MEA-triazine analysis for QA/QC

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OndaVia

App Note

MEA-triazine manufacturing QA/QC

Quantitative Raman Spectroscopy is an all-optical technique for chemical analysis and measurement. Raman spectroscopy is analogous to infrared spectroscopy in that it monitors the vibrations of chemical bonds. Each set or combination of bonds has a distinct spectrum, providing a chemical 'fingerprint' which uniquely identifies a chemical. Due to the miniaturization of lasers, electronics, and microprocessors, Raman spectrometers have decreased in size, and cost, thereby increasing portability and convenience, enabling Quantitative Raman Spectroscopy on your bench or in your factory.

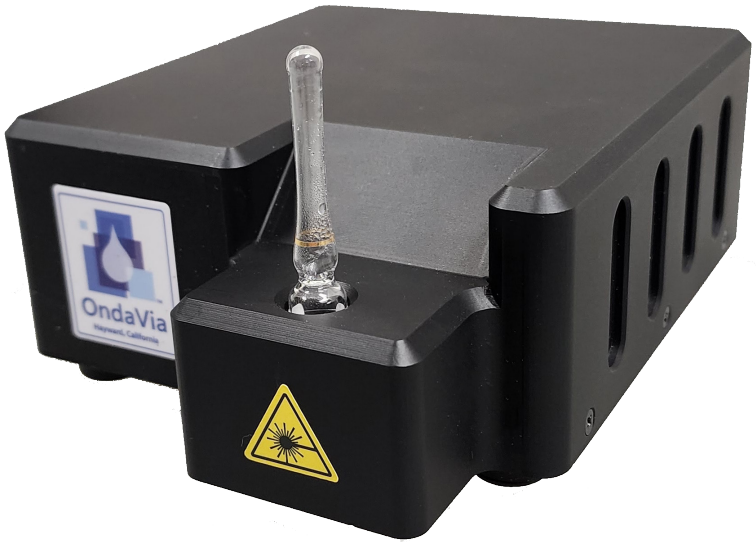

Figure 1. OPAL-103 OndaVia Portable Analysis Laboratory.

The intensity of the Raman spectrum is linearly related to the concentration. We use this relationship coupled with an internal standard to produce a fast, laboratory-quality test for MEA-triazine quantification in fresh scavenger solutions, an approach that has been used successfully for analyte quantitation in other complex sample matrices.

The MEA-triazine spectrum in aqueous solution is presented to the right. This signature is manifested in the triplet of wide and strong peaks between 800 and 1000 relative wavenumbers. These peaks are related to the ring breathing and ring-incorporated methylene hydrogen rocking vibrations for the intact triazine molecule. The figure to the right also illustrates the Raman response for a variety of concentrations from 20 to 90% by mass with three sample spectra at each concentration, illustrating the relationship with concentration

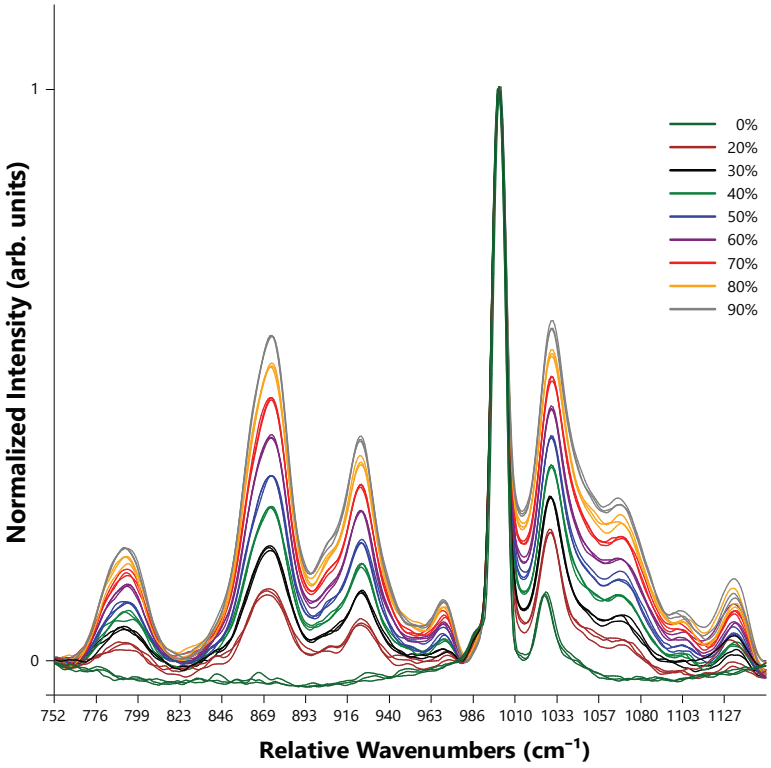

Figure 2. MEA-triazine analysis via Quantitative Raman Spectroscopy.

