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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Guide for Testing Drying Oils[1]

This standard is issued under the fixed designation D 555; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This guide covers the selection and use of procedures for testing drying oils commonly used in paints, varnishes, and related products.

1.2 The test methods included are as follows:

Test Method	Section	ASTM Test Method
Acetone Tolerance	13	D 1950
Acid Value	6	D 1639
Ash	10	D 1951, D 564
Break	12	D 1952
Clarity	5	D 2090
Color	19	D 1544, D 1209
Color after Heating of Drying Oils	25	D 1967
Drying Properties	23	D 1640
Flash Point	24	D 93, D 1310, D 56
Foots Volumetric	11	D 1954
Foots Gravimetric	11	D 1966
Gel Time	14	D 1955
Hydroxyl Value	16	D 1957
Loss on Heating	17	D 1960, D 93
Matter Insoluble in Chloroform	18	D 1958
Preparation of Sample	4	...
Refractive Index	21	...
Sampling	3	D 1466
Saponification Value	8	D 1962
Specific Gravity	20	D 1963, D 1475
Tung Oil Quality Test	15	D 1964
Unsaponifiable Matter	9	D 1965
Unsaturation:		
Diene Value:		
Spectrophotometric Method	7	D 1358
Iodine Value:		
Rosenmund-Kuhnhenn Method	7	D 1541
Wijs Method	7	D 1959
Viscosity	22	D 1545, D 445

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

2. Referenced Documents

2.1 *ASTM Standards:*

D 56 Test Method for Flash Point by Tag Closed Tester[2]

D 93 Test Methods for Flash Point by Pensky-Martens Closed Tester[2]

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)[2]

D 564 Test Methods for Liquid Paint Driers[3]

D 1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)[4]

D 1259 Test Method for Nonvolatile Content of Resin Solutions[3]

D 1310 Test Method for Flash Point and Fire Points of Liquids by Tag Open-Cup Apparatus[3]

D 1358 Test Method for Spectrophotometric Diene Value of Dehaydrated Castor Oil and Its Derivatives[5]

D 1466 Test Method for Sampling Liquid Oils and Fatty Acids Commonly Used in Paints, Varnishes, and Related Materials[5]

D 1475 Test Method for Density of Paint, Varnish, Lacquer, and Related Products[3]

D 1541 Test Method for Total Iodine Value of Drying Oils and Their Derivatives[5]

D 1544 Test Method for Color of Transparent Liquids (Gardner Color Scale)[3]

D 1545 Test Method for Viscosity of Transparent Liquids by Bubble-Time Method[5]

D 1639 Test Method for Acid Value of Organic Coating Materials[5]

D 1640 Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature[3]

D 1644 Test Methods for Nonvolatile Content of Varnishes[3]

D 1950 Test Method for Acetone Tolerance of Heat-Bodied Drying Oils[5]

[1] This Guide is under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.32 on Drying Oils.

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[2] *Annual Book of ASTM Standards*, Vol 05.01.

[3] *Annual Book of ASTM Standards*, Vol 06.01.

[4] *Annual Book of ASTM Standards*, Vol 06.04.

[5] *Annual Book of ASTM Standards*, Vol 06.03.

