

Comparative Analysis of Technical Regulations for Textiles in Major Global Markets

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Abstract: This paper comparatively analyzes the major differences in technical requirements between GB 18401—2010 National General Safety Technical Code for Textile Products and relevant technical regulations in the EU and US markets.

Keywords: GB 18401-2010; Formaldehyde content; Decomposable carcinogenic aromatic amine dyes; Comparison of technical regulations

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1. Comparative analysis based on GB 18401—2010

This standard applies to apparel, decorative and household textile products manufactured and circulated within the territory of the People's Republic of China. For exported goods, implementation may follow specific agreements stipulated in trade contracts ^[1].

The EU has no general technical standard for textile products, yet its technical regulations are mandatory. The EU issues and enforces mandatory documents covering safety, health, and environmental protection in the form of regulations and directives. Manufacturers shall prove their products comply with corresponding technical regulations. If a national technical regulation of an EU Member State is stricter than the EU regulation, products sold in that country shall comply with both the EU regulation and the corresponding national regulation simultaneously.

The United States has no universal technical standard for textile products either, but its technical regulations are comprehensive and complete. Regulatory provisions for different categories of textiles are distributed in codes issued by various federal departments, most of which are compiled into the Code of Federal Regulations (CFR). The CFR is a collection of universally applicable and legally binding US regulations regularly sorted and published by the US Office of the Federal Register ^[2].

2. Requirements and test methods

Chapter 5 of GB 18401—2010 specifies the general safety technical requirements for textile products, while Chapter 6 prescribes test methods for each test item. Clause 5.1 divides textile products into Category A, Category B, and Category C according to the stringency of index requirements, as shown in **Table 1**. Clause 5.2 stipulates that products in direct contact with skin shall at least meet Category B requirements, while products not in direct contact with skin shall at least meet Category C requirements. Hanging decorative products such as curtains are exempt from color fastness to perspiration testing.

2.1. pH value, color fastness, and odor

GB 18401—2010 sets specific requirements for pH value, color fastness, and odor in Chapters 5 and 6, while no corresponding regulatory requirements have been identified in EU and US regulations.

Among the test methods referenced in GB 18401—2010:

The pH test method GB/T 7573—2009 is modified by re-drafting ISO 3071:2005 Textiles — Determination of pH of Aqueous Extracts ^[3]. The latest version of ISO 3071 is 2020, and the national standard method is basically consistent with the corresponding ISO method in technical aspects. The color fastness to water test GB/T 5713—2013 is re-drafted based on ISO 105-E01:2013 Textiles — Tests for color fastness — Part E01: Color fastness to water ^[4], with basically identical technical content to the ISO standard. The main difference in actual testing is that multi-fiber adjacent fabrics are generally adopted in ISO tests, while single-fiber adjacent fabrics are used in national standard tests. Color fastness to perspiration GB/T 3922—2013 is re-drafted from ISO 105-E04:2013 Textiles — Tests for color fastness — Part E04: Color fastness to perspiration, with consistent technical content; the core testing difference remains the selection of single/multi-fiber adjacent fabrics as above ^[5]. Color fastness to rubbing (dry) GB/T 3920—2008 is modified based on ISO 105-X12:2001 Textiles — Tests for color fastness — Part X12: Color fastness to rubbing ^[6]; the latest ISO 105-X12 version is 2016, and technical consistency is maintained. No test method for the odor item is found in ISO standards.

2.2. Formaldehyde content

Chapters 5 and 6 of GB 18401—2010 specify formaldehyde limit requirements and test methods as shown in **Table 1**. No relevant regulatory requirements are found in the US market; comparison between China and the EU is listed below.

Table 1. Comparison of formaldehyde limits based on GB 18401—2010

Item		Chinese Market			EU Market
Formaldehyde Content/(mg/kg) ≤	Mandatory Standards/Regulations	GB 18401—2010			REACH Regulation Annex XVII Entry 72
	Technical Requirements	Category A	Category B	Category C	75
		20	75	300	
	Test Method	GB/T 2912.1			No method is specified by regulations; ISO 14184-1 may be adopted.

As shown in **Table 1**, GB 18401—2010 sets three formaldehyde limit grades: Category A ≤20mg/kg, Category B ≤75mg/kg, Category C ≤300mg/kg. Adult textile products shall at least meet Category B if in

direct contact with skin, or Category C if non-direct contact products.

