of aromatic amines in some countries, Thai manufacturers may expose to liability according to the product liability laws if their products cause damage or injury to the consumers in those countries. In addition, 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.²³ Without the standard mark displaying on the products, consumers may not trust in the quality and standard of the products and may decide not to purchase 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) in the form of a Royal Decree according to Section 17, the manufacturers shall be required to produce their products only in conformity with the requirements of 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.

□ **FACTORY ACT B.E. 2535 (1992)**

Under the **Notification of the Ministry of Industry No. 10 B.E. 2537 (1994) issued pursuant to the Factory Act B.E. 2535 (1992)**, benzidine, benzidine compounds, chromium, and chromic compounds are prohibited to use as raw material producing dyes. Also, dyes containing benzidine, benzidine compounds, chromium, and chromic compounds are prohibited to use. However, the prohibition under this Notification do not restrict on all types of aromatic amines. Benzidine is classified as one type of aromatic amines, while, aromatic amines comprise of 24 substances. In addition, there is the limitation of the control measures under this law. Only the “factory” under the definition of Section 5²⁴ is enforced by the Notification. In case that the manufacturers of textile and garment products are not considered as a factory according to such definition, they will not be obliged to comply with the requirements of the Notification. Accordingly, the Factory Act and its subordinate law are not sufficient to control the use of aromatic amines and to protect consumers from their toxicity.

□ **CONSUMER PROTECTION ACT B.E. 2522 (1979)**

Generally, textile and garment products manufactured for sale by the factories under the law on factories shall be controlled the labeling under Section 30 of the Consumer Protection Act B.E.

phenylenediamine; 2,4,5-trimethylaniline; o-anisidine; 4-amino azobenzene; 2,4-xylylidine; and 2,6-xylylidine.

²³ Industrial Product Standards Act B.E. 2511 (1968) Section 31 No person other than the licensee under Section 16, Section 20 or Section 21 shall use the standard mark.

²⁴ Factory Act B.E 2535 (1992), Section 5 “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.

2522 (1979). However, under Section 31, the descriptions required to place on a label may not be sufficient to provide information about the toxicity of aromatic amines to consumers. In addition, if textile and garment products are 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 under Section 30. Without the label providing sufficient information about carcinogenicity of aromatic amines, the consumers will certainly not realize this fact and will have the opportunity to expose to aromatic amines contaminating in textile and garment products. Therefore, textile and garment products containing aromatic amines should propose to be a label-controlled product under the Announcement of the Committee on Labels. The label should provide sufficient information warning the consumers that aromatic amines are carcinogenic and may cause cancer to consumers.

V. CONCLUSIONS AND RECOMMENDATIONS

In order to prevent and protect Thai consumers from aromatic amines causing cancer, awareness, and appropriate solutions are, therefore, certainly and urgently required in practice. As highlighted earlier, the legal measures of three countries are discussed. All aim at controlling the use of aromatic amines and preventing consumers from them; although, there are some differences in detail. 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. After thoroughly studying all three schemes with Thai legal backgrounds, the most appropriate mechanism, from the author's opinion, is prescribing the TIS 2231-2550 (2007) designated by the Notification of the Ministry of Industry No. 3764 (B.E. 2550) and the TIS 2346-2550 (2007) designated by the Notification of the Ministry of Industry No. 3765 (B.E. 2550) in the form of a Royal Decree required to manufacture fabric and garment products only in conformity with the requirements of the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17.

□ PRESCRIBING THE TIS 2231-2550 (2007) AND TIS 2346-2550 (2007) IN THE FORM OF A ROYAL DECREE REQUIRED TO MANUFACTURE FABRIC AND GARMENT PRODUCTS ONLY IN CONFORMITY WITH THE TIS 2231-2548 (2005) AND TIS 2346-2550 (2007) ACCORDING TO SECTION 17

At present, 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). They set a requirement that 24 aromatic amines shall not be contained in finished fabric and garment products at the concentration not over 30 mg/kg. In case of prescribing the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) in the form of a Royal Decree required to manufacture fabric and garment products only in conformity with 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. In this connection, the manufacturer and importer are required to manufacture or import fabric and garment products only in conformity with the TIS 2231-2550 (2007) or the TIS 2346-2550 (2007). Therefore, to propose to prescribe the TIS 2231-2550 (2007) and the TIS 2346-2550 (2007) in the form of a Royal Decree required to manufacture fabric and garment products in conformity with the TIS 2231-2550 (2007) and TIS 2346-2550 (2007) according to Section 17 would help to enhance the control measures of aromatic amines in Thailand. With this measure, the consumers in Thailand will be protected.

□ CONSUMER PROTECTION AGAINST LABELING

It is advisable that textile and garment products containing aromatic amines should be 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 are carcinogenic and may cause cancer to consumers. The content of label to declare textile and garment products containing aromatic amines could be "This product contains a chemical known to cause cancer at the concentration which is not over the limitation of 30 mg/kg." In the author's point of view, the labeling

placed on textile and garment products is the alternative solution which helps to maintain consumer's rights and to protect them from dangerous aromatic amines in textile and garment products.

□ **GENERAL SAFETY REQUIREMENT**

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 of the European Union as a model law, providing general requirement concentrated on the safety of consumer products. The general requirement can be imposed that "only safe products can be placed on the market" with the presumption clause that "any products conforming to any 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.

□ **POST-MARKET MEASURE: PRODUCT RECALL MEASURE**

A product recall measure can help to protect the consumer when there is a reasonable ground to believe that any of the products is dangerous. It can prevent consumers before they will be injured as a result of harmful products. Since the 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 well about the number of their products placed in the market and the number of product which had been sold to consumers, 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.²⁵ 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, Section 36 of the Consumer Protection Act B.E. 2522 (1979) states that 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 the businessman to recall of such products from the market or consumers who bought such products. It is said that product recall measure is an effective method of removing or correcting products which are in violation of laws or standards.

□ **PROMOTING TO USE ALTERNATIVE DYES**

Fiber-reactive dyes are one of the proposed low-impact dyes in textile and garment industry. They are a synthetic dye that chemically bonds directly to the clothing fiber molecules. The fixation or absorption rate of low-impact dyes is at least 70 percent,²⁶ 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 the European Union criteria, including Oeko-Tex, for being an eco-friendly pigment. Also, natural dyes should be proposed to use instead of synthetic dyes. They are dyes or colorants derived from plants, invertebrates, or minerals. 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. For example, root and heartwood of jackfruit and peel of mango give yellow color and leaf of indigo gives dark blue, blue and green color.

²⁵ Pakorn Nilrapunt, *Product Recall Measure: Australia and the United States at* http://www.lawreform.go.th/lawreform/index.php?option=com_content&task=view&id=246&Itemid=11.

²⁶ Aboynamedsue, *Ecodictionary: Dyes (Low Impact)*, available at <http://www.aboynamedsue.co/about/ecodictionary/>.

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

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