Application Bulletin

HYDROGEN SULFIDE BOOSTS CARBON'S APPEAL

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The medium's simplicity makes it desirable

A variety of methods can be used to remove hydrogen sulfide (H_2S) from residential water. Finding the one that's the most cost-effective, longest-lasting, most reliable, easiest to install and best fit for the individual site- that's the challenge faced by residential water treatment dealers.

One of the most promising approaches is to use catalytic/adsorptive carbons. These carbons are manufactured using a patented process that modifies the electronic properties of the carbon surface while maintaining its traditional adsorptive pore structure. The result is added catalytic functionality which is significantly greater than traditional activated carbons.

Catalytic/adsorptive carbon promotes a range of chemical reactions where conventional carbons are ineffective. Applications include oxidation/reduction reactions for H_2S, peroxide, chloramine and hydrazine. In these applications and others, catalytic/adsorptive carbon can reduce contact time, extend bed life, reduce carbon requirements and decrease equipment size. Because it's adsorptive as well as catalytic, traditional capacities for specific organics, and taste and odor compounds, are maintained.

Ed Mohler, a master mechanic with Eichelberger's, Inc., Mechanicsburg, PA, prepares to work on a pair of carbon filters used for hydrogen sulfide removal.

Hydrogen Sulfide a Problem

"Removing H_2S is a typical challenge for us, and we're always looking for a better mousetrap," says Mark Kavish, water quality specialist for Eichelbergers, Inc., Mechanicsburg, PA. One of the largest well drilling and water treatment companies in the Northeast, Eichelbergers has been using catalytic/adsorptive carbon since the product's introduction last year.

Rock formations encountered during drilling affect water quality, with shale often producing high concentrations of H_2S, Kavish says. "Unfortunately, you don't know it's down there until you hit is," he says.

Kavish says using a "passive" system such as an activated carbon filter to remove H_2S has always been attractive, but the short life span and unpredictable nature of traditional carbon made it a less-than-ideal choice for most of the H_2S removal applications he had encountered.

Catalytic/adsorptive carbon has expanded Eichelbergers' ability to use carbon for these jobs. The company now has six H_2S removal units installed with manual and automatic backwashing filters, and has experienced no bleed-through problems.

Nonetheless, whether catalytic/adsorptive carbons can solve a particular H_2S problem must be evaluated on a case-by-case basis. To determine if it's appropriate for an application, Eichelbergers performs a total water analysis, measuring H_2S levels with a field test kit. The results are by no means precise, but are applied as a rule of thumb.

"Because it's a gas, sulfur is very tough to gauge," explains Kavish. "Two parts per million (ppm) of H_2S was always the cutoff we used for choosing carbon to remove sulfur. Anything over that, and you know the carbon's performance would be short-lived."

Catalytic/adsorptive carbon is able to extend that cutoff significantly, he says, and at one site it's used on a well with 6 ppm of H_2S. Based on his customer's observations, the carbon continues to remove all sulfur odors. Eichelbergers also analyzes the water for other constituents like iron that might detract from the carbon's effectiveness. When concentrations of iron are present, the company installs a water softener. The softener eliminates the iron, then carbon is used to remove the H_2S.

Sizing Equipment

Merely measuring the amount of H_2S present in a water sample may not be enough if you hope to size carbon filtration equipment properly for H_2S removal. One manufacturer of catalytic/adsorptive carbon recommends a contact time of 5 minutes at flow rated up to 7 gallons per minute per square foot (gpm/ft^2).

To calculate contact time for catalytic/adsorptive carbon, multiply the carbon bed's diameter, in feet, by itself. Multiply the result by the depth of the carbon bed, in feet. Then multiply that result by 5.87. Lastly, divide your answer by the influent flow rate in gallons per minute (gpm).

Using this formula, Eichelbergers has used, 1, 1.5 and 2 cubic feet of catalytic/adsorptive carbon in different applications to match the customer's flow needs with the bed of carbon.

Eichelbergers accommodates fluctuating H_2S levels in its calculations by sizing equipment conservatively, but where day-to-day H_2S levels vary greatly, the task of adjusting the system's flow rates falls on the customer.

Catalytic/adsorptive carbon may be particularly suited to these applications because it's better able to handle peak H_2S loads, making adjustment by the consumer less necessary, Kavish says. The carbon's ability to handle H_2S peaks also prove useful on one occasion where an upstream chlorinator used to oxidize H_2S failed and the downstream catalytic/adsorptive carbon post-filter was the last line of defense. Kavish says the catalytic adsorptive carbon had continued to remove the 5 to 10 ppm H_2S from the water.

Eichelbergers is also considering other applications for catalytic carbon.

"Our plans include linking catalytic/adsorptive carbon with an air injection system to extend the longevity of the product even further," explains Kavish. "We'd like to do that at a site in which catalytic/adsorptive carbon is already installed, but we can't begin until the carbon bed is exhausted. At the rate things are going, that could take awhile."

Carole Zepp, president of Life-Source Water Systems, Pasadena, CA, reports that catalytic/adsorptive carbon is also effective at removing H_2S from the remote residential well water systems she services. H_2S levels in the water have at times exceeded manufacturer's recommendations, but the catalytic/adsorptive carbon continued to solve the H_2S problem.

On these installations, the typical system consists of a 12-by-52 inch tank containing 2 cubic feet of catalytic/adsorptive carbon. To keep pace with higher usage requirements, Zepp accelerates the carbon backwashing from every third night to every night.

Like Eichelbergers, Zepp's company hopes to continue to use catalytic/adsorptive carbon for other applications. Treating California spring water may be its opportunity, because it has a prospect who needs to remove H_2S from natural spring water, Zepp says.

By Steven D. Spotts