

POWDERED CARBON PERFORMANCE JAR TESTING FOR TASTE AND ODOR TREATMENT OF DRINKING WATER

Value of Performance Jar Testing

Powdered activated carbon (PAC) is widely used for controlling taste and odor events that occur during U.S. drinking water production. Earthy, musty tastes and odors are most prevalent where surface water is the raw water source or where surface water has significant influence on the ground water supply. The earthy, musty taste and odors are typically due to 2-Methylisoborneol (MIB) and Geosmin from algae growth in the raw water.

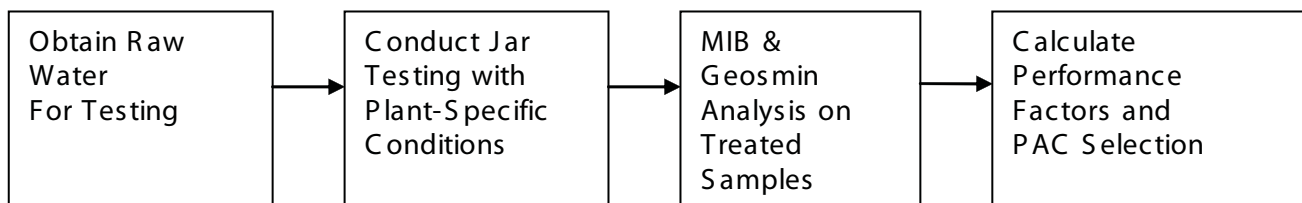
Based on research by AWWA and others, PAC effectiveness can not always be predicted by typical adsorption and physical property data (ie. iodine number, surface area, and particle size). Jar testing is the best way to evaluate PAC performance for the removal of MIB and Geosmin. A jar test simulates the conditions in which a PAC will contact the raw water in a treatment plant. The test can be used to determine the most cost effective carbon for treating a given raw water source. The AWWA Powdered Activated Carbon Standard B600-05 Appendix B.1 outlines a jar test procedure that can be used to evaluate different PACs and determine performance factors for the bid process.

The removal of color, TOC, and organics can be an added benefit of using PAC. It is recommended that additional water quality information be gathered from the water plant to better understand carbon performance.

How to Begin Performance Jar Testing

- » Request representative carbon samples from prospective bidders and obtain price quotes.
- » Define water plant process conditions at the PAC addition point such as temperature, retention time, and dosage of other treatment chemicals.
- » Collect 5 gallons of raw water and obtain properties, including TOC, Color, Turbidity, and MIB and Geosmin content or taste and odor history.
- » Choose one of the following options for performance jar testing and analysis:
 1. Send raw water and carbon samples (coded for blind testing if necessary), along with information on treatment chemicals and plant parameters to a third party laboratory for performance jar testing and analysis per the AWWA protocol.
 2. Conduct initial performance jar testing at the water treatment plant laboratory, and then test treated samples in-house or send to a third party lab for MIB & Geosmin analysis.

SCHEMATIC OF PERFORMANCE JAR TESTING

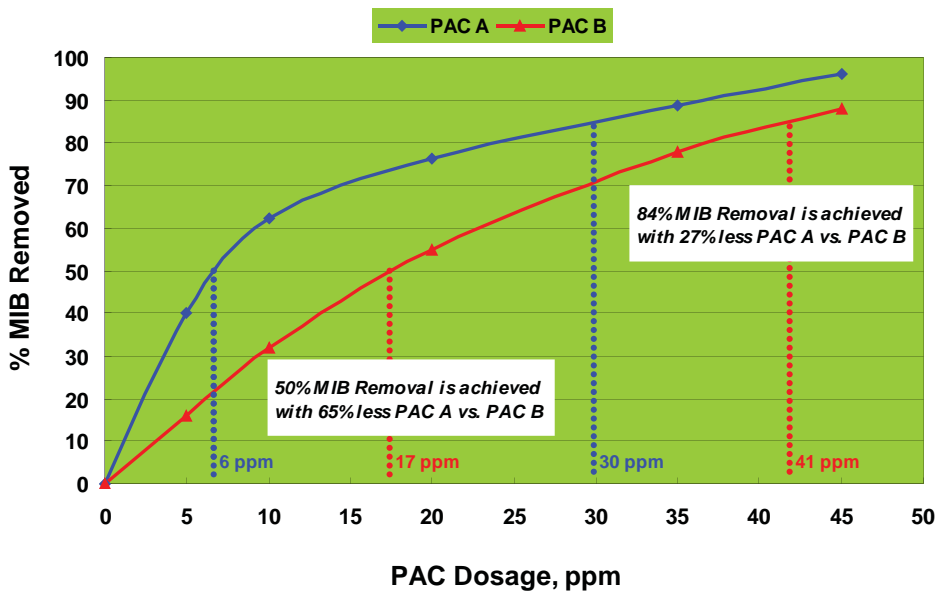


Determination of Performance Factors and Effective Cost

The goal of performance jar testing is to achieve target quality water at the lowest overall cost. A performance factor, also called a bid factor, is a measure of relative PAC adsorption performance. The Effective Cost of a PAC is determined by multiplying the performance factor by the bid price.

Per the AWWA test method, performance factors are calculated by determining the lowest amount of carbon required to achieve 84% MIB removal in raw water spiked to 50 ng/L MIB. This removal target represents a concentration of MIB that is below the odor threshold (8 ng/L).

Removal targets of both 50% and 84% were chosen for this example to better illustrate the performance difference between the two carbon grades.



The most cost effective PAC may not be the PAC with the lowest bid price, since all PACs do not achieve target removal at the same dose. The example below shows that the PAC with a higher bid price requires less carbon to achieve target MIB reduction and is actually more cost effective than the PAC with the lowest bid price.

Example Calculation Showing the Most Cost Effective PAC

PAC	PAC DOSE REQUIRED FOR 84% REMOVAL (PPM)	CALCULATION USING LOWEST PAC DOSE	RELATIVE PERFORMANCE FACTOR OR "BID FACTOR"	BID PRICE (\$/TON)	EFFECTIVE COST (\$/TON)
A	30	$30/30 =$	1.00	1575	1575
B	41	$41/30 =$	1.37	1475	2020

MWV recommends the following laboratories for MIB/Geosmin Analysis and Performance Jar Testing:

Engineering Performance Solutions, LLC, Gainesville FL
 Phone: 352-338-7770
 Website: www.epslabs.com

Underwriters Laboratories
 Phone: 800-332-4345
 Website: www.ul.com/water