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Compatibility of Basic Dyes for Acrylic Fibers

Developed in 1974 by AATCC Committee RA87 (see 10.1); reaffirmed 1976, 1977, 1980, 1989, 2009, 2013; revised 1984; editorially revised 1985, 1988, 2008, 2010; editorially revised and reaffirmed 1987, 1994, 1999, 2004. Technically equivalent to ISO 105-Z03.

1. Purpose and Scope

1.1 In the dyeing of acrylic fibers with basic dyes, the classic parameters—e.g., the time of half-dyeing—of individual dyes do not give a true indication of their dyeing behavior in admixture with other basic dyes.

1.1.1 Since basic dyes show virtually no migration in acrylic fibers under normal dyeing conditions, compatibility is of major importance in selecting dye combinations with optimum level dyeing behavior (see 10.2).

1.2 This test method is intended to determine the behavior of a dye in relation to its compatibility when applied to acrylics (see 10.3, 10.4 and 10.5).

2. Principle

2.1 Compatibility is assessed against one of two defined five-step scales, a yellow scale and a blue scale. The assessment should be made using the scale showing the greatest difference in hue from that of the dye under test.

2.1.1 The compatibility value of the dye is assessed by determining its dyeing behavior in combination with each of the standard dyes in the relevant scale.

2.1.2 The recommended standard dyes have been chosen because: (a) they form two series encompassing the compatibility behavior of nearly all basic dyes recommended for acrylic fibers; (b) the dyes in a series are spaced to produce approximately equal visual effects; and (c) the corresponding standard dyes from both scales are compatible (see 10.4).

3. Terminology

3.1 **basic dye**, *n.*—a dye that dissociates in an aqueous medium to give a positively charged colored ion (cation) with affinity for fibers containing acidic groups.

3.2 **compatibility**, *n.*—in textile dyeing, propensity of individual dye components in a combination shade to exhaust at similar rates resulting in a buildup of shade that is constant, or nearly constant, in hue throughout the dyeing process.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas and a single use dust respirator while handling powder dyes.

4.2 All chemicals should be handled with care.

4.3 Use chemical goggles or face shield, impervious gloves and an impervious apron during handling of concentrated acetic acid.

4.4 An eyewash/safety shower should be located nearby and an organic vapor respiratory with full facepiece should be readily available for emergency use.

4.5 The basic dyes listed in this method belong to the following classes:

- C.I. Basic Orange 42—Azo-methineazo
- C.I. Basic Yellow 29—Methine
- C.I. Basic Yellow 28—Monoazo
- C.I. Basic Yellow 15—Monoazo
- C.I. Basic Orange 48—Azo
- C.I. Basic Blue 69—Methine
- C.I. Basic Blue 45—Anthraquinone
- C.I. Basic Blue 47—Anthraquinone
- C.I. Basic Blue 22—Anthraquinone
- C.I. Basic Blue 77—Triarylmethane

4.6 Exposure to chemicals used in this procedure must be controlled at or below levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000; see web site: www.osha.gov for latest version). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 10.6).

5. Standard Dyes (see 10.7)

5.1 The constitution of the scales, and recommended amounts of standard dyes, to be used in the test, are as shown in Table I.

Table I

Amount of Standard Dye (% owf) ¹	C.I. Basic	Compatibility Value
Yellow		
0.45	Orange 42	1.0
0.25	Yellow 29 (200%)*	2.0
0.15	Yellow 28 (200%)*	3.0
0.75	Yellow 15	4.0
0.65	Orange 48	5.0
Blue		
0.55	Blue 69	1.0
2.7	Blue 45	2.0
0.6	Blue 47 (200%)*	3.0
0.6	Blue 77	4.0
1.2	Blue 22 (200%)	5.0

¹Note: (owf) means "on weight of fabric" and dyes marked with an (*) are 200% (see 10.9)

The percentages given produce dyeings approximately 1/2 of 1/1 standard depth of many acrylic fibers (see 10.8).

6. Apparatus and Materials

6.1 Thirty samples (pieces of skeins) of equal weight of acrylic fiber.

6.2 Any apparatus that can be used for dyeing at a 40:1 liquor:goods ratio at the required constant temperature.

6.3 A supply of the standard dyes.

6.4 Acetic acid (glacial).

6.5 Sodium acetate crystals ($\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$).

6.6 A supply of deionized or distilled water, which does not change significantly in pH on boiling.

7. Procedure

7.1 Pretreat the samples of material to be used in the test for 10 min at approximately 95°C (203°F) in a solution containing 1% (owf) acetic acid (glacial) and 1% (owf) sodium acetate crystals ($\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$) [to give pH 4.5 (± 0.2)] at a liquor to goods ratio of 40:1. Then lightly squeeze the material and keep it wet ready for use.

7.2 Set five dye baths, one for each of the standard dyes, at 95°C (203°F), a liquor to goods ratio of 40:1 and a pH value of 4.5 $\pm$ 0.2 with:

X% Standard dye (blue or yellow)

Y% Dye under test

1% Acetic acid (glacial)

1% Sodium acetate crystals

($\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$)