

TABLE 1.1.—LIST OF MONOMERS POTENTIALLY PRESENT IN UNSATURATED POLYESTER/VINYL ESTER RESINS—Continued

Monomer	CAS No.
Para methyl styrene	Vinyl toluene isomer.
Chlorostyrene	1331–28–8.
Diallyl phthalate	131–17–9.
Other volatile monomers	Various.

2. Summary of Method

2.1 Differences in specific resin and suppressant additive chemistry affect the performance of a vapor suppressant. The purpose of this method is to quantify the effectiveness of a specific combination of vapor suppressant and unsaturated polyester or vinyl ester resin as they are to be used in production. This comparative test quantifies the loss of volatiles from a fiberglass reinforced laminate during the roll-out and curing emission phases, for resins formulated with and without a suppressant additive. A criterion for this method is the testing of a non-vapor suppressed resin system and testing the same resin with a vapor suppressant. The two resins are as identical as possible with the exception of the addition of the suppressant to one. The exact formulation used for the test will be determined by the in-use production requirements. Each formulation of resin, glass, fillers, and additives is developed to meet particular customer and/or performance specifications.

2.2 The result of this test is used as an input factor in the organic HAP emissions factor equations in Table 1 to this subpart, which allows these equations to predict emissions from a specific combination of resin and suppressant. This test does not provide an emission rate for the entire lamination process.

3. Definitions and Acronyms

3.1 Definitions

3.1.1 *Vapor suppressant*. An additive that inhibits the evaporation of volatile components in unsaturated polyester or vinyl ester resins.

3.1.2 *Unsaturated polyester resin*. A thermosetting resin commonly used in composites molding.

3.1.3 *Unsaturated vinyl ester resin*. A thermosetting resin used in composites molding for corrosion resistant and high performance applications.

3.1.4 *Laminate*. A combination of fiber reinforcement and a thermoset resin.

3.1.5 *Chopped strand mat*. Glass fiber reinforcement with random fiber orientation.

3.1.6 *Initiator*. A curing agent added to an unsaturated polyester or vinyl ester resin.

3.1.7 *Resin application roller*. A tool used to saturate and compact a wet laminate.

3.1.8 *Gel time*. The time from the addition of initiator to a resin to the state of resin gelation.

3.1.9 *Filled resin system*. A resin, which includes the addition of inert organic or inorganic materials to modify the resin properties, extend the volume and to lower

the cost. Fillers include, but are not limited to; mineral particulates; microspheres; or organic particulates. This test is not intended to be used to determine the vapor suppressant effectiveness of a filler.

3.1.10 *Material safety data sheet*. Data supplied by the manufacturer of a chemical product, listing hazardous chemical components, safety precautions, and required personal protection equipment for a specific product.

3.1.11 *Tare(ed)*. Reset a balance to zero after a container or object is placed on the balance; that is to subtract the weight of a container or object from the balance reading so as to weigh only the material placed in the container or on the object.

3.1.12 *Percent glass*. The specified glass fiber weight content in a laminate. It is usually determined by engineering requirements for the laminate.

3.2 Acronyms:

3.2.1 *VS*—vapor suppressed or vapor suppressant.

3.2.2 *NVS*—non-vapor suppressed.

3.2.3 *VSE*—vapor suppressant effectiveness.

3.2.4 *VSE Factor*—vapor suppressant effectiveness, factor used in the equations in Table 1 to this subpart.

3.2.5 *CSM*—chopped strand mat.

3.2.6 *MSDS*—material safety data sheet.

4. Interferences

There are no identified interferences which affect the results of this test.

5. Safety

Standard laboratory safety procedures should be used when conducting this test. Refer to specific MSDS for handling precautions.

6. Equipment and Supplies

Note: Mention of trade names or specific products or suppliers does not constitute an endorsement by the Environmental Protection Agency.

6.1 Required Equipment.

6.1.1 Balance enclosure.¹

6.1.2 Two (2) laboratory balances—accurate to ± 0.01 g.²

6.1.3 Stop watch or balance data recording output to data logger with accuracy ± 1 second.³

6.1.4 Thermometer—accurate to $\pm 2.0^\circ\text{F}$ ($\pm 1.0^\circ\text{C}$).⁴

6.1.5 A lipped pan large enough to hold the cut glass without coming into contact with the vertical sides, e.g. a pizza pan.⁵

6.1.6 Mylar film sufficient to cover the bottom of the pan.⁶

6.1.7 Tape to keep the Mylar from shifting in the bottom of the pan.⁷

6.1.8 Plastic tri-corner beakers of equivalent—250 ml to 400 ml capacity.⁸

6.1.9 Eye dropper or pipette.⁹

6.1.10 Disposable resin application roller, $\frac{3}{16}$ "– $\frac{3}{4}$ " diameter \times 3"–6" roller length.¹⁰

6.1.11 Hygrometer or psychrometer¹¹ accurate to ± 5 percent

6.1.12 Insulating board, (Teflon, cardboard, foam board etc.) to prevent the balance from becoming a heat sink.¹²

6.2 Optional Equipment.

6.2.1 Laboratory balance—accurate to ± 0.01 g with digital output, such as an RS-232

bi-directional interface¹³ for use with automatic data recording devices.

6.2.2 Computer with recording software configured to link to balance digital output. Must be programmed to record data at the minimum intervals required for manual data acquisition.

6.3 Supplies.

6.3.1 Chopped strand mat—1.5 oz/ft.²¹⁴

7. Reagents and Standards

7.1 *Initiator*. The initiator type, brand, and concentration will be specified by resin manufacturer, or as required by production operation.

7.2 Polyester or vinyl ester resin.

7.3 Vapor suppressant additive.

8. Sample Collection, Preservation, and Storage

This test method involves the immediate recording of data during the roll out and curing phases of the lamination process during each test run. Samples are neither collected, preserved, nor stored.

9. Quality Control

Careful attention to the prescribed test procedure, routing equipment calibration, and replicate testing are the quality control activities for this test method. Refer to the procedures in section 11. A minimum of six test runs of a resin system without a suppressant and six test runs of the same resin with a suppressant shall be performed for each resin and suppressant test combination.

10. Calibration and Standardization

10.1 The laboratory balances, stopwatch, hygrometer and thermometer shall be maintained in a state of calibration prior to testing and thereafter on a scheduled basis as determined by the testing laboratory. This shall be accomplished by using certified calibration standards.

10.2 Calibration records shall be maintained for a period of 3 years.

11. Test Procedure

11.1 Test Set-up.

11.1.1 The laboratory balance is located in an enclosure to prevent fluctuations in balance readings due to localized air movement. The front of enclosure is open to permit work activity, but positioned so that local airflow will not effect balance readings. The ambient temperature is determined by suspending the thermometer at a point inside the enclosure.

11.1.2 The bottom of the aluminum pan is covered with the Mylar film. The film is held in position with tape or by friction between the pan and the film.

11.1.3 The resin and pan are brought to room temperature. This test temperature must be between 70°F and 80°F. The testing temperature cannot vary more than $\pm 2^\circ\text{F}$ during the measurement of test runs. Temperature shall be recorded at the same time weight is recorded on suppressed and non-suppressed test data sheets, shown in Table 17.1.

11.1.4 The relative humidity may not change more than ± 15 percent during the test runs. This is determined by recording the relative humidity in the vicinity of the test