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ChemScan® Method Summary #127 Specific UV Absorbance (SUVA)

Absorbance Spectra of Chemicals

Specific absorbance refers to the measurement of light absorbance in mixed media at one specific wavelength. The light absorbance measured at one wavelength may be attributable to a specific component or to a group of components. The media may be a liquid such as water, wastewater, process solutions, product solutions or heat transfer solutions. (The same principles apply to mixed fluids such as gasses or air samples, although the measurement apparatus may differ.)

Light absorbance is a function of the molecular structure of a chemical. Each chemical has its own light absorbance signature (pattern) within a specific range of wavelengths. If the light absorbance follows Beer's Law, there will be some portion of the signature which will change in intensity directly in proportion to changes in chemical concentration. In a non-absorbing solvent, direct measurement of light absorbance can be used to measure the concentration of an absorbing component. In mixed media, where absorbance signatures from multiple components are overlapped, measurement of a specific wavelength may reflect contributions from numerous chemicals if the wavelength is common to their signatures. This may be a desirable result, if the chemicals are to be classified together and measured as a class (such as "dissolved organics") but may be an undesirable result if only one specific chemical is of interest. Light absorbance is the inverse of light transmittance. (See ChemScan Method Summary #42, Percentage Transmittance in Treated Wastewater.)

SUVA can be an excellent method for rapid on-line monitoring of dissolved organics in water that would otherwise require TOC analysis. (See ChemScan Method Summary #126, TOC Estimation)

Absorbance Issues

Suspended solids are an issue for accurate measurement of the absolute absorbance at a specific wavelength. Particles will tend to scatter light at any wavelength across the spectrum. This will interfere with the analysis, because light as measured after transmission through the sample will not only be affected by absorbance from the dissolved chemicals of interest, but also from scattering.

Absorbance is typically measured by comparison of light intensity before and after passing through a known path length of a sample. The light absorbance in a given sample can be increased or decreased by increasing or decreasing the path length of the sample cell. This can assist in the analysis of samples at lower detection limits or samples with higher chemical concentrations.

Two adjustments are required to obtain an accurate specific absorbance result. If the samples are contained within a transparent cell, the measurement must compensate for losses of light at the cell walls and from any film or deposits on the cell surfaces. A blank or zero standard is used to define any light absorbance losses attributable to the sample cell itself. Other losses can be attributable to light scattering within the sample from suspended particles in the sample. If specific absorbance is to be used for analysis, the possible effects from suspended particle should be considered. If an absolute specific absorbance measurement independent of light scattering is to be performed, the suspended particles must either be removed prior to analysis or their effects must be independently measured at a second wavelength and removed mathematically from the analysis.

After absolute specific absorbance measurements are made, the absorbance values may be used to correlate to the concentration of specific chemicals, chemical groups or physical conditions. Or, alternatively, specific absorbance can be reported as measured for a specific wavelength usually in Absorbance Units (AU).

ChemScan Analytical Method

On-line analysis of specific absorbance can be most economically performed on the ChemScan UV-0254 analyzer. This analyzer is designed to detect light intensity at 254 nm with or without compensation for turbidity.

Other ChemScan analyzers such as the UV-3150 can perform specific absorbance analysis at any desired ultraviolet or visible wavelength or at several independent wavelengths. These full spectrum analyzers can automatically apply a calculation to translate between specific absorbance measurements and chemical concentration based on multivariate correlation techniques. Some ChemScan analyzers can support multiple chemical correlations.

All ChemScan Process Analyzers are designed to perform periodic zeroing using deionized water standards and periodic chemical cleaning of optical surfaces within the cell. Best results for specific absorbance applications will be obtained with frequent zeroing and cleaning accomplished with an automatic system.