Arsenic Removal from FGD Wastewaters by Sorbster® Media

Proficiency for Arsenic

The functionalized activated alumina composition of Sorbster® MM-1 media provides a strong adsorbent for the reduction of arsenic from industrial wastewaters. Building on the proficiency of plain activated alumina to adsorb arsenic that was identified in the 1980's, Sorbster® media has further enhanced activated alumina by reacting additional proprietary functional chemistry groups throughout the alumina pore structure. This reacted additional chemistry provides arsenic removal with greatly reduced competition from competing anions such as fluoride. As a result, Sorbster® media can simultaneously remove arsenic, fluoride and selenium anions and also mercury, copper and other cations from wastewater streams. The media is proficient for both arsenic (V) and arsenic (III). Typical expected removal rates of arsenic (V) are 90–99% and 70-90% for arsenic (III) with an expected 30% weight capacity if the arsenic is in a soluble form.

Flow-Through Column Results for a Sampling of Twelve Power Station FGD and Leachate Waters

Sorbster provides comprehensive removal evaluation for client waters in dynamic flow-through columns of Sorbster® media for extended bed volumes of treatment. Sorbster® media was applied to various power station flue gas desulfurization scrubber field wastewaters for arsenic removal at water-to-media contact times of 20 to 27 minutes. These FGD waters were characterized by a high concentration of dissolved solids (TDS), typically containing calcium, magnesium, sulfate and chloride at levels well over 1000 mg/L each and boron at levels in the hundreds of mg/L. The pH of these waters ranged from 7 to 10. The specific arsenic species were not known. The arsenic levels were generally low in these FGD systems and present at trace ppb levels, with the exception of two of the leachate waters. In all cases regardless of concentration, Sorbster® media provided a marked reduction in arsenic levels as shown in Table 1.

For five of the twelve waters, the arsenic was reduced to non-detection levels (measured by EPA Method 200.7, ICP) and removal was maintained throughout the numerous bed volumes treated. Of note regarding fluoride competing anions is FGD Water #8, which exhibited >95% arsenic removal in the presence of 24 ppm of fluoride, indicating little to no competing anion effect from fluoride.
The solubility of arsenic plays a role in removal by an adsorbent, which are designed to bond soluble contaminants permanently to the surface and will only partially filter insoluble contaminants.

Performance is strongest when the arsenic is all present in a soluble form. For example, FGD Water #3 contained 9.4 ppb total arsenic of which only 3.9 ppb was soluble. Adsorbing and filtering such a large fraction of insoluble arsenic is reflected in the lower 40% removal rate.

Sorbster® media performance for high ppm levels of arsenic is strong. For Leachate Water #10, 2.8 ppm of arsenic was reduced to 430 ppb, an 85% removal rate. Sorbster® media treatment at additional contact time could be expected to further polish the 430 ppb to lower levels.

Table 1 - Simultaneous Removal of Arsenic Along With Mercury and Selenium By Sorbster® Media Functionalized Enhanced Activated Alumina Treating FGD Waters			
Station – Water Type	Initial Total Arsenic, ppb	Sorbster® Media Treated Arsenic in Effluent, ppb	Removal
1 - FGD	6	ND	>95%
2 - FGD	4.6	2	56%
3 - FGD	9.4	5.6	40%
4 - FGD	5.6	3.9	30%
5 - FGD	5.5	ND	>95%
6 - FGD	9.9	5.9	40%
7 - FGD	12	6	50%
8 - FGD	5.2	ND	>95%
9 - Leachate	150	47	69%
10 - Leachate	2800	430	85%
11 - Leachate	6.2	ND	>95%
12 - Leachate	4.8	ND	>95%
Average % Arsenic Removal @ Varied Contact Times		70%	

Summary

- Sorbster® media removes both high and low levels of arsenic in FGD wastewaters and can help power stations achieve tighter discharge guidelines.
- Sorbster® media is recommended for both “heavy lifting” removal of ppm arsenic levels and “polishing” removal to reduce trace levels. Polishing of already installed treatments can be done.
- Removal is a function of water-to-media contact time, arsenic solubility and the total contaminant loading