

CETCO NEW MERCURY-ARSENIC REMOVAL MEDIA, ORGANOCLAY MRM™

Introduction

Previously available technologies for mercury-arsenic removal, such as precipitation, coagulation/flocculation, activated carbon adsorption and ion-exchange are relatively ineffective. CETCO's organoclay media have proven to be effective in the removal of a variety of organic contaminants. Recently, CETCO R&D had developed a new class of proprietary media which is very effective in mercury and arsenic removal. The new Hg-As removal media, called Organoclay MRM™, is granular and can be incorporated into Reactive Core Mat™, used in groundwater remediation applications (such as PRBs or pump-and-treat filtration vessels) or used in soil solidification/stabilization applications as an additive to cement-based treatment.

Technology Description

Fundamentally, Organoclay MRM™ is based on organoclay technology, but has been modified to enhance mercury and arsenic adsorption. The mechanisms for mercury and arsenic adsorption are based on both physical removal and chemical bonding. The physical removal mechanism is principally applied when the contaminants are associated to particulates. The chemical bonding is predominant when the contaminants are in the dissolved forms. The mercury and arsenic species will be chemically bonded on media's external and internal surfaces. The chemical bonding process is typically non-reversible.

The media is effective on all types of mercury including organic mercury, elemental mercury (zero valent) and mercury ions (both I and II valent). When organic mercury is involved, the adsorption mechanism of partitioning can be involved to enhance the chemical bonding. It is noteworthy that the media is as effective as CETCO organoclay media in removal of oil, grease and other organic contaminants. The media will be spent eventually when all of the adsorption sites are saturated. The actual media life will depend on the contaminant concentrations and the field operation conditions. Laboratory testing with a representative waste stream is recommended.

Operation Procedures

As described earlier, the media is effective at removing oil and grease, therefore, we suggest that Organoclay MRM™ media is to be used after PM-199 organoclay media in order to protect and extend its active life of the Hg-As removal media. An operation procedure using PM-199 organoclay media and Organoclay MRM™ in series is highly recommended. Activated carbon media can also be used after Organoclay MRM™, if necessary, to remove more soluble organic compounds.

In general, the retention time for Organoclay MRM™ media should be no less than two minutes. If possible, a slow flow rate and longer retention time are preferred in order to maximize the media's life.

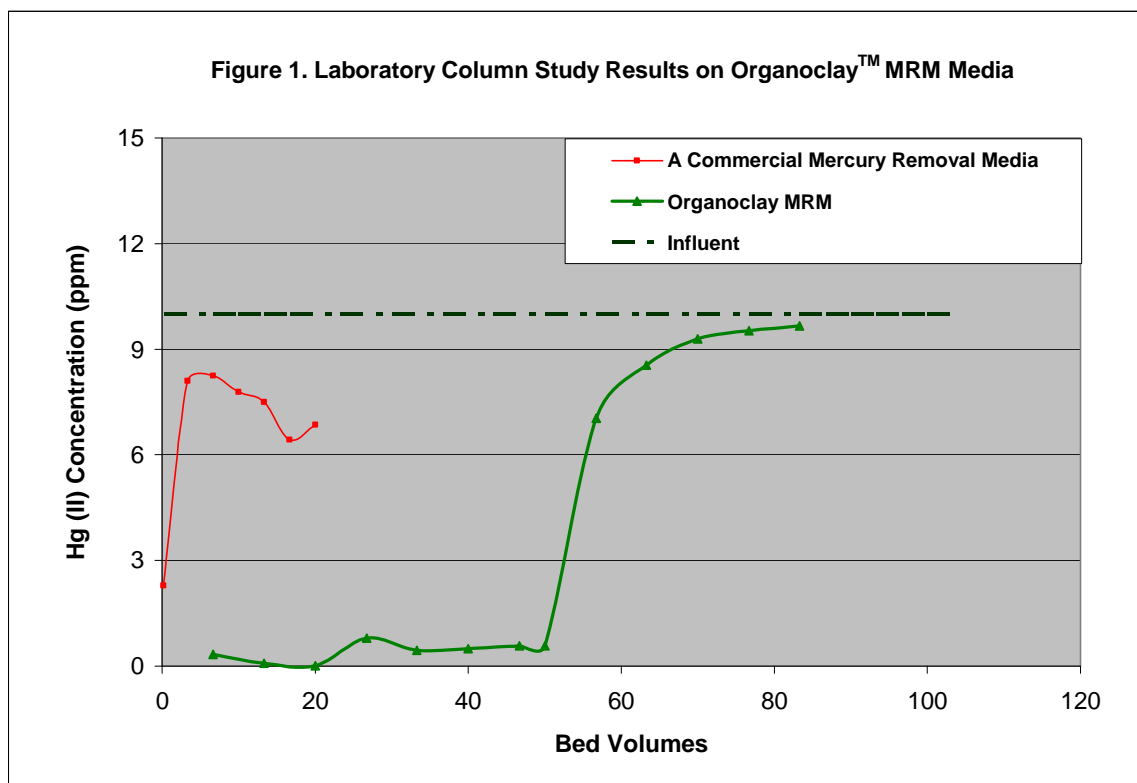
Case Studies

Column studies were conducted at CETCO's R&D laboratory to demonstrate Organoclay MRM™ media's ability to remove mercury.

