Designation: E 1772 – 95

Standard Test Method for Particle Size Distribution of Chromatography Media by Electric Sensing Zone Technique[1]

This standard is issued under the fixed designation E 1772; 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 is valuable for the measurement of particle size and covers determination of the particle size distribution of chromatography media in the overall size range of approximately 1 to 450 µm using the electric sensing zone (ESZ) apparatus. This instrument uses an electric current path of small dimensions that is modulated by individual particle passage through an aperture and produces individual pulses of amplitude proportional to the particle volume **(1)**.[2]

1.2 The values stated in SI units are to be regarded as 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:*

D 1193 Specification for Reagent Water[3]

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[4]

E 456 Terminology Relating to Quality and Statistics[4]

2.2 *Other Document:*

Manufacturer's Operating Manual for Particle Size Distribution Analyzer[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *equivalent volume diameter*—the diameter of a sphere with a volume equal to that of the actual particle.

3.1.2 *volume weighted (mass) median diameter*—a number distribution, $n\ (d)$, is measured, and $N = \sum_{i=1}^{C} n\ (d_i)$ is the total number of particles in the C classes and $n\ (d_i)$ is the number of particles in class i (corresponding to diameter d_i).

3.1.2.1 *Discussion*—From $n\ (d)$, the corresponding volume distribution can be calculated:

$$f(d_i) = n(d_i)\,\frac{\pi}{6}\,d_i^3/V = n(d_i)d_i^3/\sum_{i=1}^{C} n(d_i)d_i^3 \quad (1)$$

where:

$$V = \frac{\pi}{6}\sum_{i=1}^{C} n(d_i)d_i^3 \quad (2)$$

is the total particle volume.

A cumulative volume distribution, $F(d_i)$, is defined by

$$F(d_i) = \sum_{x_i \le d_i} f(x_i) \quad (3)$$

The *volume weighted (mass) median diameter* is the diameter, d_{50}, given by

$$F(d_i) = 0.5 \quad (4)$$

that is, the diameter that divides the particle volume into two equally sized halves.

4. Summary of Test Method

4.1 A carefully dispersed, dilute suspension of the particles in a beaker filled with electrolyte is placed in the counting position on the instrument sample stand. The suspension is forced through a restricting aperture. Each particle passing is recorded on an electronic counter according to selected particle size levels.

4.2 The instrument determines the particle volume (liquid displacement); therefore, the equivalent spherical diameter is commonly used to express the particle size.

5. Significance and Use

5.1 It is important to recognize that the results obtained by this test method or any other test method for particle size determination using different physical principles may disagree. The results are strongly influenced by physical principles used by each method of particle size analysis. The results of any particle sizing method should be used only in a relative sense and should not be regarded as absolute when comparing results obtained by other methods.

5.2 Both sellers and purchasers of chromatography media will find the test method useful if mutually acceptable to all parties concerned to determine the particle size distributions for materials specifications, manufacturing control, and development and research.

[1] This test method is under the jurisdiction of ASTM Committee E-48 on Biotechnology and is the direct responsibility of Subcommittee E48.03 on Unit Processes and Their Control.

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[2] The boldface numbers in parentheses refer to the list of references at the end of this test method.

[3] *Annual Book of ASTM Standards*, Vol 11.01.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

[5] Available from Coulter Corp., Scientific Instruments, P.O. Box 169015, MC 195-10, Miami, FL 33116-9015.