2003 AATCC Standard Reference Liquid Laundry Detergent

Developed in 2003 by AATCC Committee RA88; revised 2005.

1. Background on Standard Reference Detergents

1.1 The AATCC and other testing and development groups have used standard reference detergents since the 1960s. AATCC Standard Reference Detergent 124 and AATCC Standard Reference Detergent WOB (without optical brightener) were the first formulations adopted by the AATCC to represent typical home laundry products of that era, primarily phosphate-built powder detergents.

1.2 During the 1970s, due to environmental pressures to eliminate the use of phosphates in detergents, a major shift in the composition of marketed laundry detergents began.

1.3 By the 1980s, the composition of the detergent market had moved from being predominantly phosphate-built, powder detergents to ~50% carbonate-built powder detergents and ~50% citrate-built heavy-duty liquid detergents.

1.4 Consequently, in 1993 the AATCC adopted a new standard reference detergent that was more representative of powder laundry products of the 1990s.

2. Trends in the Laundry Detergent Industry

2.1 Over the past decade, powder detergent sales have fallen while liquid detergent sales have experienced steady growth. In the mid 1990s, the powder and liquid detergent split was ~50/50. In 2001, the market split was closer to 40/60 in favor of liquid laundry detergents, with additional growth expected in that category. Other product forms (tablets, pouches, bags) make up a small percentage of the market. In the U.S., there has been increased activity with the tablet and pouch forms; their impact on the overall detergent market is to be determined.

2.2 The detergent market will continue to evolve as the demands of the consumer and chemical industries change. Detergents of the future will be impacted by many factors, including environmental concerns, conservation efforts, chemical availability, raw material costs, performance benefits, consumer needs, etc. There is therefore a need to ensure that reference detergents are reflective of marketed products and should be updated after major shifts in the detergent industry are noted.

3. Comparison of Powder and Liquid Laundry Detergents

3.1 Both powder and liquid laundry detergents are primarily composed of surfactants and builders (except non-built liquid detergents which contain primarily surfactants). They both also contain processing or delivery aids for product stability and can contain many optional ingredients to provide performance or aesthetic benefits, such as fluorescent brighteners, enzymes, bleaches, anti-redeposition agents, fiber and dye protective agents, perfumes, suds control agents, etc.

3.2 A key difference between powder and liquid laundry detergents is their builder system. Powder detergents are typically better built than liquid laundry detergents, have a carbonate-builder system, often contain aluminosilicates (zeolites) for added builder capacity, and perform optimally at higher pHs (pH=~10). Heavy-duty liquid laundry detergents are typically citrate-built and perform optimally at lower pHs (pH=~8.5).

4. Rationale for 2003 AATCC Standard Reference Liquid Laundry Detergent

4.1 Based on market share, the inclusion of a reference liquid laundry detergent for standard and developmental testing in the textile area is long overdue. For the past 10 years, liquid laundry detergents have made up at least ~50% of the U.S. detergent market and now make up nearly 60%. To be able to test and develop products that are relevant to the current laundry market, a reference liquid laundry detergent is needed.

4.2 Although powder and liquid detergents are designed to provide cleaning and stain removal, they achieve these objectives differently. A key difference is the pH regime in which the two product forms operate. Powder detergents perform optimally at higher pHs (pH=~10). This higher pH is a relatively hostile environment for stains making powder detergents very effective at stain removal; however, the higher pH also tends to negatively impact fibers and dyes. Over the years, technologies have been developed to deliver benefits under high pH conditions and powder detergents have been able to overcome many of their initial disadvantages.

4.3 Liquid detergents perform optimally at lower pHs (pH=~8.5). Because this pH is closer to neutrality, liquid laundry detergents tend to be less harsh on fabrics and dyes. Over the years, technologies have been developed to help liquid laundry detergents deliver stronger cleaning benefits while maintaining the less harsh fabric and dye profiles. Since there are significant formulation differences between powder and liquid laundry detergents, different reference detergents are needed to fairly represent them.

