Designation: D 5742 – 95 (Reapproved 2000)

Standard Test Method for Determination of the Butane Activity of Activated Carbon[1]

This standard is issued under the fixed designation D 5742; 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 activation level of activated carbon. Butane activity (BA) is defined herein as the ratio (in percent) of the mass of butane adsorbed by an activated carbon sample to the mass of the sample, when the carbon is saturated with butane under the conditions listed in this test method.

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.* For a specific warning statement, see Note 2.

2. Referenced Documents

2.1 *ASTM Standards:*

D 2652 Terminology Relating to Activated Carbon[2]

D 2854 Test Method for Apparent Density of Activated Carbon[2]

D 2867 Test Method for Moisture in Activated Carbon[2]

D 3195 Practice for Rotameter Calibration[3]

D 3467 Test Method for Carbon Tetrachloride Activity of Activated Carbon[2]

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

E 300 Practice for Sampling Industrial Chemicals[5]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[4]

3. Terminology

3.1 Definitions—For definitions of terms used in this test method, refer to Terminology D 2652.

4. Summary of Test Method

4.1 An activated carbon bed of known volume and mass is saturated with butane vapor. The mass adsorbed at saturation is noted and reported as mass of butane per unit mass of carbon.

5. Significance and Use

5.1 The butane activity as determined by this test method is a measure of the ability of an activated carbon to adsorb butane from dry air under specified conditions. It is useful for the quality control and evaluation of granular activated carbons. The butane activity is an indication of the micropore volume of the activated carbon sample. This activity number does not necessarily provide an absolute or relative measure of the effectiveness of the tested carbon for other adsorbates or at other conditions of operation.

5.2 The butane activity test can be used as a non-ozone depleting substitute for the carbon tetrachloride activity test in Test Method D 3467. Fig. 1 shows an experimental correlation of activity values obtained using the two adsorbates.

NOTE 1—This test has not been designed for use with powdered activated carbon, but it has been used successfully when the flow rate or time are adjusted or the sample volume is decreased to keep the pressure drop at an acceptable value.

6. Apparatus

6.1 *Water Bath*, capable of maintaining a temperature of 25 ± 0.2°C and of sufficient depth so that the entire carbon bed in the sample tube is immersed in the water.

6.2 *Sample Tube*, with the options shown in Fig. 2.

6.3 *Flowmeter*, capable of delivering butane at 0 to 500 mL/min, calibrated in accordance with Practice D 3195.

6.4 *Balance*, capable of weighing to within ±0.01 g.

6.5 *Fill Device*—The vibration feed device used in Test Method D 2854.

6.6 *Apparatus Assembly*, shown in Fig. 3.

7. Reagents

7.1 *n-Butane*, C. P. Grade.

NOTE 2—**Warning:** Butane is a flammable gas with a flash point of −138°C and a boiling point of 0.5°C. Its specific gravity is 2.046 relative to air. Butane may be narcotic in high concentrations and is considered a simple asphyxiant. If the entire apparatus is not set up in a fume hood, provision must be made to vent the gas coming from the discharge stem of the sample tube.

8. Sampling

8.1 Refer to Practice E 300 for guidance in sampling granular activated carbon.

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[1] This test method is under the jurisdiction of ASTM Committee D-28 on Activated Carbon and is the direct responsibility of Subcommittee D28.04 on Gas Phase Evaluation Tests.

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[2] *Annual Book of ASTM Standards*, Vol 15.01.

[3] *Annual Book of ASTM Standards*, Vol 11.03.

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

[5] *Annual Book of ASTM Standards*, Vol 15.05.

