



Applied Speciation and Consulting, LLC

www.appliedspeciation.com

Treatment Plant Optimization for Removal of Trace Metals

Exceedance of discharge permit limits due to poor treatment efficiencies often result in costly fines. Unfortunately, inherent interferences associated with most analytical methods applied to the regulatory monitoring can result in biased data artificially representing systematic problems. Applied Speciation and Consulting employs state of the art technology for background monitoring and investigations associated with trace metals and metalloids in treatment plant operations.

Although trace metals analysis may seem straightforward, interferences inherent with nearly all analytical platforms can result in significantly biased results. Application of an inductively coupled plasma mass spectrometer (ICP-MS) equipped with a dynamic reaction cell (DRC) for trace metals analyses minimizes, often totally eliminating, isobaric interferences associated with ICP-MS. The DRC facilitates different reactive gases to preferentially react with different interferences (Cl, S, Ar, C, etc.). Pending confirmation of elevated trace metals concentrations in treatment plant discharge, a more detailed examination of the target trace metals, in the

form of speciation, can be performed to identify operational modifications to achieve the desired treatment efficiencies.

Trace metals speciation analysis is a powerful tool to identify the exact molecular form of the target analyte and the chemical equilibrium within the system. Upon identification of the exact chemical species, chemists can apply this information to identify appropriate treatment methods and efficiencies with a focused experimental plan using bench scale and process studies. In addition, monitoring trace metals species in the influent and effluent can identify issues associated with variable waste streams for modifying operations prior to regulatory compliance sampling. Depending on the complexity of the influent waste stream chemical modeling may be necessary to generate a more robust treatment process to accommodate variability.

Chemical modeling of treatment processes is often performed in a controlled laboratory setting to minimize variables which may interfere with mechanism identification and optimization. Once the mechanisms are understood for ideal conditions, application to real world samples can be initiated.

Highlights

Regulatory Monitoring
Trace Metals Analysis
(ICP-MS)

Discharge Exceedance
Confirmation
Ultra Trace Metals Analysis
(ICP-DRC-MS)

Treatment Optimization
and chemical Modeling
Trace Metals Speciation
(IC-ICP-DRC-MS)

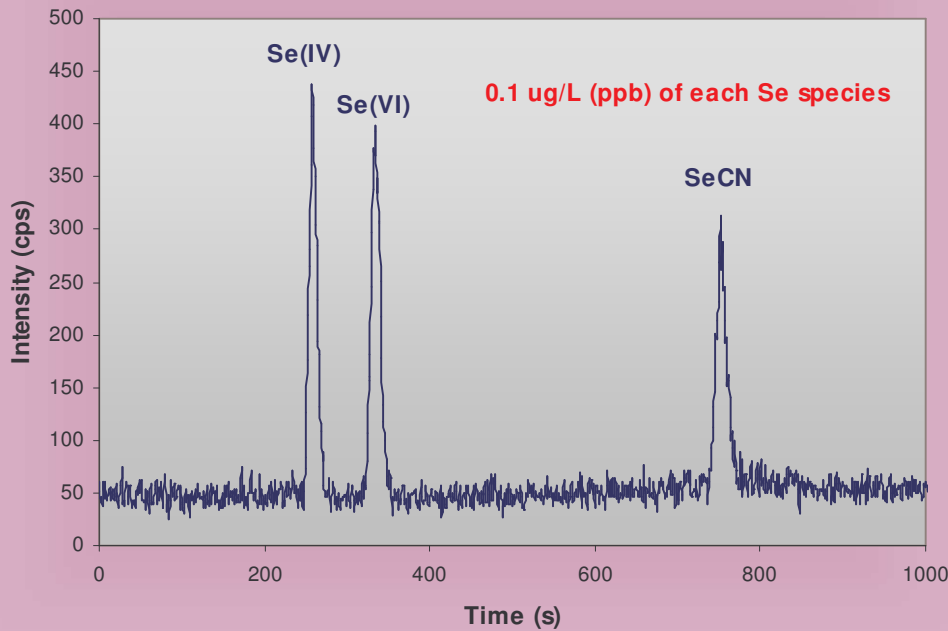
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Selenium Speciation by IC-ICP-MS



When pursuing chemical modeling associated with variable waste streams, all active variables must be taken into consideration. Interfering compounds, such as soluble salts, organic molecules, and other metals, may preferentially interact with the projected treatment process or the target metal. An excellent example is the competitive binding between arsenate and phosphate on iron packing materials (both having triangular pyramidal structures). At specific pH ranges, phosphate can dramatically decrease the binding efficiency for arsenate onto sorbent materials; thus, decreasing coprecipitation and column treatment processes. Interferences may include competitive binding, induced solubility of flocculent and precipitates, increased buffering capacity, and encapsulation of active sites. By no means is the presented list exhaustive; therefore, the importance of an encompassing vision with regards to remediation cannot be overstressed.

In addition, stratification of contaminants through substrate columns can also result in varying treatment efficiencies. Substrate stratification is not limited to solid materials; rather, redox conditions within water columns can affect metals speciation which in turn, would affect coprecipitation efficiencies as associated with waste water treatment plants. Other factors which may induce stratification of water columns is thermal variability as well

as UV penetration (temporal variability throughout the year).

Collaborations with Applied Speciation and Consulting benefit from our small business status. By reducing our costs and streamlining operational processes, we can offer analytical services with unparalleled quality along with faster turn around times and competitive pricing.

Feel free to contact an Applied Speciation and Consulting representative at info@appliedspeciation.com to identify how we can work with you to solve your monitoring and treatment needs.

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Typical Detection Limits (ug/L)

Ag	0.007
Al	0.07
As	0.006
Ba	0.005
Be	0.007
Cd	0.004
Co	0.005
Cr	0.004
Cu	0.004
Mn	0.005
Mo	0.006
Ni	0.006
Pb	0.005
Sb	0.005
Se	0.008
Tl	0.005
Zn	0.005



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