



Designation: E2686 – 09

Standard Test Method for Volatile Organic Compound (VOC) Solvents Absorbed/ Adsorbed By Simulated Soil Impacted by Pesticide Emulsifiable Concentrate (EC) Applications¹

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1. Scope

1.1 This test method simulates the application of an emulsion of a pesticide emulsifiable concentrate (EC) to soil with high organic matter (corn cob granules) and to soil with high inorganic matter (clay granules) and determines the amount of solvent retained by the granules, and withheld from the atmosphere, before and after exposure to 40°C in a vented oven. The granules simulate two extremes of soil composition, and the 40°C exposure simulates high temperature weathering. Solvent loss from organic substrates other than corn cob may also be determined by repeating the 40°C exposure tests with the chosen substrate replacing corn cob. The results with corn cob, however, are a reference that must be reported with the alternate substrate results. The difference in solvent content of the granules before and after weathering is an indication of the emission of the solvent from soil impacted by emulsions or solutions during pesticide applications using common practices such as spraying and drip irrigating. Analysis of the granules for solvent content is by high pressure liquid chromatography (HPLC), gas chromatography (GC), or other methods tested and proven to be accurate and reproducible.

NOTE 1—Since it evaluates soil surface sorption, this test method will underestimate soil sorption from pesticide applications made below the soil surface. Sub-soil surface treatments may include, but are not limited to, mechanical soil injection and soil incorporation applications. In these cases, the increased depth of the sub-soil treatments reduce the soil surface exposure and facilitate increased levels of soil sorption.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.*

¹ This test method is under the jurisdiction of ASTM Committee E35 on Pesticides and Alternative Control Agents and is the direct responsibility of Subcommittee E35.22 on Pesticide Formulations and Delivery Systems.

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2. Referenced Documents

2.1 Other Standards:²

40 CFR 51.100(s) Protection of Environment—Requirements for Preparation, Adoption, and Submittal of Implementation Plans—Definitions

3. Terminology

3.1 Definitions:

3.1.1 *absorb*, *v*—a process in which one material (the absorbent) takes in, and retains, through its pores and interstices the molecules of another material (the absorbate).

3.1.2 *adsorb*, *v*—a process in which one material (the adsorbent) attracts to, and retains on, its surface the molecules of another material (the adsorbate).

3.1.3 *emulsifiable concentrate*, *n*—a single-phase liquid system having the property of forming an emulsion when mixed with water.

3.1.4 *emulsifying agent*, *n*—a surfactant that promotes the suspension of one liquid in another.

3.1.5 *gas or liquid chromatography*, *n*—a process in which a chemical mixture carried by a mobile liquid or gas is separated into components as a result of different affinities of the components for the liquid or gas and the adsorbing medium through which they pass.

3.1.6 *inorganic matter*, *n*—substances of mineral origin that are not characterized by primarily carbon-based structures.

3.1.7 *organic matter*, *n*—in soil, organic matter consists of plant and animal material that is in the process of decomposing.

3.1.8 *tropospheric ozone*, *n*—an air pollutant formed by the sunlight catalyzed reaction between hydrocarbons and nitrogen oxides present in the troposphere, the layer of the atmosphere closest to the earth's surface.

² Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

3.1.9 *volatile organic compound (VOC)*, *n*—any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions; excluded is a list of organic compounds which have been determined to have negligible photochemical reactivity (40 CFR 51.100(s)).

3.1.10 *volatilize*, *v*—to pass off as vapor; to evaporate.

4. Summary of Test Method

4.1 A pesticide EC (emulsifiable concentrate) is simulated with a concentrate consisting only of solvent plus emulsifying agent(s). The concentrate is then mixed with water, and the emulsion is applied to corn cob granules (organic substrate) and montmorillonite clay granules (inorganic substrate), which absorb/adsorb the liquid.

4.2 Other organic substrates, like corn stover, straw, or sphagnum peat, for example, may simulate the harvest debris from some crops better than corn cob, and the test method can be used with any of this type substrate replacing corn cob. Care must be taken to select a substrate appropriate for the crop of concern, and the results with corn cob are a reference that must be reported with the alternate substrate results. The treated granules are placed in a vented 40°C oven in uncapped bottles. The uncapped bottles allow for loss of the solvent by volatilization. Each bottle is left in the oven for a different, and ever increasing, time period. The time period for the first bottle may be as little as two hours, and that for the last bottle may be as much as one-hundred twenty hours or longer. After the 40°C exposure, the granules are analyzed to determine the amount of solvent still retained. Successive time periods continue until the amount of solvent found in two or more successive samples indicates more exposure time is not expected to cause significantly more loss of solvent. Analysis is by high pressure liquid chromatography (HPLC), gas chromatography (GC), or other methods tested and proven to give accurate and reproducible results.

5. Significance and Use

5.1 This test method is designed specifically for emulsions of pesticide emulsifiable concentrates.

5.2 This test method provides information on the absorption/adsorption of solvents by simulated organic soil and inorganic soil impacted by pesticide EC emulsion applications.

5.3 The amount of solvent lost by volatilization at 40°C as determined by this method is an indirect measure of the atmospheric availability of the solvent to potentially react with nitrogen oxides to form tropospheric ozone, a major air pollutant.

6. Apparatus

6.1 *Balance*, sensitivity of 0.01 g.

6.2 *Roller System*, two or more rollers with a drive bed, capable of rotating a glass bottle or jar, about 1 to 4 L in size, at 20 to 60 r/min.

6.3 *Glass bottle or jar*, round, with screw-thread cap, for use with roller system. Typical size is 1 to 4 L.

6.4 *Oven*, vented, mechanical convection, 40 ± 2°C, 2.0 ft³ minimum inside capacity, 50 to 90 air exchanges per hour.

6.5 *125-mL laboratory media bottles*, glass, round, outside diameter about 55 mm, height about 123 mm, inside diameter opening about 30 mm, with screw-thread caps. An example is Wheaton brand, available from many laboratory supply companies.

6.6 Apparatus required by the analytical test method.

7. Reagents and Materials

7.1 Corn cob granules, 20/40 Mesh

7.2 Montmorillonite clay granules, LVM, 12/24 Mesh.

7.3 Solvent to be tested.

7.4 Emulsifying agent(s) suitable for emulsifying the solvent.

7.5 Reagents and materials required by the analytical test method.

8. Hazards

8.1 Before testing, read the precautionary statements on product labels and the Material Safety Data Sheets (MSDS). Take proper precautions to prevent skin contact and inhalation of fumes or dust. Take care to prevent contamination of the surrounding area. Always wear the appropriate safety equipment and, where indicated, wear respiratory devices approved by the National Institute of Occupational Safety and Health (NIOSH) for the product being tested.

8.2 Store, handle, and dispose of test materials with consideration for health and environmental safety, and in accordance with federal, state, and local regulations.

9. Sampling, Test Specimens, and Test Units

9.1 The uniform mixing of the roller system procedure ensures any size sample taken from the roller system jar is a representative sample. Do not use riffing to reduce a gross sample of the treated granules to a representative, suitable size. Significant volatilization of the solvent may occur during riffing or any other time the granules are not in a sealed container.

10. Preparation of Apparatus

10.1 For all apparatus, see the manufacturers' instructions for proper operation and maintenance.

11. Calibration and Standardization

11.1 See the analytical test method to be used for determining solvent content for information relative to calibration and adjustment of the apparatus necessary for the use of the method.

11.2 See the analytical test method for the standardization and use of reference standards and blanks used in the method.

12. Procedure

12.1 Prepare an emulsifiable concentrate consisting only of solvent plus emulsifying agent(s). A typical formula is 90 to