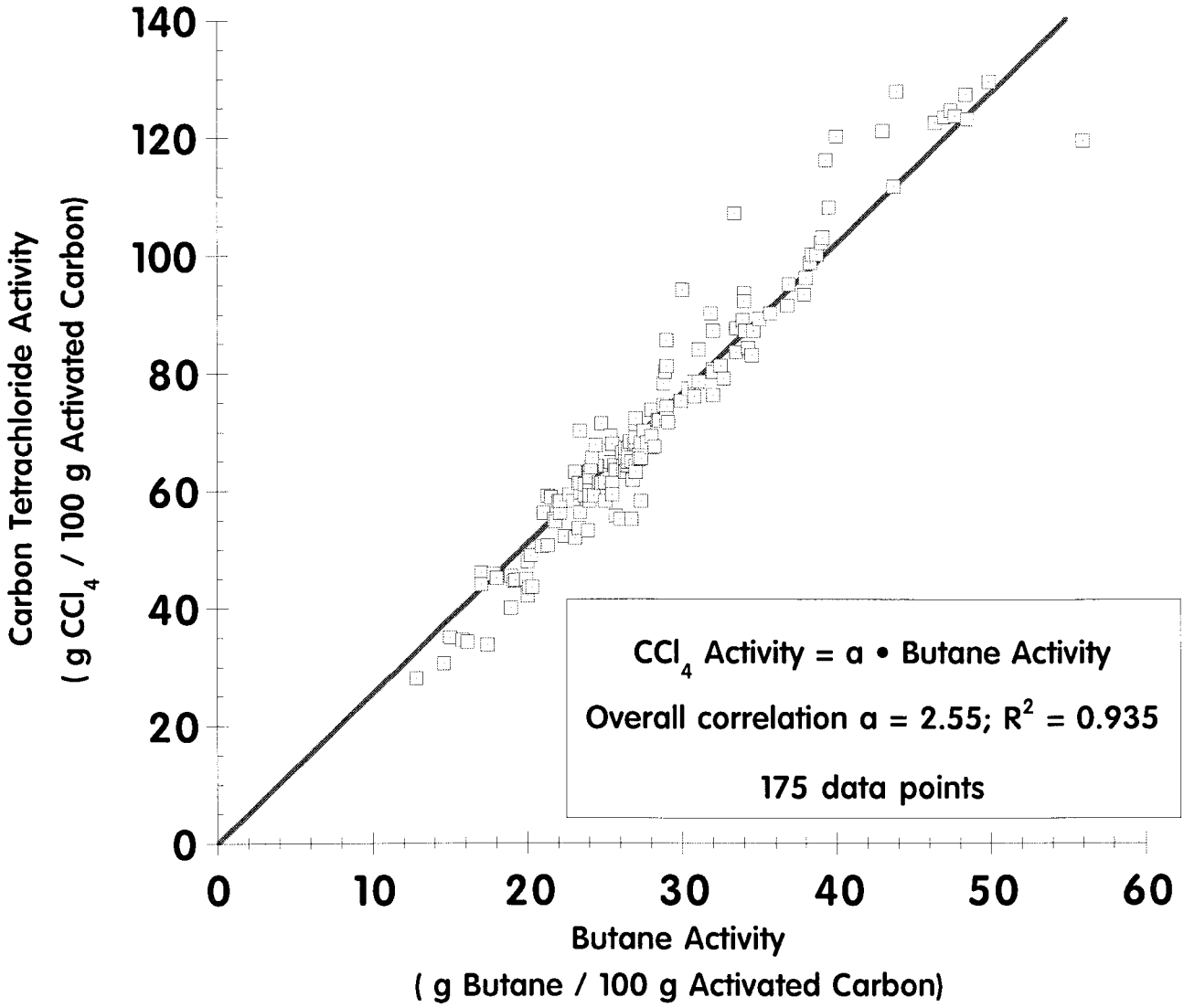


FIG. 1 Butane Versus Carbon Tetrachloride Correlation

9. Maintenance of Bath Water

9.1 The bath water should be changed periodically in order to prevent mold formation.

10. Procedure

10.1 Dry the sample using the procedure described in Test Method D 2867.

10.2 Determine the apparent density in accordance with Test Method D 2854 and record.

10.3 Accurately weigh the empty, dry sample tube and stoppers to the nearest 0.01 g and record.

10.4 Weigh a representative sample of the carbon equivalent to 16.70 ± 0.05 mL based on the apparent density determined in 10.2. Transfer the weighed sample into the sample tube using the filling technique described in Test Method D 2854 through a funnel modified to accommodate the adsorption tube.

