



Standard Test Method for Agricultural pH Control Agents, Measurement of pH Change and Buffering Capacity¹

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1. Scope

1.1 These test methods cover determining if an adjuvant meets the definitions of an acidifier, a basic blend, alkalinity agent, or buffer in Terminology E1519.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1126 Test Method for Hardness in Water

D1193 Specification for Reagent Water

E70 Test Method for pH of Aqueous Solutions With the Glass Electrode

E200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis

E1519 Terminology Relating to Agricultural Tank Mix Adjuvants

3. Summary of Test Method

3.1 Test Method A measures the change in pH of a sample on the addition of an acidifier or a basic blend. Test Method B measures the buffer capacity of the adjuvant by titration.

¹ These test methods are under the jurisdiction of ASTM Committee E35 on Pesticides, Antimicrobials, and Alternative Control Agents and are the direct responsibility of Subcommittee E35.22 on Pesticide Formulations and Delivery Systems.

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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.

4. Significance and Use

4.1 This test method is intended for products sold as tank mix adjuvants for use with agricultural products.

4.2 Part A provides a determination of whether the pH modification characteristics of the adjuvant tested meet the definition of an acidifier, alkalinity agent, or a basic blend in Terminology E1519. Part B provides a measure of the buffer capacity of the adjuvant. This can be used to estimate the amount of a buffer that will be required to keep a spray solution at the desired pH.

4.3 Other pH standards can be used (see Test Method E70) as long as the pHs measured are not outside the range of the standards used.

4.4 If samples of the material to be used in a particular application are available, the first method can be used to determine what adjuvant rate is required to obtain the desired pH. The ability of an adjuvant to adjust the pH of a particular system will depend on the initial pH before addition.

4.5 The second method can be used to determine the amount of an adjuvant required to change the pH of a quantity of spray solution to the required value (see Note 1).

NOTE 1—Many acidifiers and basic blends also are buffers, so the pH change does not provide a useful measure of buffer capacity.

5. Apparatus

5.1 *pH Meter*, accurate to 0.01 unit.

5.2 *Combination Glass/Calomel Electrode*, or separate glass and calomel electrodes or other suitable pH electrode system.

5.3 *Beakers*, 250 mL.

5.4 *Magnetic Stirrer*, 120 to 1200 rpm, or equivalent.

5.5 *Magnetic Stir Bar*, 1 in. (2.5 cm) in length and $\frac{3}{8}$ in. (0.95 cm) in diameter.

5.6 *Burette*, 50 mL, Class A.

6. Reagents

6.1 *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.

6.2 *Purity of Water*— Unless otherwise indicated, reference to water shall be understood to mean reagent water, Type IV, as defined by Specification **D1193** (see **Note 2**).

NOTE 2—Type IV grade reagent water may be prepared by distillation, ion exchange, reverse osmosis, electrodialysis, or a combination thereof.

6.3 *Synthetic Hard Water Stock*, transfer 12.14 g of anhydrous calcium chloride (CaCl_2) and 5.55 g of magnesium chloride hexahydrate ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$) to a 1000-mL volumetric flask. Dissolve the reagents with approximately 750 mL of water and equilibrate to 20°C. Dilute the solution to 1000 mL total volume with water at 20°C, stopper the flask and mix the solution thoroughly. This mixture has a hardness equivalent to 13680 ppm of calcium carbonate (CaCO_3) and is based on a compositional ratio of 4:1 calcium to magnesium.

6.4 *Standard Hard Water*, equivalent to a total hardness of 342 ppm of calcium carbonate (CaCO_3). Transfer 25 mL of synthetic hard water stock by pipette to a 1000 mL volumetric flask and dilute to volume with water at 20°C. Mix the solution thoroughly (see **Note 3**).

NOTE 3—It is recommended that the total hardness be checked in accordance with Test Method MT-73, CIPAC 1, EDTA titration.³ An alternate method is provided in Test Method **D1126**, where the value is represented as CaCO_3 . A value within $\pm 5\%$ of the nominal hardness value is acceptable.

6.5 *pH Reference Solution*, pH 4.00.

6.6 *pH Reference Solution*, pH 7.00.

6.7 *pH Reference Solution*, pH 10.00.

6.8 *0.05 N Sodium Hydroxide*, prepared according to Practice **E200**, or the equivalent.

6.9 *0.05 N Sulfuric Acid*, prepared according to Practice **E200**, or the equivalent.

6.10 *0.05 N Hydrochloric Acid*, prepared according to Practice **E200**, or the equivalent.

