

# GAC Can Be Affordable Alternative

Most people believe powdered activated carbon (PAC) is a more cost-effective water treatment method than granular activated carbon (GAC). Over the last decade, several articles have been published about the cost of installed GAC treatment systems, and their conclusions are enough to make most cities think twice about implementing GAC.

In reality, these research studies are based on constructing GAC treatment facilities from the ground up when most U.S. plants using activated carbon have retrofitted existing facilities. Data show the incremental cost of retrofitting GAC is usually less than 1/2 cent per day per family, with the high end (involving facility construction) at 6 cents per day per family, placing GAC more in line with PAC economically.

Across the country water departments that retrofitted their plants for GAC were recently surveyed regarding the actual costs they have experienced. The results show most facilities incurred little capital costs to retrofit their plants. The majority of sites only required a replacement of the current media (sand/anthracite) with GAC.

In day-to-day operation, the typical PAC water treatment facility, using an average of 3, 5 or 7 milligrams of powdered carbon for every 1 liter of water annually, spends between \$31,000 and \$75,000 per year to produce 10 mgd of treated water. Since GAC provides taste and odor control for three years, it is necessary to first annualize the cost for GAC treatment, then compare those numbers with the PAC numbers.

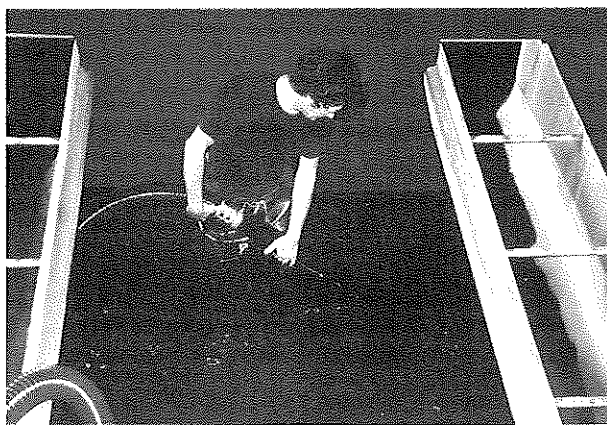
At a typical empty bed contact time (EBCT) of five minutes, the cost of GAC is comparable to PAC at standard dosages. Obviously, the numbers vary based on the EBCT and PAC dosage level, but – for the majority of water plants – the additional cost per family is between 1/4- to 1/2- cent per day for either PAC or GAC. To determine an accurate PAC vs GAC cost comparison for a facility, the influent conditions of the water and the ultimate treatment objective must be considered.

A quick rule of thumb to estimate conversion quantities is that GAC is roughly three times more effective on a weight-basis than PAC for taste and odor control. That means for 90,000 pounds of PAC, the same quality of water can be achieved with 30,000 pounds of GAC.

A report issued by Environmental Engineering & Technology, a New York environmental consulting firm, for Erie County (Pa.) Water Authority concludes that the use of

GAC filter media is cost-effective. They base their findings on comparing GAC filter usage with PAC doses ranging from 15 mg/L to 30 mg/L, for a 70 mgd plant flow at two- and one-year replacement frequency.

EBCT in these studies averaged two minutes. In normal circumstances, a five-minute EBCT is recommended for effective treatment over several years. It is better to operate at a five-minute EBCT and keep the carbon on-line for three years instead of only one year at a two-minute EBCT.



Granular carbon can last up to three times longer than powdered carbon with typical EBCTs of five minutes.

As a result of installing GAC, retrofitted plants reported a minor savings in sludge disposal costs and utility costs (for running the mixer for the PAC slurry). The biggest savings, however, centers on chemical cost changes. After installing GAC, the use of chemicals—including disinfectants (primarily chlorine), coagulants/polymers (aluminum sulfate, sodium sulfate, ferric sulfate) for turbidity removal and potassium permanganate for

taste and odor control—declines substantially.

For example, the City of Cincinnati reduced chlorine costs by two-thirds when it switched to GAC. The City estimates an incremental cost of \$22 per family annually or six cents per day. Another city reported its decrease in chemical costs was so significant the move to GAC resulted in net savings.

Granulated carbon offers other advantages, including:

**Passive technology.** Once a GAC system is installed, an operator does not have to determine dosages on a day-to-day basis as influent conditions change. This is especially important if source water comes from a highly traveled river where spills or contamination frequently occur.

**More convenience.** Most PAC users dose at particular times, roughly four months a year, but if PAC is used year-round, the advantages of GAC increase.

**Less waste.** Reducing powdered carbon cuts the amount of sludge requiring disposal.

**Less contamination.** GAC eliminates powdered carbon bleeding into the distribution system.

**Better taste and smell.** Many water plants report a drop in customer complaints after a switch to GAC.

**Increased effectiveness.** GAC's effectiveness for organics removal will help since regulation of organics in drinking water is becoming more stringent.

*This article was written by Annette Vickers and Gary Van Stone of Calgon Carbon, Pittsburgh.*