4.4 The performance of the 2003 AATCC Standard Reference Liquid Laundry Detergent was compared to five nationally marketed products in the areas of cleaning (stain removal), color care, and fabric appearance. The standard reference liquid detergent is representative of the U.S. market.

4.4.1 Overall and on individual stains, the cleaning (stain removal) profile of the 2003 AATCC Standard Reference Liquid Laundry Detergent falls within the performance of the five nationally marketed liquid laundry detergents. ASTM Method D 4265-98 (Volume 15.04) was used under full-scale, median wash conditions (wash water at 90°F, 6 gpg hardness, 12 min wash cycle). Stain removal was assessed instrumentally and reported in SRI (stain removal index).

4.4.2 The colorfastness to washing of the 2003 AATCC Standard Reference Liquid Laundry Detergent is comparable to a nationally marketed liquid laundry detergent. AATCC Method 135, Dimensional Changes of Fabrics after Home Laundering, was used under full-scale, median wash conditions and taken to 30 wash cycles. Fabrics were assessed instrumentally (ΔE_{CIE}) and visually (Gray Scale). Using either assessment scale, the relative ranking of color change was similar between the 2003 AATCC Standard Reference Liquid Laundry Detergent and the nationally marketed product. Due to the very large size of this testing, the reference detergent was compared to only one nationally marketed product that is similar in composition.

4.4.3 In conjunction with the colorfastness testing, the impact of the 2003 AATCC Standard Reference Liquid Laundry Detergent on fabric appearance was also assessed and found to be similar to a nationally marketed liquid laundry detergent. AATCC Method 135 was used under full-scale, median wash conditions and taken to 30 wash cycles. Fabrics were assessed visually (color, pilling/abrasion).

4.4.4 The 2003 AATCC Standard Reference Liquid Laundry Detergent was also compared to the powder 1993 AATCC Standard Reference Detergent

for shape retention and color care profile. The performance results for these standards fall within their general market counterparts.

4.5 AATCC technical committees will incorporate the standard reference liquid detergent into appropriate test methods as they are developed and come up for reaffirmation.

4.6 This 2003 Liquid Standard is available without brighteners (referred to as "2003 AATCC Standard Reference Liquid Laundry Detergent WOB") and with brighteners (referred to as "2003 AATCC Standard Reference Liquid Laundry Detergent").

5. Rationale for Use of Reference Detergents in Laboratory Testing

5.1 Many fabric attributes critical to consumer use and acceptability, such as dimensional change, surface or smoothness appearance, colorfastness, soil release, and flammability resistance performance are influenced by the manner in which textile products are laundered. The textile industry has adopted standard detergents and laundering conditions to allow for the prediction of the acceptability of textile products to judge the performance of their products. The standard detergents have been designed to represent a cross section of market detergents.

5.2 The use of locally purchased national brands of detergents in testing labs is a fairly common practice. This practice has been driven by several factors: a) care labeling considerations, b) inaccurate assumption that the same detergent brand has the same composition from location to location and from one year to the next one, c) the convenience of buying locally, and d) price. The use of "off the shelf" detergents in laboratory testing adds an element of variability that use of standard test methods and detergents intends to control. The percentage of optical brightener or fluorescent brightener agents has a definite effect on colorfastness evaluations. The amount of optical brightener or fluorescent brightening agents is known to vary within a single brand of detergent sold for consumer use.

5.3 Detergent producers have developed detergents with other cleaning components such as non-chlorine color safe bleach systems. AATCC now has full-scale (washing machine) methods and accelerated standard procedure for determination of colorfastness using such products. They are AATCC Method 172, Colorfastness to Non-Chlorine Bleach in Home Laundering, and AATCC Method 190, Colorfastness to Home Laundering with Activated Oxygen Bleach Detergent: Accelerated.

5.4 It should be noted that different standard laundering equipment and detergents are used in Europe and Asia.