Designation: D 1413 – 99

Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures[1]

This standard is issued under the fixed designation D 1413; 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 test method covers determination of the minimum amount of preservative that is effective in preventing decay of selected species of wood by selected fungi under optimum laboratory conditions.

1.2 The requirements for preparation of the material for testing and the test procedure appear in the following order:

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 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]

D 841 Specification for Nitration Grade Toluene

D 1193 Specification for Reagent Water

E 11 Specification for Wire-Cloth Sieves for Testing Purposes

2.2 *AWPA Standard:*

M-1-66 Method to Determine the Comparative Leachability of Wood Preservatives[3]

3. Summary of Test Method

3.1 Conditioned blocks of wood are impregnated with solutions of a preservative in water or suitable organic solvent to form one or more series of gradient retentions of the preservative in the blocks. After periods of conditioning or weathering, the impregnated blocks are exposed to one or more strains of wood-destroying fungi, one fungus for each test series. The minimum amount of preservative that in the prescribed testing protects the impregnated blocks against decay by a given test fungus is defined as the threshold retention for that organism. Failure to protect is evidenced by loss of wood from the treated wood blocks, as indicated by a loss in weight.

3.2 Provision must be made for coordinated preparation of the test cultures and for impregnation, conditioning, or weathering and conditioning, of the test blocks.

4. Apparatus

4.1 *Conditioning Chamber or Room*, maintained at a selected temperature between 20 and 30°C (68 and 86°F) and a selected relative humidity between 25 and 75 %. The selected temperature shall not vary more than ±1°C (±2°F) and the selected humidity not more than ±2 %.[4]

4.2 *Incubation Room or Incubation Cabinet*, maintained at a selected temperature between 25 and 27°C (77 and 81°F) and a relative humidity between 65 and 75 %. The selected temperature shall not vary more than ±1°C (±2°F) and the selected humidity percentage not more than 2.

4.3 *Drying Oven*—A suitable, vented oven, maintained at a temperature of 105 ± 2°C (220 ± 4°F).

4.4 *Steam Sterilizer*.

4.5 *Balances*, fast-acting types preferred, sensitive and accurate to 0.01 g.

4.6 *Vacuum Pump or Water Suction Pump*, capable of reducing pressure to 100 mm (3.94 in.) Hg, or less.

4.7 *Impregnation Apparatus*—A suitable desiccator or bell jar shielded to protect personnel in event of breakage, provided

[1] This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.06 on Treatments for Wood Products.

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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] American Wood Preservatives Assn., 1625 Eye St., N.W. Washington, DC 20006.

[4] Scheffer, T. C., "Humidity Controls for Conditioning Rooms," Forest Products Laboratory Report No. 2048, U.S. Forest Service, 4 pp., 5 Figs., January 1956.

with suitable separatory funnel or auxiliary flask for holding the treating solution and vacuum gage or manometer (Fig. 1).

4.8 *Trays or Racks, or Pin Bars*—Trays or racks made from suitable screening to permit free air movement around each block during initial drying and for convenient handling of the test blocks. Pin bars facilitate handling (see 6.2).

4.9 *Weathering Apparatus*:

4.9.1 *Forced Draft Oven*. [5]

4.9.2 Apparatus designed for weathering salts-treated blocks is described in AWPA Method M-1-66.

4.10 *Culture Bottles*, cylindrical or square (Note 1), capacity nominal 225 or 450 cm^3 (8 or 16 oz), fitted with screw caps without liners (Fig. 2).

NOTE 1—*Culture Bottles:*
(1) 225-cm^3 (8-oz) French square, for use with one block only.
(2) 225-cm^3 (8-oz) cylindrical, for use with one or two blocks.
(3) 450-cm^3 (16-oz) cylindrical, for use with two blocks only.

4.11 *Soil Sieves*—U.S. No. 6 sieve in accordance with Specification E 11.

5. Reagents

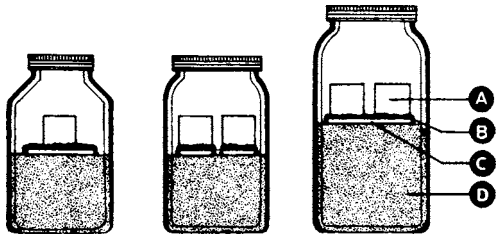
5.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the Specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[6] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Type IV of Specification D 1193.