TEST METHOD A—MEASUREMENT OF pH CHANGE OF STANDARD HARD WATER

7. Procedure

7.1 The pH meter should be turned on and allowed to warm up according to manufacturers instructions.

7.2 Calibrate the pH meter according to manufacturers directions using the pH 4.00 and pH 7.00 reference standards for an acidifier or the pH 7.00 and pH 10.00 reference standards for a basic blend or alkalinity agent (see **Note 4**). Place the standards in a 250 mL beaker and stir with the magnetic stirrer and stir bar, while the measurements are being made. Care should be taken to thoroughly wash the electrodes with water between measurements.

NOTE 4—Other or additional reference standards may be used (see Test Method **E70**) as long as the pHs measured are not outside the range of the standards used.

7.3 Place a clean stir bar and 100 mL of standard hard water (see **Note 5**) in a 250 mL beaker. Begin stirring with the magnetic stirrer. After carefully rinsing the electrodes, place them in the water and measure and record the pH, which should be between 5.5 and 7.

NOTE 5—Other water samples can be used if appropriate. In this case the initial pH may not be between 5.5 and 7. For specific applications the actual water to be used is preferred.

7.4 Add 2 mL of the adjuvant to be tested to the beaker and allow to stir for 5 min. Other dilutions may be used if specified on the product label.

7.5 Record the new pH value.

7.6 Remove the electrodes from the solution, clean them, and store them properly. Dispose of the solution properly.

8. Report

8.1 Report the initial and final pH values (see **Note 6**).

NOTE 6—For an acidifier the final pH should be lower than the initial. For a basic blend or alkalinity agent it should be higher.

9. Precision and Bias

9.1 The precision and bias of this test method has not been determined.

TEST METHOD B—BUFFER CAPACITY

10. Procedure

10.1 Turn on and warm up the pH meter according to manufacturers directions.

10.2 Calibrate the pH meter according to manufacturers directions using the pH 4.00 and pH 7.00 reference standards for an acidifier or acidic buffer, or the pH 4.00 and pH 10.00 reference standards for a basic blend, alkaline buffer, or alkalinity agent (see **Note 7**). The standards should be placed in a 250 mL beaker and stirred with the magnetic stirrer and stir bar, while the measurements are being made. Care should be taken to thoroughly wash the electrodes with water between measurements.

NOTE 7—Other or additional reference standards may be used (see Test Method **E70**) as long as the pH's measured are not outside the range of the standards used.

10.3 Place a clean stir bar and 100 mL of standard hard water (see **Note 8**) in a 250 mL beaker. Begin stirring with the magnetic stirrer. After carefully rinsing the electrodes, place them in the water and measure and record the pH, which should be between 5.5 and 7.

NOTE 8—Other water samples can be used if appropriate. In this case the initial pH may not be between 5.5 and 7. For specific applications the actual water to be used is preferred.

10.4 For an acidifier or acidic buffer fill the burette with 0.05 N sodium hydroxide. For a basic blend, alkaline buffer, or alkalinity agent, fill the burette with 0.05 N hydrochloric acid or 0.05 N sulfuric acid. Record the initial volume.

³ "Analysis of Technical and Formulated Pesticides," *CIPAC Handbook*, Vol 1, compiled by Ashworth, R de B., Henriet, J., Lovett, J.F., Collaborative International Pesticide Analytical Council Ltd., Great Britain, 1970.

10.5 Weigh 2 ± 0.1 g to the nearest 0.01 g of the adjuvant to be tested (see **Note 9**) into the beaker and allow to stir for 5 min.

NOTE 9—If necessary for a particular product, the sample size should be adjusted to give a titration volume between 5 and 40 mLs.

10.6 Record the pH versus volume titration curve. The curve should be measured carefully in the region of the initial water pH.

10.7 From the titration curve determine the volume of titrant required to return the sample pH to its initial value.

11. Calculation

11.1 Calculate the number of milliequivalents of acid (for an acidifier or acidic buffer) or base (for a basic blend, alkaline buffer, or alkalinity agent) per gram of product. Multiply the titration volume times the concentration of the titrant solution. Divide this result by the product weight.

$$\frac{\text{meq of acid or base}}{\text{Gram of A}} = \frac{(T \cdot 0.05 \text{ (meq/mL)})}{S} \quad (1)$$

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where:

meq = Milliequivalents
 A = Adjuvant
 S = Sample Weight (g)
 T = Titration Volume (mL)

12. Report

12.1 Report the number of milliequivalents of acid (for an acidifier or acidic buffer) or base (for a basic blend, alkaline buffer, or alkalinity agent) per gram of adjuvant.

13. Precision and Bias

13.1 The precision and bias of this test method has not been determined.

14. Keywords

14.1 acidifier; adjuvant; agricultural adjuvant; alkalinity agent; basic blend; buffer; pH