Designation: D 6646 – 03

# Standard Test Method for Determination of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon[1]

This standard is issued under the fixed designation D 6646; 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 intended to evaluate the performance of virgin, newly impregnated or in-service, granular or pelletized activated carbon for the removal of hydrogen sulfide from an air stream, under the laboratory test conditions described herein. A humidified air stream containing 1 % (by volume) hydrogen sulfide is passed through a carbon bed until 50 ppm breakthrough of $H_2S$ is observed. The $H_2S$ adsorption capacity of the carbon per unit volume at 99.5 % removal efficiency (g $H_2S/cm^3$ carbon) is then calculated. This test is not necessarily applicable to non-carbon adsorptive materials.

1.2 This standard as written is applicable only to granular and pelletized activated carbons with mean particle diameters (MPD) less than 2.5 mm. See paragraph 5.3 if activated carbons with larger MPDs are to be tested.

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]

D 2652 Definition of Terms Relating to Activated Carbon

D 2854 Determination of Apparent Density of Activated Carbon

D 2867 Test For Moisture in Activated Carbon

E 300 Practice for Sampling Industrial Chemicals

## 3. Terminology

3.1 Terms relating to this standard are defined in D 2652.

## 4. Summary of Test Method

4.1 Breakthrough capacity is determined by passing a stream of humidified air containing 1 volume % hydrogen sulfide through a sample of granular or pelletized activated carbon of known volume under specified conditions until the concentration of hydrogen sulfide in the effluent gas reaches 50 ppmv.

## 5. Significance and Use

5.1 This method compares the performance of granular or pelletized activated carbons used in odor control applications, such as sewage treatment plants, pump stations, etc. The method determines the relative breakthrough performance of activated carbon for removing hydrogen sulfide from a humidified gas stream. Other organic contaminants present in field operations may affect the $H_2S$ breakthrough capacity of the carbon; these are not addressed by this test. This test does not simulate actual conditions encountered in an odor control application, and is therefore meant only to compare the hydrogen sulfide breakthrough capacities of different carbons under the conditions of the laboratory test.

5.2 This test does not duplicate conditions that an adsorber would encounter in practical service. The mass transfer zone in the 23 cm column used in this test is proportionally much larger than that in the typical bed used in industrial applications. This difference favors a carbon that functions more rapidly for removal of $H_2S$ over a carbon with slower kinetics. Also, the 1 % $H_2S$ challenge gas concentration used here engenders a significant temperature rise in the carbon bed. This effect may also differentiate between carbons in a way that is not reflected in the conditions of practical service.

5.3 This standard as written is applicable only to granular and pelletized activated carbons with mean particle diameters less than 2.5 mm. Application of this standard to activated carbons with mean particle diameters (MPD) greater than 2.5 mm will require a larger diameter adsorption column. The ratio of column inside diameter to MPD should be greater than 10 in order to avoid wall effects. In these cases it is suggested that bed superficial velocity and contact time be held invariant at the conditions specified in this standard (4.77 cm/sec and 4.8

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

Current edition approved Oct. 1, 2003. Published November 2003. Originally approved in 2001. Last previous version approved in 2001 as D 6646–01.

[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.

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