5.3 *Toluene*, conforming to Specification D 841.

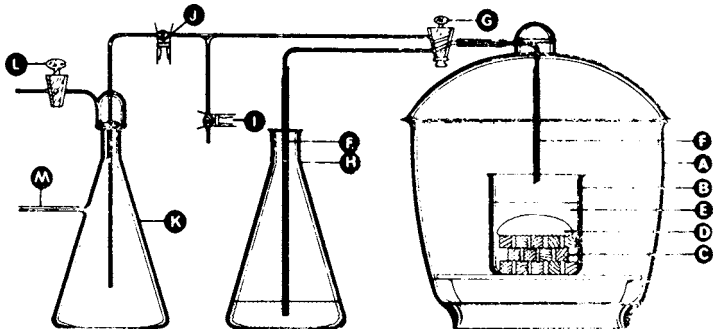
6. Wood

6.1 *General Properties*—Pine sapwood, free of knots and visible concentration of resins, and showing no visible evidence of infection by mold, stain, or wood-destroying fungi, with 2½ to 4 rings/cm (6 to 10 rings/in.) should be used for standard comparative tests intended to show comparative wood preserving values of preservatives under test. If southern pine is used, it should be 40 to 50 % summerwood. Whenever practicable, selection of the wood for the test blocks should begin at the sawmill. Quartersawed boards are preferable. Newly cut boards, nominally (25 mm) (1 in.) thick, that are immediately kiln dried without antistain treatment provide



A—Wood cubes, 19-mm or 0.75-in.
B—Test fungus growing over feeder block.
C—Wood feeder block.
D—Soil.

FIG. 2 French Square and Cylindrical 225 cm^3(8 oz) and cylindrical 450-mm (16-oz) Culture Bottles with Metal Screw Lids



A—Vacuum desiccator, internal diameter 250 mm.
B—Plastic or glass treatment beaker.
C—Test wood blocks.
D—Glass or other suitable weight.
E—Treating solution.
F—Polyethylene tubing.
G—Three-way stopcock with TFE-fluorocarbon plug.
H—Flask containing treating solution.
I—Glass joint with O-ring leading to either vacuum gage or mercury manometer.
J—Glass joint with O-ring.
K—Flask for vacuum trap.
L—Stopcock to atmosphere.
M—Line to source of vacuum.

FIG. 1 Apparatus for Vacuum Impregnation

[5] Blue M Model OV 490 A.

[6] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia.

chemical-free wood that has had minimum opportunity for fungus infection or deterioration before use in the soil-block culture test.

6.1.1 *Sapwood Identification*—When the boundary between heartwood and sapwood is difficult to recognize, use a color test[7] to distinguish between the two. Uneven absorptions may be caused by the presence of heartwood.

6.1.2 *Conditioning of Parent Boards*—Open-stack the boards under shelter and permit.

6.2 *Test Blocks* (Note 2), should be cubes milled as accurately as possible to 19 mm (0.75 in.). If desired (for example, for convenience in handling), blocks may be drilled through the center of a tangential face with a 3-mm drill (approximately 0.125 in. or a No. 30 drill). Pin bars may then be used for handling. The volume of the blocks without the hole should be 6.9 ± 0.2 cm^3, determined by caliper or by mercury displacement.

NOTE 2—Store working stocks of test blocks and feeder strips in the conditioning room. It is desirable to weigh the blocks after they come to approximate equilibrium moisture content in storage or in the conditioning room, and to sort them into fairly narrow-range weight groups. Since the blocks are cut accurately to size this division into weight groups is, in effect, a segregation into density groups (see 10.4).

6.3 *Feeder Strips*:

6.3.1 *General Considerations*—One feeder strip is needed for each block in a culture bottle. If test blocks other than pine are used for special investigations, the sapwood selected for feeder strips should be capable of furnishing a satisfactory growth of the test fungus; for example, sweetgum sapwood often is used with hardwood test blocks and *Coriolus versicolor* (L.) Quél. = [*Polyporus versicolor* L. ex. Fr.] fungus.

6.3.2 *Size*—The feeder strips should be approximately 3 by 28 by 35 mm (⅛ by 1⅛ by 1⅝ in.) with the grain of the wood parallel to the short dimension.

