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# ChemScan® Application Summary #97 Natural Organic Matter (NOM) Reduction

## Statement of the Problem

Large organic molecules such as tannins, lignin's and humic acid are the major fraction of Natural Organic Matter (NOM) in soil and water. These substances (which are also called Aquatic Humic Substances - AHS) are oxidized very slowly and their solubility in water may vary with pH. NOM have been shown to produce by-products such as trihalomethane during chlorination and to affect the transport and fate of other organic and inorganic species in water. Certain surface water sources have variable concentrations of NOM which vary seasonally and in response to environmental conditions such as wind and rain. These large organic molecules may be removed by coagulation and sedimentation processes within the treatment plant. Failure to remove these organics prior to disinfection may result in the formation of disinfection by-products (DPB's) which are a threat to public health.

## Control Strategy

Some treatment facilities are using membrane filtration to remove suspended solids, NOM and other substances from water. Other facilities use coagulants such as iron salts or alum followed by sedimentation or filtration. Some facilities may use permanganate or other chemicals to oxidize the organics at the raw water intake point.

Analysis of NOM in the raw water before coagulation, filtration or oxidation can be used to verify the starting concentration and the relative effectiveness of any variable unit process intended for NOM removal. Under conditions where incoming NOM is modest, chemical feed rates and contact time may be able to be reduced. This is especially true for feed control of an oxidant such as permanganate.

Analysis of NOM following coagulation, filtration or oxidation can be used to verify the effectiveness of the removal process. This information can be fed back for improved organic removal control and/or feed forward to help control primary disinfection.

## Apparatus

Natural Organic Matter components each have unique light absorbance signatures in the ultraviolet wavelength range. Components such as tannin, humic acid or fulvic acid can be detected as individual parameters through the contribution made by their individual

absorbance signatures to the overall absorbance signature of a sample. A single wavelength such as $UV_{254}$ is not sufficient for this analysis because equal concentrations of each component have very different absorbance intensities at 254 nm. A full spectrum analyses across the entire ultraviolet wavelength range is required for individual or combined analysis of NOM components. A full spectrum analysis using pattern recognition techniques can detect NOM components and can compensate for the effects of other organic and inorganic matter and turbidity present in the sample. The ChemScan Process Analyzers are fully capable of this analysis. ChemScan can also be used to detect the residual amount of oxidants such as permanganate or chlorine used to oxidize NOM.