Determination of Amines by Ion Chromatography
Using Cation-Exchange Columns

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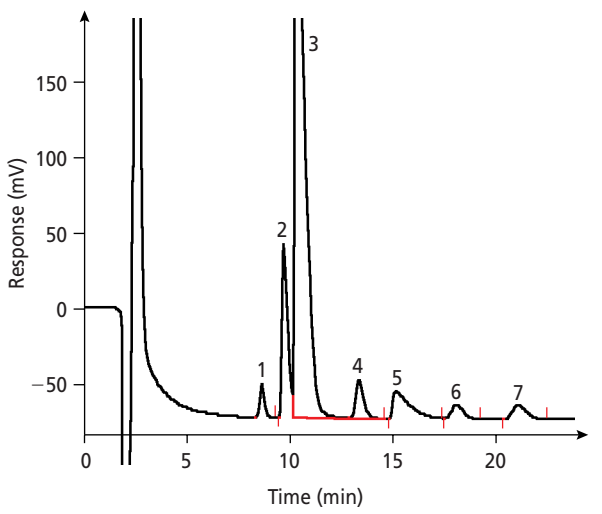
Ethanolamines are widely used in the power industry cooling waters as carbon dioxide scrubbers. They are also used for the production of emulsifying agents, for gas purifications (for the removal of acidic components) and as corrosion inhibitors. Carryover of amines from scrubber units into waste streams can cause severe problems in refinery waste-treating pools. Different amines are sometimes used in various production areas to make it easier for plant operators to locate sources of amine contamination. It is now possible to easily and rapidly analyse amines by non-suppressed ion exchange chromatography without gradient.

Experimental Conditions

A Metrohm Modular Ion Chromatographic system is used for the analysis. Model 732 conductivity Detector, 709 dual piston IC pump, 766 autosampler, 733 IC separation center and IC-Net 2.1. A Metrosep C2-250 column is employed for separation of common cations and ethanolamines in a single isocratic analysis. Most importantly, direct conductivity is employed for the analysis resulting in excellent sensitivity and simplified operation. Eluent = 4 mM/L tartaric acid + 0.45 mM/L PDCA + 0.05 mM/L Crown ether (18,6) with flow-rate of 1.0 mL/min.

Figure 1: Separation of common cations and ethanolamines.



Peaks: 1 = sodium, 2 = NH_4^+, 3 = MEA, 4 = DEA, 5 = potassium, 6 = TEA, 7 = MDEA.

Results and Discussion

Figure 1 is a demonstration of lean industrial scrubber water containing 30% Monoethanolamine (MEA) and low level of other amines and cations. TEA was spiked in the sample to indicate its respective retention time. The sample was diluted 1000-fold prior to injection. Excellent selectivity and resolution is demonstrated for separation of ethanolamines and common cations. This separation was achieved using a C2 column with capacity of 194 µmol (K^+). The Metrosep C2 column is a silica-based cation exchanger, comprised of poly(butadiene-maleic acid) copolymers. Another advantage of these columns is that organic solvents like acetone or acetonitrile can be used. Separation of C1-C4 secondary amines and tertiary amines can also be achieved with these columns. Various ratios of complexing agents such as PDCA and Crown ether (18,6) were tested to study the effects of selectivity and resolution for common cations and amines.

Conclusion

Amines, alkanolamines and cations can be isocratically separated using direct conductivity ion chromatography. Organic modifiers and complexing agents can be used to customize the separation for individual needs. Use of organic modifiers such as acetone or acetonitrile also sharpens the peak shape of strongly retained amines.

References

Metrohm Application Works AW-MP6-0019-042001
Metrohm Application Works AW MP6-0034-112001

Metrohm
Ion analysis

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