CALGON CARBON CORPORATION

Case History

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React-pH“ Improves pH in Carbon Effluent

Stephanie Carr and Richard W. Farmer - Calgon Carbon Corporation, Pittsburgh, PA

Problem

An electronics company in the northeast United States had been using granular reactivated carbon to treat 500-1000 gallons per minute (gpm) of groundwater for volatile organic compound (VOC) removal. With this process, regenerated carbon backwash water showed pH elevation above 9.0, a level unacceptable for direct discharge to the publicly owned treatment works (POTW). This resulted in the need for a backwash water holding tank and restricted permissible backwashing time. The company’s objective was to ensure an acceptable discharge pH to allow backwashing for a longer time to remove fines and avoid using the holding tank.

Solutions considered for this problem had been limited to acid addition, allowing the elevated pH to run its course, or acid-washed carbon. Unfortunately, these options required the addition of monitoring equipment, operating at unacceptable pH levels, and ineffective treatment in many situations. Since the pH rise was not a function of ash content, the problem persisted even with the use of acid-washed products.

Effluent water from a newly installed bed of virtually any granular activated carbon often experiences an increase in pH over its influent characteristic. Studies indicate that the phenomenon is an ion exchange-type interaction between anions, protons (hydronium ions), and the surface groups of activated carbon. This elevated pH may correct itself after startup of a fresh bed of carbon; however, considerable bed volumes of water may be required before the pH returns to influent levels.

Solution

Calgon Carbon Corporation proposed a trial with its new pH-stable React-pH“ carbon. The electronics company’s carbon adsorption system consisted of four 20,000 pound adsorbers. The VOCs involved were primarily 1,2 cis-dichloroethylene, tetrachloroethylene, and trichloroethylene at 100 to 1400 ug/l (total) concentration.

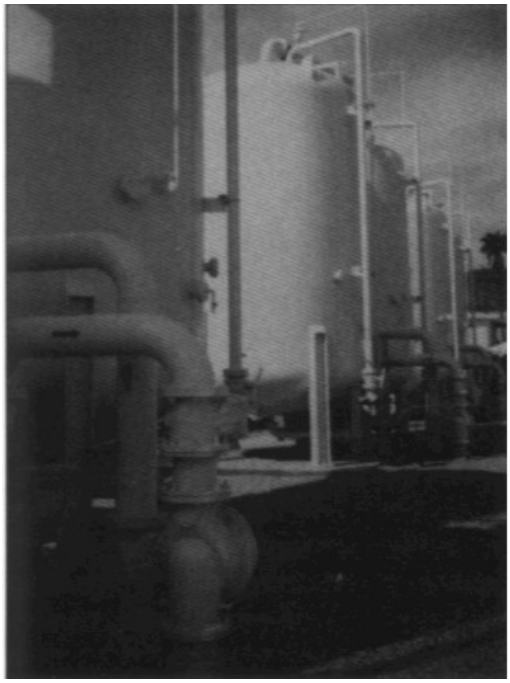
No change of equipment, process or amount of carbon was required for the trial. The granular activated carbon was simply replaced, pound for pound, in one unit of the Calgon Carbon Modular Model 10 adsorption system, with React-pH. The process was subsequently monitored for pH stability. The results of that trial, beginning at startup, are shown in Table 1.

Table 1 - pH Change Across the Adsorber

Adsorber influent		Adsorber effluent		
Sample time	pH	Sample time	pH	Bed volumes treated
14:40 14:57	7.22 6.51	14:47 15:00	6.82 7.18	Initial 1.2
15:08 15:21	6.46 6.48	15:24 15:39	7.21 7.31	2.2 3.3
15:36	6.46	15:39	7.31	4.6

15:54	6.45	15:56	7.28	6.1
16:08 16:20	6.50 6.41	16:11 16:23	7.30 7.21	7.4 8.5
16:36 16:52	6.44 6.48	16:39 16.55	7.24 7.19	9.9 11.3
17:09 17:25	6.43 6.40	17.12 17.26	7.22 7.14	12.8 14.1
17:37 17:49	6.43 6.45	17.39 17.51	7.13 7.14	15.2 16.3
07:38 07:52	6.40 6.44	07:41 07:54	6.59 6.55	89.7 90.8
08:05 08:25	6.46 6.40	08:07 08:28	6.51 6.49	92.0 93.9
09:15 09:29	6.42 6.41	09:18 09:31	6.50 6.46	98.3 99.4
Notes: 1. Adsorbers brought online at 14:34 10/13/93 2. Flowrate ranged from 380 to 400 gpm				

As shown, pH levels across the carbon bed were kept well below the water discharge ceiling of pH 9.0. The maximum effluent pH observed was 7.3, compared to the influent pH range of 6.4 to 6.5. Of particular interest was the backwash water pH, where the maximum pH observed was 7.4. Since this was significantly below the discharge limit of 9, the customer was able to backwash directly to the POTW for longer periods of time than with the storage tank system.



Results

Data showed that a pH-stable carbon could maintain the pH of the backwash water and carbon treated effluent water at less than 9.0. Actual treated effluent pH was 7.3, maximum compared with an influent value of 6.4 to 6.5. A maximum effluent backwash water pH of 7.4 was observed. As a result, no backwash holding vessels or pH adjustment systems were necessary, and as an added benefit, React-pH provided some cost savings over other activated carbons, depending on factors such as elimination of pH-lowering treatments and compliance-related penalties.

Calgon Carbon Corporation is a major supplier of activated carbon and related adsorption systems and services worldwide. Calgon Carbon Corporation, Pittsburgh, PA. 800-422-7266.

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