MEA-triazine manufacturing starts with equimolar concentrations of formaldehyde and monoethanolamine. This reaction is simple—in theory. Monoethanolamine is 60 g/mol; formaldehyde is 30 g/mol. Mix two parts of formaldehyde with one part of monoethanolamine (by weight) and the result is MEA-triazine.

Unfortunately, the real world is not this simple. There are many concentrations of formaldehyde available: formalin is 37% formaldehyde, often with a few percent methanol as a stabilizer; heated trucks can deliver 50% formaldehyde; and paraformaldehyde is polymerized, 100% formaldehyde. They vary in cost and complexity of handling. Additionally, the reaction produces water, three moles per mole of triazine; and it produces a lot of heat, too much of which causes the MEA-triazine to degrade.

The combination makes it challenging to produce a high-quality product if you do not have the tools to measure the components or products. Not only is it

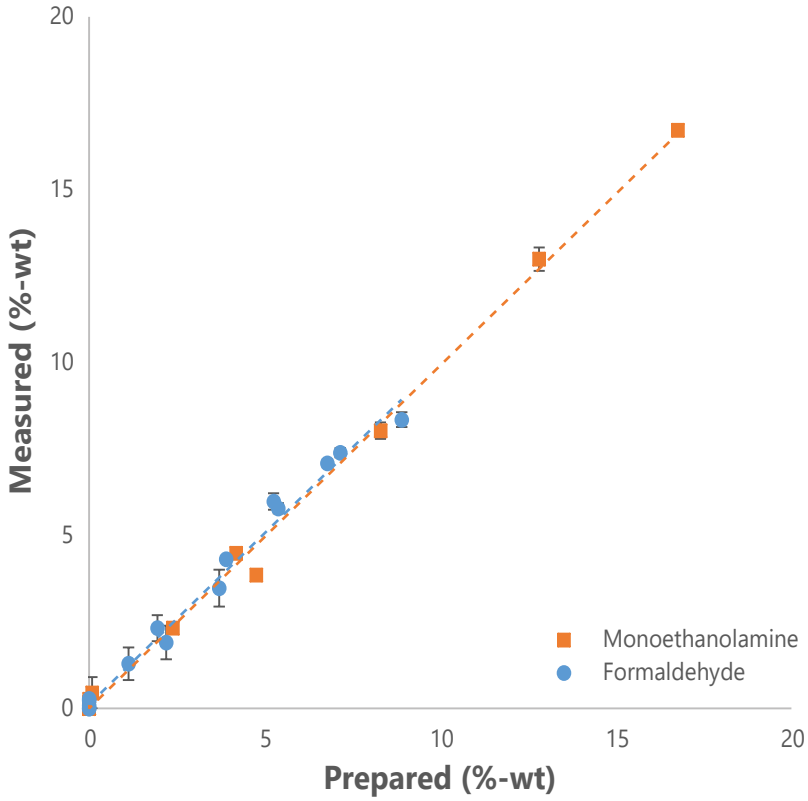

Figure 3. MEA-triazine excess reactants analysis via Quantitative Raman Spectroscopy.

essential to measure your incoming products, but also to monitor the reaction product to verify the presence or non-presence of all reagents.

Quantitative Raman Spectroscopy provides a tool for measuring all components of the MEA-triazine production process. Using the information in the spectrum, OndaVia equipment measures the concentration monoethanolamine or formaldehyde before the reaction; the concentration of MEA-triazine, excess monoethanolamine, and excess formaldehyde in the reaction product; and the concentration of methanol added as a co-solvent or introduced in the formaldehyde. An OPAL-103 Triazine Analyzer eliminates the guesswork and helps optimize your manufacturing process.