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

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]

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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:

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

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 described in Test Method D 1959, which gives fairly good accuracy and precision. It has largely superseded the Hanus and other methods that tend to give high results. When the Wijs method is applied to oils containing conjugated double bonds, such as tung oil and dehydrated castor oil, an empirical figure is obtained that is indicative of the relative amount of unsaturation present, but is not a measure of the total unsaturation. With careful control of the reaction conditions, however, reproducible and useful results may be obtained. Where the total unsaturation is required, make the determination using a modification of the Rosenmund-Kuhnhenn method as described in Test Method D 1541. This method gives an accurate measure of total unsaturation on conjugated oils and is also satisfactory for nonconjugated oil, although somewhat more difficult to run than the Wijs method. Quantitative hydrogenation will also yield an accurate measure of the total unsaturation. There is no standard procedure for this method. It is the only satisfactory method for oils containing acetylenic bonds, such as isano oil.

7.3 The iodine value is useful for the identification of linseed, soybean, safflower, and similar natural oils. The amount of conjugated diene (or triene) is useful for identifying tung and oiticica oils, as well as dehydrated castor oil. Conjugated diene is a measure of the quality of dehydrated castor oil, although it is not the only measure that should be used. Determine the amount of conjugated diene by spectrophotometric measurement using Test Methods D 1358.

8. Saponification Value

8.1 The saponification value is, essentially, a measure of the molecular weight of the fatty acid portion of the glyceride, varying inversely with the weight, except for certain modified oils. It is not a measure of the quality or identity of the oil. The value is useful for certain calculations in the use of the oil, such as in the manufacture of alkyd resins.

8.2 Determine the saponification value in accordance with Test Method D 1962, which is satisfactory for all normal oils and for many special and synthetic products. As indicated in the test method, longer saponification times are required for certain synthetic oils, and some special products may require the use of a higher-boiling solvent, such as ethylene glycol, for complete saponification.

8.3 Saponification value is not changed significantly by polymerization but increases rapidly with oxidation. A saponification value significantly higher than normal indicates the presence of oxidized or blown oils or else modification with chemicals such as maleic or fumaric acids.

9. Unsaponifiable Matter

9.1 The unsaponifiable matter is a measure of the materials present in the oil that are oil-soluble and are not converted to water-soluble soaps by the saponification conditions used. A small amount of unsaponifiable matter is characteristic of all natural oils, varying with the extraction and refining conditions. Within the limits of the individual oil specifications, the amount of unsaponifiable matter is no measure of the quality or identity of the oil. An excessive amount of unsaponifiable matter indicates contamination with nonglyceride matter, such as mineral oil, hydrocarbon resins, etc.

9.2 Determine the unsaponifiable matter in accordance with Test Method D 1965, which is the referee method. Since the exact amount of unsaponifiable matter obtained is governed by the partition coefficient of the matter between the soap solution and the solvent, different results may be expected if some other solvent such as ethyl ether is used. A rapid, qualitative test for excessive unsaponifiable matter consists in saponifying a small quantity of the oil and diluting with water. A milky emulsion indicates excess unsaponifiable matter.

10. Ash

10.1 Ash is determined by igniting the oil, under specified conditions, and weighing the noncombustible material. Most natural and processed oils contain small amounts of ash, but the amount is insignificant. Certain, synthetic drying oils may contain residual catalyst or other materials, thus giving larger amounts of ash. Although the ash and metal content of boiled oils may be specified, the trend with new and improved driers is toward the specification of drying time, allowing the manufacturer to obtain this in any way desired.

10.2 Determine the ash in accordance with Test Method D 1951. Determine the drier metal content of the ash in accordance with Test Methods D 564. Wet ashing or extraction methods may give more accurate results.

11. Foots

11.1 "Foots" is the term applied to nonoil material that will settle out of natural oils on storage. Since the material measured as foots is usually suspended rather than dissolved in the oil, extreme care in sampling is necessary to get a representative sample for measurement. This applies not only to the sampling of the bulk oil but also to the taking of specimens for running the test. Careful agitation to ensure thorough mixing before sampling is absolutely essential.

11.2 Some of the materials included in the foots hydrate readily in the presence of moisture, particularly at low temperatures, and these hydrated materials have a much larger volume than they had originally. Therefore, oils exposed to moisture for periods of time, particularly with chilling, may be expected to show a substantial increase in volumetric foots with time.

11.3 Determine volumetric foots in accordance with Test Method D 1954. Very careful control of all variables in the test is absolutely necessary, as the test is empirical. Even under the best conditions, the reproducibility is not good. The test is usually used for raw linseed oil. It has no meaning when applied to oils that have been processed to any marked degree.