10.5 Weigh the filled sample tube and stoppers to the nearest 0.01 g and record.

10.6 Set the water bath control to maintain a temperature of 25 ± 0.2°C.

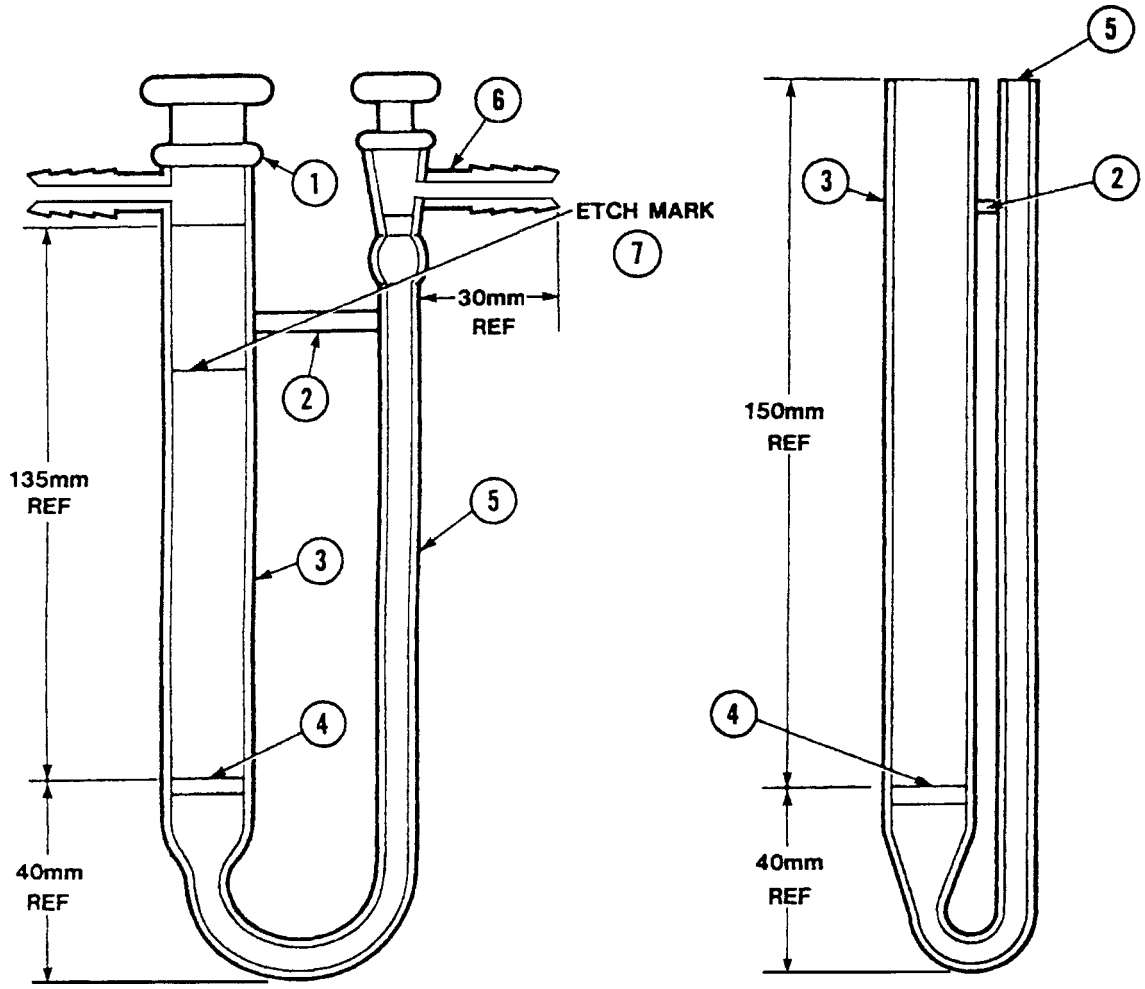
10.7 Clamp the sample tube in a vertical position in the 25 ± 0.2°C water bath, and attach the tube to the output of the flowmeter. If the entire apparatus is not in a hood, attach a length of tubing from the effluent side of the sample tube to an exhaust vent.

10.8 Regulate the flow to pass butane through the carbon bed at 250 ± 5 mL/min. Continue the flow of butane for at least 900 s.

10.9 Turn off the butane, disconnect the tubing, and stopper the sample tube immediately. Remove the sample tube from the water bath, dry the sample tube, and inspect the tube visually for any condensed water vapor. Stop the testing and begin the test procedure again if any condensed water is observed.

10.10 Weigh the filled sample tube and its stoppers to the nearest 0.01 g and record.

10.11 Reconnect the sample tube to the apparatus and flow butane for consecutive 600-s time intervals until the mass of the sample is constant to within ±0.02 g.