The EU REACH Regulation Annex XVII Entry 72 specifies a formaldehyde limit of 75mg/kg, equivalent to the Category B limit in GB 18401—2010 ^[7]. REACH stands for Registration, Evaluation, Authorization and Restriction of Chemicals, the core legal framework for chemical regulation in the EU. Under REACH, all commodities circulating in the EU market are classified into substances, mixtures and articles according to physical form. Textiles are typical “articles,” defined as manufactured goods with fixed shape and design whose functions depend on geometric structure rather than chemical composition. The restriction clauses of REACH stipulate that the concentration of restricted substances listed in Annex XVII contained in manufactured articles placed on the EU market shall not exceed specified threshold values, which is widely concerning across industries.

For test methods: the national standard GB/T 2912.1—2009 Textiles — Determination of formaldehyde — Part 1: Free and hydrolyzed formaldehyde (water extraction method) is re-drafted based on ISO 14184-1:1998, whose latest edition is 2011 ^[8]. The two methods are technically consistent; the key difference is the detection limit: GB/T 2912.1 has a limit of 20mg/kg, while ISO 14184-1:2011 reaches 16mg/kg ^[9].

2.3. Decomposable carcinogenic aromatic amines

Chapters 5 and 6 of GB 18401—2010 specify limits and test methods for decomposable carcinogenic aromatic amines as shown in **Table 2**. No mandatory relevant regulations are found in the US market; comparison with EU requirements is as follows.

Table 2. Comparison of limits for decomposable carcinogenic aromatic amines based on GB 18401—2010

Item		Chinese Market			EU Market	
Decomposable carcinogenic aromatic amines ^{c/} (mg/kg)	Mandatory Standards/ Regulations	GB 18401—2010			The list of carcinogenic aromatic amines is shown in Appendix C, with a	Entries 43 and 72 of Annex XVII to the REACH Regulation
	Technical Requirements	Category A	Category B	Category C	limit value of ≤20mg/kg.	≤30 (22 plus 4 types for each)
		24 types prohibited				
	Test Method	GB/T 17592 & GB/T 23344 Note: Test by GB/T 17592 first; if aniline and/or 1,4-phenylenediamine are detected, further test via GB/T 23344				EN ISO 14362-1:2017 & EN ISO 14362-3:2017

As indicated in **Table 2**, Appendix C of GB 18401—2010 bans 24 types of aromatic amines, with every single compound limited to ≤20mg/kg.

EU REACH Annex XVII Entries 43 and 72 prohibit 22 out of the 24 amines listed in GB Appendix C plus four additional aromatic amine salts, with each amine limited to ≤30mg/kg. The regulation does not restrict No.23 (2,4-dimethylaniline) and No.24 (2,6-dimethylaniline) from GB Appendix C.

Regarding test methods: GB/T 17592—2024 Textiles — Determination of Banned Azo Dyes is modified from ISO 14362-1:2017 Textiles — Methods for determination of certain aromatic amines derived from azo colorants — Part 1: Detection of azo colorants extractable and non-extractable fibers ^[10]. Certain discrepancies remain between the latest national standard and ISO 14362-1:2017. The major difference is that xylene extraction for disperse dyes is a mandatory step in ISO, but only an optional informative appendix

(Appendix G) in the Chinese standard. Besides, Appendix F “Determination of certain aromatic amines from colorants” is removed from the national standard.

GB 18401—2010 stipulates that after testing per GB/T 17592, if aniline and/or 1,4-phenylenediamine are detected, supplementary testing with GB/T 23344 is required. GB/T 2334—2009 Textiles — Determination of 4-aminoazobenzene corresponds to ISO 14362-3:2017. The key distinction is that xylene extraction of colorants is mandatory in ISO but listed as an optional informative Appendix B in the Chinese standard.

3. Analysis and conclusion

Taking GB 18401—2010 National General Safety Technical Code for Textile Products as the benchmark, this paper systematically sorts out and compares technical specifications of textiles under prevailing EU and US regulations and directives. After literature review and comparative analysis, it is concluded that neither the EU nor the US has a universal general technical standard for adult textile products, and technical requirements for textiles vary greatly among major global consumer markets.

Items not covered by GB 18401—2010 carry additional mandatory regulatory requirements in both the EU and US markets, including labeling requirements, flammability performance, and restricted chemical substances ^[11–15].

Disclosure statement

The author declares no conflict of interest.

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