7. Test Fungi

7.1 *General Considerations*—Always include a comparatively tolerant fungus (see 7.2 and 7.3) in testing a preservative. Other economically important fungi may be used in addition to the tolerant fungus in special investigations, or in some cases substituted for it.

NOTE 3—The following numbers refer to standard strains of test fungi maintained in the American Type Culture Collection (ATCC), 12301 Parklawn Drive, Rockville, MD 20852.

7.2 *Fungus Species for Softwood Sapwoods*:

7.2.1 *Lentinus lepideus* Fr. (Madison 534, ATCC No. 12653)—A fungus particularly tolerant to creosote or to mixtures containing creosotes.

7.2.2 *Gloeophyllum trabeum* (Pers. ex. Fr.) Murr. = [*Lenzites trabea* Pers. ex. Fr.] (Madison 617, ATCC No. 11539)—A fungus particularly tolerant to phenolic and arsenic compounds.

7.2.3 *Poria placenta* (Fr.) Cook = [*Poria monticolor* Murr.] (Madison 698, ATCC No. 11538)—A fungus particularly tolerant to copper and zinc compounds. Suggested for testing mercury compounds.

7.3 *Fungus Species for Hardwood Sapwoods*:

7.3.1 The three fungi listed in 7.2.

7.3.2 *Coriolus versicolor* (L.) Quél. = [*Polyporus versicolor* L. ex. Fr.] (Madison 697, ATCC No. 12679), a white-rot fungus prevalent on hardwood products.

8. Culture Media

8.1 *Malt Agar Substrate*—For both stock test-tube and petri dish cultures of the test fungi use a nutrient medium consisting of about 2 weight % malt extract and 1.5 weight % agar. Sterilize the medium at 103 kPa (15 psi) for 20 min and allow to cool before inoculations.

8.2 *Soil Substrate*—Use a soil substrate with a water-holding capacity between 20 and 40 % (Note 4) and pH between 5.0 and 8.0 and weighing not less than 90g/120 cm^3. After breaking up all clumps, mix and screen the soil through the U.S. No. 6 sieve and store in large covered containers. The soil should not be so wet when it is sifted that the particles again stick together. Pass a sample of air-dry soil through a U.S. No. 6 sieve. Determine the water-holding capacity as follows. Use the sieved soil to fill a small Buchner funnel approximately 50 mm in diameter and 25 mm in depth, and fitted with rapid-filtering paper, to somewhat more than capacity. Compact the soil by dropping the funnel three times through a height of 10 mm (0.4 in.) on a wooden tabletop. Level the soil surface by cutting off excess soil with a spatula at the top of the funnel without further compaction. Then place the filled funnel in a 400-cm^3 beaker and retain in an upright position by wedges at the sides of the funnel. Add water to the beaker to a depth slightly beyond the level of the filter paper. Allow the soil to wet by capillarity so as to reduce the danger of entrapping air within the column. When the upper soil surface shows signs of wetting, add more water until the water level approximates the upper surface of the funnel. Place a cover over the beaker, and allow the soil to soak for 12 h or overnight. Then place the funnel in a suction flask which is connected to a water aspirator or vacuum pump, and apply full suction for 15 min. During suctioning, cover the funnel with a moist cloth on which an inverted cup is placed to prevent evaporation of water from the exposed soil surface. After 15 min remove the funnel from the suction flask, scrape the soil into a weighed receptacle, and weigh to obtain the wet weight, W_1. Ovendry for 24 h at 105 ± 2°C (220 F ± 4°F) and reweigh soil, W_2. Determine soil moisture content (water-holding capacity) based on the ovendry weight of soil.

$$\text{Water-holding capacity (WHC), \%} = [(W_1 - W_2)/W_2] \times 100 \quad (1)$$

NOTE 4—The water-holding capacity of a soil should be considered as that percentage of water, based on the ovendry weight of the soil, that is retained after subjecting the soil to the following procedure based on a method of Bouyoucos, G. J. A., "A Comparison Between the Suction Method and the Centrifuge Method of Determining the Moisture Equivalent of Soils." *Soils Science,* Vol 40, 1935, pp. 165–170.

8.2.1 *Preparation of Soil Culture Bottles*—The soil substrate, sifted and lightly compacted by tapping, should half-fill

[7] "Standard for Inspection of Treated Timber Products," AWPA Standard M 2-73, Section 5.51.