

# What is Coagulation and How to Control it Using Online UV-VIS Spectrometers

**Roger Powell, Process Measurement & Analysis Ltd**

Brook Mills House, Carr Lane, Slaithwaite, Huddersfield, West Yorkshire, HD7 5BQ

Tel: [44] 01484 843708 • Email: roger@processmeasurement.uk.com • Web: www.processmeasurement.uk.com

**Achieving reliable automatic coagulation control is something many water companies struggle to maintain in highly variable catchment areas that are at one time or another; typically low in particulates with a moderate to high natural organic matter (NOM) content & vice versa. The water quality can change very rapidly following rainfall events. This upsets previous steady state conditions, and can often reverse the balance. Such water quality “events” present a challenge to conventional water treatment processes and coagulation control in particular. Recent advances in instrumentation have enabled water suppliers to install UV-VIS spectrophotometers for continuous online water quality monitoring. These instruments can be used to measure the quantity of NOM and infer changes in the characteristics of NOM during water quality events. This knowledge can be used to optimise conventional treatment plants for NOM removal in the most cost effective manner, without a deleterious effect on particulate removal by regulating automating coagulation control in a robust and reliable manner.**

## UV-VIS & NOM Characterisation & SUVA Calculation

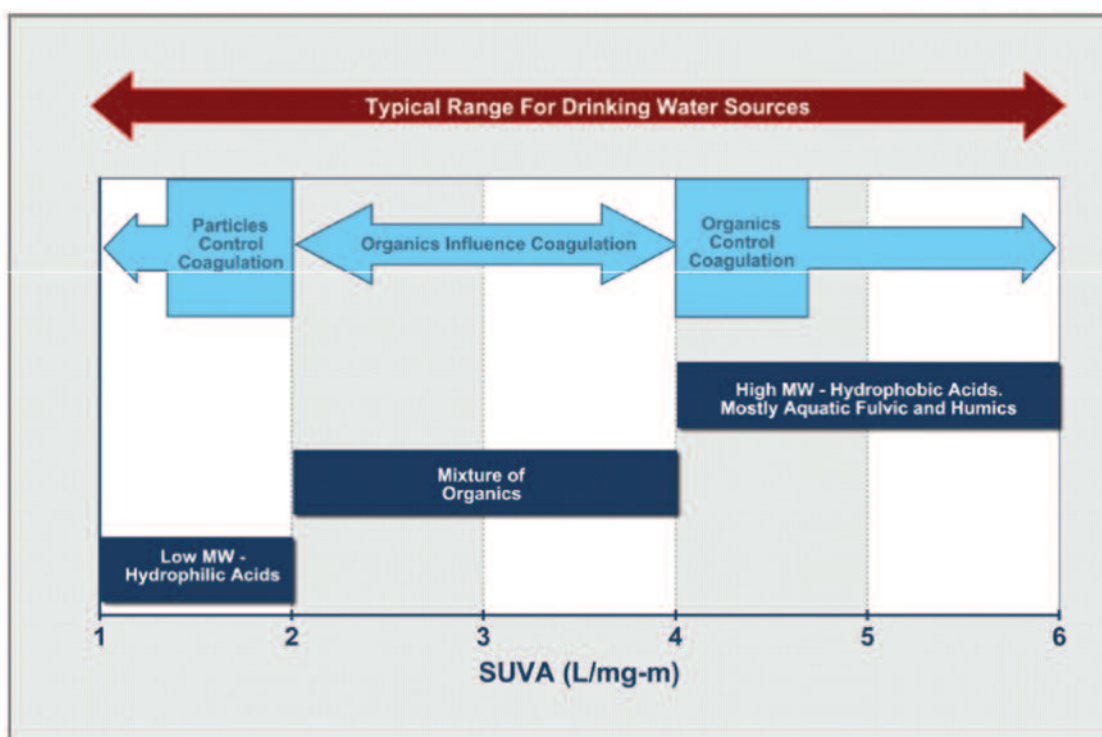
In the water industry measurement of UV absorbance at a single wavelength of 254nm is a widely accepted surrogate for natural organic matter (NOM). However, in order to characterise NOM, additional measurements need to be made. Measuring the dissolved organic carbon content (DOC) enables the specific UV absorbance, or SUVA<sub>254</sub>, of the water to be calculated. SUVA<sub>254</sub> has been shown to correlate with the apparent molecular weight (AMW) of aquatic NOM. As the AMW of NOM increases, the SUVA<sub>254</sub> value tends to increase. A higher SUVA<sub>254</sub> value suggests that the NOM present is more hydrophobic in nature and therefore more likely to influence and be removed by coagulation and subsequent solids separation. The diagram below attempts to illustrate the relationship.