11.4 Determine gravimetric foots in accordance with Test Method D 1966. The precision of this procedure is much better than the older volumetric method. Internationally the procedure is known as the P.A.T. test and its use is increasing in oil trading.

12. Break

12.1 "Break" is the nonoil material that separates from natural oil on heating. It is usually reported by weight. Break is not significant except in oils that are to be heated, as in the manufacture of varnishes or alkyd resins, and this requirement should not be included in a specification unless necessary for the proposed end use.

12.2 Determine break in accordance with Test Method D 1952. Test Method D 1952 is empirical, and the conditions prescribed must be carefully followed, but results correlate well with practical performance.

13. Acetone Tolerance

13.1 The acetone tolerance is a measure of the amount of high polymer in a heat-bodied oil when no nonfatty material is present. It is only applicable to heat-bodied oils and should only be used to assure uniformity of deliveries. There is no correlation between the acetone tolerance and the usefulness of an oil, but, if acetone tolerance and other properties of an oil are the same as those of an accepted sample, the two probably have been produced by the same technique.

13.2 Determine the acetone tolerance in accordance with Test Method D 1950. The test method consists of adding acetone until a cloudy dispersion persists. Temperature is extremely important and must be controlled very closely. This determination may be made as a "cloud point," measuring the temperature at which cloudiness appears for a given acetone concentration, but this is a more difficult technique, experimentally, for this particular solvent-solute combination. Quantities greater than the smallest traces of water in the acetone also affect the result significantly, and the amount must be kept within the prescribed limits.

14. Gel Time

14.1 Gel time is a measure of the tendency of oils to solidify under certain specified conditions. The test is designed primarily for the detection of adulteration in tung and oiticica oils. The method, usually at a higher temperature, may also be used to evaluate oils treated to produce rapid polymerization as well as dehydrated castor oil. The method is not applicable to natural oils such as linseed and soybean that do not show a sharp end point at practicable temperatures. Other natural oils such as tung and oiticica are subject to some variation, depending upon many factors. Slight variations from the standard values should not at first glance be taken as sufficient evidence of adulteration.

14.2 Determine the gel time in accordance with Test Method D 1955. In this test method, since the volume of the oil bath is relatively small, the bath is chilled by the introduction of the specimens, and must be raised above the operating temperature in order to be correct after insertion of the tubes. Since the control of temperature is very important and is difficult to maintain accurately by manual means over a long period of time, oils that gel slowly should be tested at higher (but accurately defined) temperatures, in order that gelation may take place in a reasonable time.

15. Tung Oil Quality Test

15.1 Determine the quality of tung oil in accordance with Test Method D 1964, which is designed to detect adulteration of tung oil with nonconjugated oils. It is not intended for use with any other oil. Temperature is extremely important, and the correct thermometer, used in the correct way, is essential.

16. Hydroxyl Value

16.1 The hydroxyl value is a measure of hydroxyl content of an oil, expressed as milligrams of potassium hydroxide equivalent to the hydroxyl content of 1 g of oil. It is used to determine the efficiency of the dehydration of dehydrated castor oil. It is also a measure of the residual hydroxyl groups of processed oils, when other interfering groups are not present.

16.2 Determine the hydroxyl value in accordance with Test Method D 1957. This test method involves the acetylation of hydroxyl-containing fatty oils and acids using pyridine as solvent. Other groups that will react with acetic anhydride under the conditions of the test method will be reported as hydroxyl. A correction is applied for acid groups present and, if necessary, similar corrections may be applied for other interfering groups.

17. Loss on Heating

17.1 Determine the loss on heating in accordance with Test Method D 1960, which is a quick method for detecting contamination or adulteration of natural oils with volatile solvents. It is not a true loss measure since small amounts of oxygen, if any, in the inert gas used will be absorbed by the oil, resulting in a small gain in weight, that may more than offset small losses. This method should be used only for gross contamination. When small amounts of flammable volatile solvent are to be qualitatively detected, as in solvent-extracted oil, use Test Method D 93. For oils containing larger amounts of volatile matter where an accurate determination is required, use Test Methods D 1259 or D 1644.

18. Matter Insoluble in Chloroform

18.1 The matter insoluble in chloroform, in a drying oil, represents mineral contamination, since all materials naturally occurring in such oils are soluble under the conditions outlined in this test method.

18.2 Determine insoluble matter in accordance with Test Method D 1958. This test method is rarely applied to drying oils other than oiticica oil which, because of the production process, may be contaminated with mineral matter.

19. Color

19.1 The color of an oil, in bulk, is usually relatively useful in predicting how it will behave in use in comparison with other similar oils. However, since some oils darken on heating or oxidation and others bleach, the color in bulk is rarely helpful in comparing oils of different types.