NOTE 1—(*1*) Ground glass stopper, hollow, medium length, 14/20, from Ace Glass catalog No. 8529, Schwartz drying tube, or similar; (*2*) 5-mm rod, brace; (*3*) 17-mm OD × 1.2-mm standard wall tubing; (*4*) coors perforated porcelain disk or extra-coarse fritted disk, or similar; (*5*) 10-mm OD × 1.0-mm standard wall tubing; (*6*) right-angle stopcock, Ace Glass catalog No. 8197, Size 4, 10-mm OD stem, with Ace Glass catalog No. 8470, Size B, serrated hose connector, or similar; and (*7*) dimension corresponding to a volume of 16.7 mL above the retainer plate.

FIG. 2 Butane Activity Sample Tube

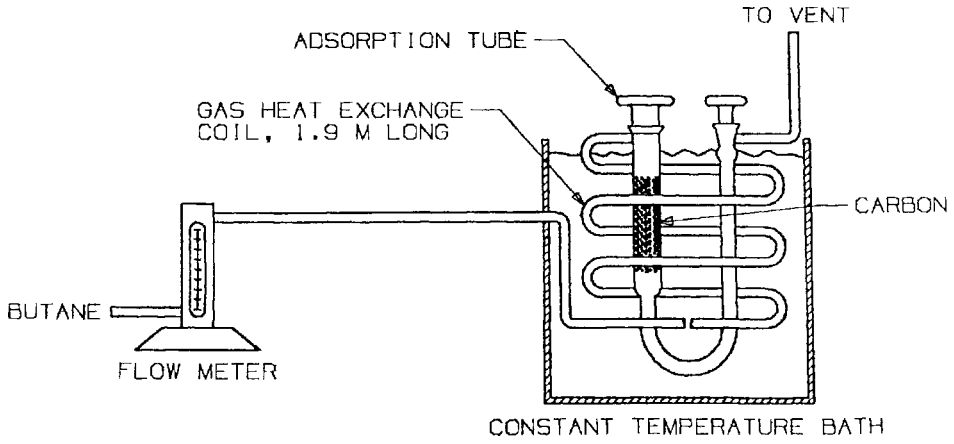


FIG. 3 Butane Activity Apparatus

11. Calculation

11.1 The calculations described in this section are based on the following determinations made during the course of the procedure:

M = mass of sample tube and stoppers,
C = mass of carbon, sample tube, and stoppers, and

D = mass of saturated carbon, sample tube, and stoppers.

11.2 Calculate the butane activity on mass basis as follows:

$$\text{butane activity, \%} = \frac{(D - C) \times 100}{(C - M)} \quad (1)$$

11.3 Fig. 1 shows an experimental correlation between butane activities measured using this test method and carbon tetrachloride activities measured in accordance with Test Method D 3467.

12. Report

12.1 Report the following information in the analysis:

12.1.1 Name of activated carbon supplier,

12.1.2 Grade designation of the sample,

12.1.3 Nominal partial size range,

12.1.4 Apparent density of the sample,

12.1.5 Butane activity,

12.1.6 Name of the agency and technician running the test,

12.1.7 Identification number and date of the test,

12.1.8 Lot number from which the sample was taken, and

12.1.9 Estimated carbon tetrachloride activity (optional).

13. Precision and Bias

13.1 An interlaboratory study of this test method was conducted in 1990.[6] Each of eight laboratories tested three randomly drawn test specimens from each of three different activated carbons. Carbon A was a wood-based granular carbon, Carbon B was a pelleted wood-based carbon, and Carbon C was a granular coal-based carbon. Butane activities were 41.4 %, 40.0 %, and 27.2 %, respectively. Practice E 691 and Practice E 691 computer software were used to design the study and analyze the data.

13.2 *95 % Limit on Repeatability (Within Laboratory), %*:

	Activated carbon		
	A	B	C
Butane activity, %	1.95	2.34	0.97

13.3 *95 % Limit on Reproducibility (Between Laboratories), %*:

	Activated carbon		
	A	B	C
Butane activity, %	3.57	3.15	1.05

NOTE 3—The terms repeatability and reproducibility limit are used as specified in Practice E 177.

14. Keywords

14.1 activated carbon

[6] Available from ASTM Headquarters. Request RR: D 28-1003.