



Standard Practice for the Prediction of Contaminant Adsorption On GAC In Aqueous Systems Using Rapid Small-Scale Column Tests¹

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1. Scope

1.1 This practice covers a test method for the evaluation of granular activated carbon (GAC) for the adsorption of soluble pollutants from water. This practice can be used to estimate the operating capacities of virgin and reactivated granular activated carbons. The results obtained from the small-scale column testing can be used to predict the adsorption of target compounds on GAC in a large column or full scale adsorber application.

1.2 This practice can be applied to all types of water including synthetically contaminated water (prepared by spiking high purity water with selected contaminants), potable waters, industrial waste waters, sanitary wastes and effluent waters.

1.3 This practice is useful for the determination of breakthrough curves for specific contaminants in water, the determination of the lengths of the adsorbates mass transfer zones (MTZ) and the prediction of GAC usage rates for larger scale adsorbers.

1.4 The following safety caveat applies to the procedure section, Section 10, of this practice: *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 1129 Terminology Relating to Water
- D 1193 Specifications for Reagent Water
- D 2652 Terminology Relating to Activated Carbon
- D 2854 Test Method Apparent Density of Activated Carbon
- D 2867 Test Method Moisture Content of Activated Carbon

D 2862 Test Method Particle Size Distribution of Granular Activated Carbon

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms in this practice relating to activated carbon, refer to Terminology D 2652.

3.1.2 For definitions of terms in this practice relating to water, refer to Terminology D 1129.

4. Summary of Practice

4.1 This practice consists of a method for the rapid determination of breakthrough curves and the prediction of GAC usage rates for the removal of soluble contaminants from water. This is accomplished by passing the contaminated water at a constant controlled rate down flow through a bed of a specially sized granular activated carbon until predetermined levels of breakthrough have occurred.

4.2 When the assumption is made that conditions of constant diffusivity exist within the GAC column, the breakthrough data obtained from the column test can be used to estimate the size and operational conditions for a full-scale carbon adsorber.

5. Significance and Use

5.1 Granular activated carbon (GAC) is commonly used to remove contaminants from water. However if not used properly, GAC can not only be expensive but can at times be ineffective. The development of engineering data for the design of full-scale adsorbers often requires time-consuming and expensive pilot plant studies. This rapid standard practice has been developed to predict adsorption in large-scale adsorbers based upon results from small column testing. In contrast to pilot plant studies, the small-scale column test presented in this practice does not allow for a running evaluation of factors that may affect GAC performance over time. Such factors may include, for example, an increased removal of target compounds by bacterial colonizing GAC³ or long term fouling of GAC caused by inorganic compounds or background organic

¹ This practice is under the jurisdiction of ASTM Committee D28 on Activated Carbon and is the direct responsibility of Subcommittee D28.02 on Liquid Phase Evaluation.

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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.

³ Owen, D.M., Chowdhury, Z.K., Summers, R.S., Hooper, S.M., and Solarik, G., "Determination of Technology and Costs for GAC Treatment Using the ICR Methodology" AWWA GAC & Membrane Workshop, March 1996, Cincinnati, OH.