Metrohm-Peak, Inc.

Determination of Anions in Heat-Stable Salts Containing High Level Sulfide by Suppressed Conductivity

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Amines have been used for many years to remove acid gases from natural gas, and there is a large volume of technical information on their performance capabilities. It is also common knowledge that certain contaminants can "poison" the amine solutions over an extended amount of time and limit its performance capabilities. As environmental regulations pertaining to "clean fuels" have become more stringent in recent years, additional burdens have been placed on sour gas processors. Amine systems have been the workhorse of the gas treating industry for many years and the push is harder than ever for optimum performance and reliability. Along with proper maintenance of equipment, proper care of the chemical solutions can also significantly improve plant throughput and lower operating cost. Optimal performance can be achieved if proper attention is paid to "amine hygiene." Excessive corrosion and amine solvent loss from foaming upsets are two of the most costly expenses in operating an amine system. A simple amine hygiene program will be: 1) monitor amine contaminants with regular lab analysis, 2) reduce amine losses by locating and fixing leaks, and 3) periodically remove objectionable contaminants to meet industry recommended amine quality standards. For over 70 years, the alkanolamine process has been considered the best approach in removing H_2S and CO_2 acid gases from natural gas. Heat-stable salts is one of the five major categories of amine contaminants. Strong acid anions such as formate, acetate, thiosulfate, thiocyanate, and chloride can tie-up an amine molecule to form a salt that is not capable of being regenerated by the addition of heat, and thus referred to as heat-stable salts. Not only do they tie-up the amine and thereby reduce the acid gas carrying capacity, but they are also considered corrosive. Other categories of amine contaminants are amine degradation products, injection chemicals, hydrocarbons, and particulates. On an ion-exchange column, sulfide ion and chloride ion elutes very closely. Sulfide ion has negative conductivity and hence, it impacts reproducible determination of chloride ion. In this application note, an in-line sample preparation device from Metrohm AG (Switzerland) allows us to determine chloride ion reproducibly in the presence of a high level of sulfide ion.

Experimental Conditions

The Metrohm Advanced Modular Ion Chromatography system is used for the analysis, as well as the Model 819 conductivity Detector, 818 Dual piston IC Pump (optional second IC pump can be use to have binary high pressure gradient), 838 Autosampler, 820 IC Separation center, 833 MSM Module, 853 MCS Module, and IC-Net 2.3. A MetroSep ASUPP5 (4 mm × 100 mm) column is employed for this analysis. Eluent = 5 mM Na_2CO_3 + 0.7 mM $NaHCO_3$, with the flow rate of 0.5 mL/min.

Results and Discussion

Figure 1 represents suppressed conductivity data containing 2% sulfide (S-2) ion in the solution. Determination of chloride and other anions is achieved without compromising chromatography and most importantly without any sample preparation. Removal or reduction of sulfide ion is not required. If there is a need for sample dilution, the autodilution feature of model 838 autosampler can handle it very efficiently.

Conclusion

Therefore, using Metrohm Advanced IC, low molecular organic acids and anions can be determined isocratically or using carbonate gradient. Tandem UV detector provides ability to determine sulfide content and UV-active anions like nitrate, oxalate, thiosulfate, and thiocyanate.

References

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(3) "Gas Conditioning Fact Book," Dow Chemical Company (Midland, Michigan).
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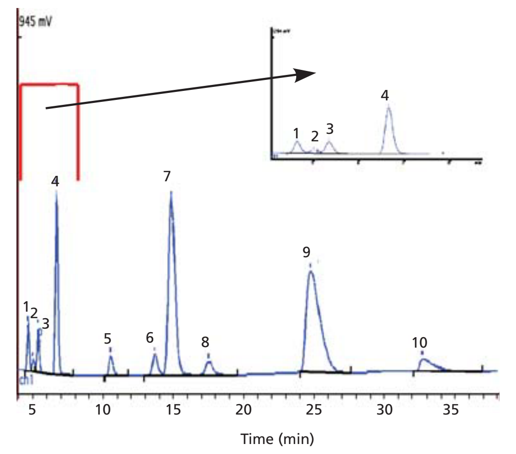

Figure 1: Chromatogram for "sour water" sample with 2% sulfide content.

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