Case Study 1 – Hg⁺² Removal Effectiveness

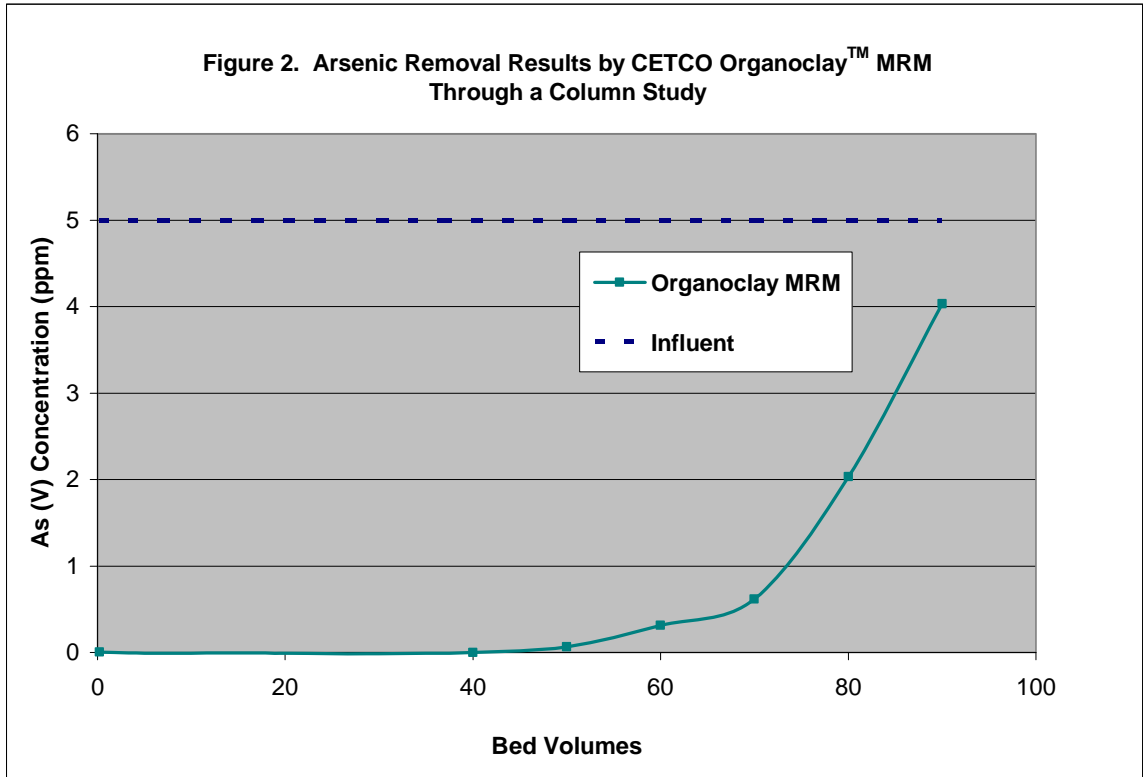
Organoclay MRM™ was packed in a column with inner diameter of 1.5” and empty bed volume of approximately 86 mL. The influent was composed of ~10 ppm of Hg(II) in the presence of nitric acid. The effluent samples were taken at regular intervals and the mercury content was measured by the Inductively Coupled Plasma (ICP) analytical technique. The flow rate was around 10 bed volumes/hr with 6-minute retention time. The effluent data is plotted in Figure 1. A competitive media marketed for mercury removal was also included in this study under similar testing conditions for comparison.

CETCO MRM removal media demonstrated that it could remove dissolved Hg (II) very efficiently and outperformed the other commercial product easily in both efficiency and lifetime.



Case Study 2 – Arsenic Removal Effectiveness

Organoclay MRM™ was examined for its ability to remove arsenic. Organoclay MRM™ was packed in a column with inner diameter of 1.5” and empty bed volume of approximately 86 mL. The influent solution was composed of ~5 ppm of As(V). The As(V) stock solution was prepared by dissolving Na₂HAsO₄·7H₂O in the de-ionized water. The effluent samples were taken at regular intervals and the arsenic content was measured by the Inductively Coupled Plasma (ICP) analytical technique. The flow rate was approximately 10 bed volumes per hour with a six minute retention time. The effluent data is plotted in Figure 2.



Conclusions

Organoclay MRM™ was developed as an adsorption media for the removal of all types of mercury and arsenic. In two laboratory column studies, Organoclay MRM™ demonstrated that it can effectively remove mercury and arsenic from contaminated water.