## UV-VIS Submersible Spectrometer

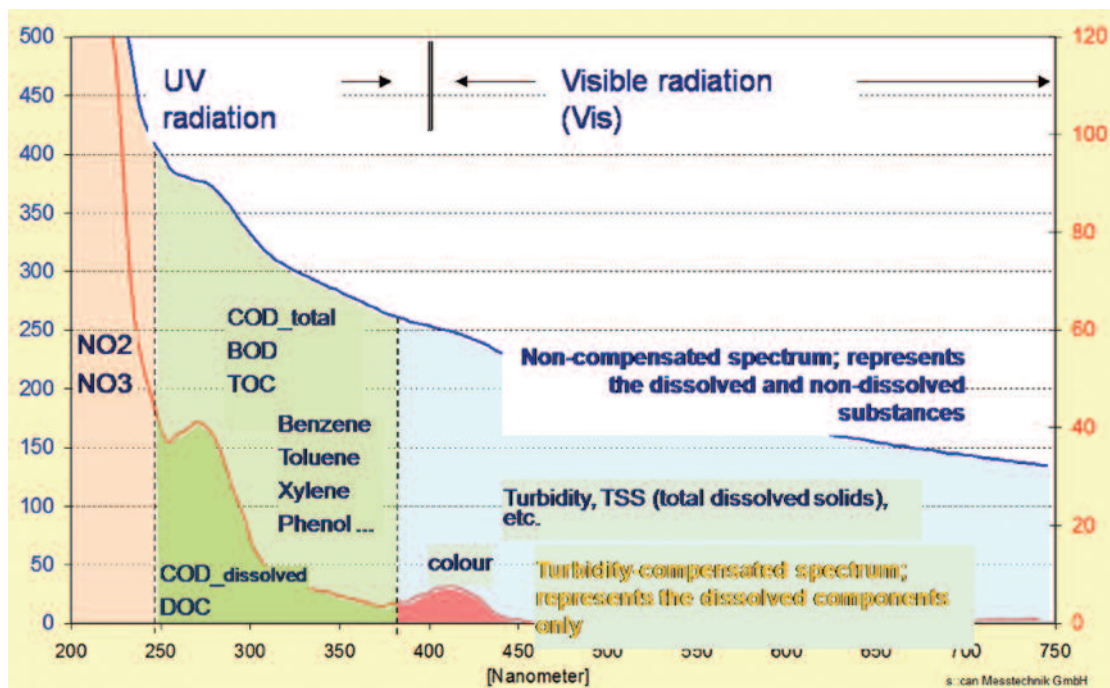
UV-VIS spectrometers measure the absorbance across a range of wavelengths (e.g. 200-750nm) and are generally accepted to improve the robustness and accuracy of the measurement when compared to a single wavelength measurement. Measurement across multiple wavelengths provides an absorption fingerprint profile or “spectra” from which other parameters can be derived, such as a DOC equivalent (DOC<sub>eq</sub>). Recent developments in instrument technology have resulted in the availability of UV-VIS spectrophotometers capable of online measurement, giving the user real time UV-VIS spectral data. This in turn has resulted in online, real time coagulation control becoming a very real possibility.

## Automatic Coagulation Control

DOC removal tends to follow the course predicted by the graph below. Extreme ends of the scale result in treatment failure, or excessive coagulant dosing that fails to provide any additional DOC removal. It can be seen that ideally the coagulant dose rate would fall between approximately 1.1 – 1.7mg/l. The most economical use of coagulant can be used as a control point in order to maintain plant compliance with a degree of safety built in.



Suva Raw Water Quality Diagram



**Commercially available UV-Vis based automatic coagulation controls system**

There is a commercially available system as described above known as the Compass System available from Process Measurement & Analysis Ltd. PMA have worked with H2Hope and DCM Process Controls to successfully combine the S::CAN ([www.s-can.at](http://www.s-can.at)) submersible spectrometer into a robust and reliable coagulation control system for the UK potable water market ([www.processmeasurement.uk.com](http://www.processmeasurement.uk.com)). We welcome enquiries from any Municipal UK water company with a further interest in automatic coagulation control.