19.2 Determine the color by comparison with standards, either liquid or glass, as described in Test Method D 1544 which is the fastest method and, in general, is sufficiently accurate. For extremely light-colored oils (Gardner color No. 3 or lower) use the APHA or Hazen method as described in Test Method D 1209. Since this test method uses a much thicker layer of oil than Test Method D 1544, light colors may be judged more precisely. However, because of this thickness difference, there is no precise correlation between the two methods and the method specified must be used.

NOTE 1—For edible oils, methods based on Lovibond glasses (American Oil Chemists' Society Method Cc 13b) or, rarely, on spectrophotometric measurements (AOCS Method Cc 13c) are used. For tallows and certain other inedible oils, the FAC Method (AOCS Method Cc 13a) is commonly specified. These methods should not be used for drying oils.

19.3 In making visual comparisons of the color of specimen and standard, careful control of the conditions of illumination and view are necessary if high precision is called for. Care must be taken that the observer has normal color perception.

19.4 Standards darker than Gardner color No. 18 are not very useful, since comparison of specimen and standard under the conditions specified is difficult. When it is necessary to specify the color of very dark oils, it is usually more satisfactory to specify the color of the oil diluted with a standard amount of solvent sufficient to bring the color into the range of the standard color-measuring methods. The nature of the solvent and the dilution must be specified exactly.

20. Specific Gravity

20.1 Specific gravity of an oil is a useful measure, since translation from volume to weight, or vice versa, is often required. For this reason it should be determined with care. Specific gravity is not a measure of the quality of the oil, and an oil that deviates slightly from the specified limits, but otherwise conforms, is usually completely satisfactory. Specific gravity increases with polymerization or oxidation in a regular manner, and for every bodied or blown oil of a given viscosity there is an appropriate specific gravity.

20.2 Determine the specific gravity in accordance with Test Method D 1963, which is capable of high precision and is the referee method. If less accurate results (3 significant figures) are adequate, "weight-per-gallon" cups as described in Test Method D 1475 may be used. Specific gravity is very sensitive to temperature, and the temperature of measurement must be controlled, or at least known, with high precision. If measurements are made at other than the standard temperature, or if the value of the specific gravity is required at some temperature other than the standard, the approximate value may be calculated as described in Test Method D 1963.

21. Refractive Index

21.1 Refractive index is a scientifically defined property and numerous accurate instruments are available for its determination. Since the method used depends upon the instrument, no method for its determination is given. Any one of a large number of instruments operated according to the manufacturer's instructions will give satisfactory results.

21.2 Refractive index is not a very useful means of specifying drying oils. It is useful in detecting adulteration in oils containing substantial amounts of conjugation, such as tung, oiticica, and dehydrated castor oils. Since refractive index varies with iodine value, it can be used as a quick approximation of iodine value.

22. Viscosity

22.1 Viscosity is the resistance experienced by one portion of a liquid flowing over another portion. It is expressed in poises, the absolute unit, or in stokes, equivalent to poises divided by density.

22.2 The viscosity of most natural oils is very low and its specification serves no useful purpose. Tung, oiticica, castor, and many processed oils have measurable (by the tube method) viscosities, but in the case of processed oils the viscosity is a result of the method of processing and is in no way related to the merit of the oil.

22.3 Determine the viscosity of drying oils in accordance with Test Method D 1545. This test method describes a means for measuring the travel of an air bubble in a cylindrical tube either by timing or by comparison with standard tubes of known viscosity. The results are very close to the true viscosity in stokes, but are not exactly correct, so that viscosity determined by this test method should be reported in "approximate stokes" or "bubble seconds." More precise results may be obtained for viscosities of less than 4 s by comparison with standards, and for more viscous oils by timing. If higher precision is required, use capillary viscometers such as those described in Test Method D 445. Results obtained in poises should be divided by the density to give stokes.

22.4 When tube methods are used, results are affected by the size and shape of the air bubble. Therefore, if precise results are required, tubes conforming exactly to the standard must be used, and the air bubble must be adjusted to the correct size. A difference in tube diameter of 0.05 mm will result in an error of approximately 2 %. All viscosity measurements are very sensitive to temperature and extremely close temperature control (±0.1°C) is necessary for precise results.

23. Drying Properties

23.1 Since drying oils, by definition, set to a solid film, the time required for this to take place is an important property of all such oils. Unfortunately, the time required is greatly affected by a number of variables including temperature, drier content, light, humidity, film thickness, air circulation, etc. All these must be controlled with great care to assure reproducible results. Furthermore, results obtained under one set of conditions do not necessarily allow prediction of results that might be obtained under other conditions.

23.2 Empirical measures of drying properties are useful in comparing one oil with others of the same general type, but must be used cautiously otherwise. Because of the effect of pigmentation and other variables, it is difficult to predict the drying time of a paint from the drying time of the oil used in its manufacture.