D 1951 Test Method for Ash in Drying Oils and Fatty Acids[5]
D 1952 Test Method for Quantitative Determination of Break in Drying Oils[5]
D 1954 Test Method for Foots in Raw Linseed Oil (Volumetric Method)[5]
D 1955 Test Method for Gel Time of Drying Oils[5]
D 1957 Test Method for Hydroxyl Value of Fatty Oils and Acids[5]
D 1958 Test Method for Chloroform–Insoluble Matter in Oiticica Oil[5]
D 1959 Test Method for Iodine Value of Drying Oils and Fatty Acids[5]
D 1960 Test Method for Loss on Heating of Drying Oils[5]
D 1962 Test Method for Saponification Value of Drying Oils, Fatty Acids and Polymerized Fatty Acids[5]
D 1963 Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C[5]
D 1964 Test Method for Tung Oil Quality[5]
D 1965 Test Method for Unsaponifiable Matter in Drying Oils, Fatty Acids and Polymerized Fatty Acids[5]
D 1966 Test Method for Foots in Raw Linseed Oil (Gravimetric Method)[5]
D 1967 Test Method for Measuring Color After Heating of Drying Oils[5]
D 1983 Test Method for Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters[5]
D 2090 Test Method for Clarity and Cleanness of Paint and Ink Liquids[5]
D 2245 Test Method for Identification of Oils and Oil Acids in Solvent-Reducible Paints[3]
D 2800 Test Method for Preparation of Methyl Esters from Oils for Determination of Fatty Acid Composition by Gas Chromatography[5]
D 3457 Test Method for Preparation of Methyl Esters from Fatty Acids for Determination of Fatty Acid Composition by Gas-Liquid Chromatography[5]
D 3725 Test Method for Semiquantitative Determination of Fish Oil in Drying Oils and Drying Oil Fatty Acids by Gas-Liquid Chromatography[5]

3. Sampling

3.1 Sample the material in accordance with Test Method D 1466. This test method covers in considerable detail a procedure for obtaining representative samples of liquid oils and fatty materials from drums, barrels, casks, and tank cars. The test method gives instructions on obtaining representative samples from 4000, 6000, 8000, 10 000 and 12 000-gal (15, 23, 30, 38, and 45-m^3) cars. Additional directions must be obtained for sampling cars of other capacities.

3.2 Test Method D 1466 takes into consideration the possible presence of settled solid or "footy" materials that may exist in the container. The test method requires that drums or casks be thoroughly mixed by rolling before a sample is taken. However, with regard to tank cars, the procedure, if followed carefully, will yield representative samples from cars that contain considerable quantities of settled solid material. If it is known that there is no settled material in a tank car, any one of a number of established liquid samplers may be used with good results.

4. Preparation of Sample

4.1 Melt the sample if it is not already completely liquid. The temperature during melting should not exceed 10 to 15°C above the melting point of the sample.

4.2 Mix the laboratory sample thoroughly by shaking, stirring, or pouring from one vessel to another. Take the specimens for the individual tests from this thoroughly mixed sample.

5. Clarity

5.1 This requirement provides for the quick rejection of natural oils that are obviously contaminated by solid matter, such as dirt, or water in excess of the solubility limit.

5.2 Most natural oils contain some saturated glycerides, which may crystallize out at low temperatures giving a cloudy appearance. If the cloudiness disappears on warming, it is probably due to these saturated glycerides and should be disregarded.

5.3 Some processed oils are naturally hazy, as a result of the processing methods used, and a clarity requirement should not be included in specifications for processed oils unless it is known that properly processed oils of the type desired will meet the requirements.

5.4 Determine the clarity in accordance with Test Method D 2090.

6. Acid Value

6.1 The acid value of an oil is an indication of the condition of the seed from which the oil has been extracted and of the refining to which it has been subjected. It is not useful for the identification of the type of oil.

6.2 Test Method D 1639 is generally most satisfactory as to precision. There is no choice between sodium and potassium hydroxides except personal preference.

6.3 If the percent of free fatty acids calculated as oleic is required, the following equation may be used for the transformation:

$$\text{Free fatty acids, \%} = 0.503 \times \text{acid value} \quad (1)$$

7. Unsaturation

7.1 The drying properties of fats and oils are indicated by the amount and nature of unsaturation they contain. The amount is conventionally expressed as the iodine value, that is, centigrams of iodine absorbed per gram of sample (weight percent of iodine absorbed). The iodine value is a fairly satisfactory measure of the relative drying time and speed of heat-polymerization among a group of oils of the same type. However, because both drying time and heat-polymerization are affected by the kind and distribution of fatty acids in the oil, these methods are not so useful in comparing oils of different types. The measurement of unsaturation is an alternative to the determination of the individual fatty acids for the identification of natural oils, since each natural oil has its own range of unsaturation values.

7.2 Determine the unsaturation of natural drying oils that do not contain conjugated double bonds by the Wijs method as