Designation: D4817 – 88 (Reapproved 2017)

Standard Classification for Rubber Compounding Materials—Stearic Acid[1]

This standard is issued under the fixed designation D4817; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This classification covers the compounding materials commercially known as stearic acid.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1466 Test Method for Sampling Liquid Oils and Fatty Acids Commonly Used in Paints, Varnishes, and Related Materials (Withdrawn 2003)[3]

D1951 Test Method for Ash in Drying Oils and Fatty Acids (Withdrawn 2003)[3]

D1959 Test Method for Iodine Value of Drying Oils and Fatty Acids (Withdrawn 2006)[3]

D1962 Test Method for Saponification Value of Drying Oils, Fatty Acids, and Polymerized Fatty Acids (Withdrawn 2004)[3]

D1965 Test Method for Unsaponifiable Matter in Drying Oils, Fatty Acids, and Polymerized Fatty Acids (Withdrawn 2007)[3]

D1980 Test Method for Acid Value of Fatty Acids and Polymerized Fatty Acids (Withdrawn 2007)[3]

D1982 Test Method for Titer of Fatty Acids

D1983 Test Method for Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters (Withdrawn 2003)[3]

D4075 Test Methods for Rubber Compounding Materials—Flame Atomic Absorption Analysis—Determination of Metals

3. Significance and Use

3.1 Stearic acid is important in the rubber vulcanization process. It is believed that the stearic acid reacts with zinc-oxide or other metallic oxides, during vulcanization, to form a rubber soluble salt or soap, that reacts with the accelerator enabling it to exert its full effect.

3.2 Stearic acid of commerce is generally a mixture of palmitic, stearic, and oleic acids usually derived from tallow base stock but can be derived from other fats and oils of animal or vegetable origins.

4. Basis of Classification

4.1 *Classification of Stearic Acid by Classes:*

4.1.1 There are several different classes of stearic acid, based on stearic acid content and iodine value. There are two classes predominantly used in rubber compounding.

4.1.1.1 *Class Number 1: Stearic Acid Containing Unsaturated Fatty Acids*—Stearic acid containing unsaturated acids is commonly referred to as rubber grade stearic acid. Three grades are commonly available with low, medium, and high unsaturation. These grades of stearic acid are used in rubber compounding where unsaturated fatty acids can be tolerated. (See Table 1 for typical analysis of Class 1 stearic acid.)

4.1.1.2 *Class Number 2—Stearic Acid with Low Levels of Unsaturated Fatty Acids—Low IV:*

(1) Low iodine value stearic acid is produced in several grades. Two grades are commonly used in rubber compounding where a 1.0 maximum iodine value is needed. These two grades are distinguished by their ratios of palmitic to stearic acid content. The physical and chemical properties of the stearic acid will change as the palmitic/stearic acid ratio changes. The palmitic/stearic ratio may be checked by Test Method D1983. (See Table 2 for a typical analysis of the Class 2 stearic acid.)

(2) Stearic acid can be made to customer specifications by employing various processing steps such as hydrogenation to lower iodine value, bleaching with diatomaceous earth to improve color and distillation, or crystallization to change chain length distribution or improve color, or both. A combination of the processing steps may be used to produce the final product.

[1] This classification is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.20 on Compounding Materials and Procedures.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Typical Physical and Chemical Properties of Stearic Acid—Class Number 1[A]

Property	Test Method	Grade 1 Low-IV[B]	Grade 2 Med-IV[B]	Grade High-IV[B]
Ash, %	D1951	0.2 max	0.2 max	0.2 max
Iodine value, g/100 g	D1959	8 max	15 max	39 ± 5
Saponification value, mg KOH/g	D1962	204.5 ± 5.0	204.5 ± 5.0	...
Unsaponification matter, %	D1965	3.0 max	3.0 max	...
Acid value, mg KOH/g	D1980	203.5± 4.5	203.0 ± 4.5	203.5 ± 4.5
Titer, °C	D1982	56.0± 4.5	53.0 ± 3.0	48.5 ± 4.5
[C] Trace metals, ppm	D4075	varies from industry to industry		

[A] The values listed in Table 1 are typical ranges and values.
[B] IV = iodine value.
[C] Trace metals such as nickel, iron, copper, and manganese can be determined in accordance with Test Method D4075.

TABLE 2 Typical Physical and Chemical Properties of Stearic Acid—Class Number 2[A]

Property	Test Method	Grade 1, Palmitic/Stearic 50/40[B]	Grade 2, Palmitic/Stearic 30/65
Ash,%	D1951	<0.1	<0.1
Iodine, value, g/100 g	D1959	1.0 max	1.0 max
Saponification value, mg KOH/g	D1962	208.5 ± 2.5	203.5 ± 3.0
Unsaponification matter, %	D1965	0.2 max	0.5 max
Acid value, mg KOH/g	D1980	208.5± 2.0	203.0 ± 3.0
Titer, °C	D1982	55.5± 1.0	60.0 ± 2.0
[C] Trace metals, ppm	D4075	varies from industry to industry	

[A] The values listed in Table 2 are typical ranges and values
[B] Even though this grade contains more palmitic acid than stearic acid, this grade is still referred to as “stearic acid” in the rubber industry.
[C] Trace metals such as nickel, iron, copper, and manganese can be determined in accordance with Test Method D4075.

5. Sampling

5.1 Sampling to conduct tests as outlined in Section 2 shall be carried out in accordance with Test Method D1466.