23.3 Select from Test Methods D 1640 one set of generally acceptable conditions (except for drier content, which must be specified). These conditions may, of course, be varied as required, but any variation must be outlined carefully if agreement is to be obtained. Numerous other methods of measuring drying time have been proposed. Most of these use some mechanical device to determine the end point. However, many of these devices interfere, in an unpredictable manner, with the circulation of air, the amount of oxygen, and the amount of light available to the film so that results are likely to be erratic. The most widely used device, the Sanderson machine which drops sand on the film, gives results between the" set-to-touch" and "dry" times.

23.4 Since the drying of oils is a continuing process that goes on indefinitely, it is difficult to select sharp end points that may be measured precisely. The "set-to-touch" point, where the internal cohesion of the film exceeds its adhesion to the finger, is probably the sharpest. This point coincides very closely with the point where the film changes from a liquid to a gel. The "dry time" is more subjective, and it is difficult to get close agreement between laboratories, especially for oils with relatively long drying times. Agreement, however, is better as to whether or not a film is dry at a specified time.

24. Flash Point

24.1 The flash point of a liquid is defined as the lowest temperature, corrected to 101.3 kPa (760 mmHg) of pressure, of the material under test at which application of an ignition source causes its vapor to ignite under specified conditions of test.

24.2 Most natural and synthetic drying oils have very high flash points of about 500°F (260°C), unless they contain traces of volatile, flammable materials. If the contaminating solvent is known, it is possible to set up a relationship between the solvent content and the flash point.

24.3 Flash point of vegetable oils is helpful in determining that no hazardous amounts of solvents have been left in solvent-extracted oils, or that the oils have been contaminated with such solvents. If flammable solvents are not present, the flash point of natural oils is meaningless as far as specifications are concerned.

24.4 Determine the flash point in accordance with Test Method D 93 which uses the Pensky-Martens Closed Cup. Use Method B for Testing flash point of highly viscous materials. The exact flash point obtained is empirical, depending upon the rate of heating and other factors set forth in the test method. These must be followed carefully if reasonable precision is to be obtained.

NOTE 2—If open-cup methods, such as Test Method D 1310 are used, traces of flammable solvents may evaporate and be lost without ever igniting and an unduly high result may be obtained. Since many oils are fairly viscous liquids, the use of test methods that do not provide for stirring, such as Test Method D 56, may give anomalous results.

25. Color After Heating of Drying Oils

25.1 Some drying oils darken on heating to polymerization temperatures while others may lighten in color. The procedure in Test Method D 1967 gives an indication of this color change.

26. Composition of Drying Oils and Fatty Acids by Gas-Liquid Chromatography

26.1 Gas-liquid chromatography has proven to be a very effective tool for the determination of the fatty acid composition of fats and oils. It is often beneficial to know the actual chemical composition of a fatty mixture. This can be obtained by the use of several applicable related ASTM test methods.

26.2 The oil or fatty acid to be tested must first be converted to the methyl ester for the gas-liquid chromatographic determination. This is accomplished using Test Method D 2800 in the case of oils and Test Method D 3457 for fatty acids.

26.3 Test Method D 1983 is the general method for the determination of composition by gas chromatography. Test Method D 3725 shows the modifications to Test Method D 1983 needed to determine fish oil present in other drying oils. This gas-liquid chromatography method is more reliable than the old bromination procedures referred to in X1.3.

26.4 Typical composition of oils used in paint products are shown in Table 1 of Method D 2245.

27. Keywords

27.1 drying oils

APPENDIX

(Nonmandatory Information)

X1. REFERENCES TO DELETED METHODS

X1.1 ASTM Method D 1956, Test for Heat Bodying Rate of Drying Oils, last appeared in Part 29 of the *1974 Annual Book of ASTM Standards*. Last approved in 1969. Withdrawn in April 1975.

X1.2 ASTM Method D 1961, Test for Maleic Diene Value of Drying Oils, last appeared in Part 29 of the *1974 Annual Book of ASTM Standards*. Last approved in 1969. Withdrawn in April 1975.

X1.3 ASTM Method D 1724, Qualitative Determination of Fish Oil in Drying Oils and Drying Oil Fatty Acids, last appeared in Part 29 of the *1978 Annual Book of ASTM Standards*. Last approved in 1974. Withdrawn in 1978. This method is still used in ISO 150, Specification for Raw, Boiled, and Refined Linseed Oil.

X1.4 The preceding methods have been deleted due to nonuse or due to replacement by other more reproducible methods. If the instrumentation or equipment needed for the new methods is not available then by mutual agreement between concerned parties the older methods, copies of which may be obtained from ASTM Headquarters, may be used.