

Pi Technical Note 19

Correlating the UV254 Water Quality Parameter to Other Organics Parameters

Background

The UV254 water quality parameter is a measurement of the absorbance of light by a water sample at 254nm wavelength. Absorbance measurements are very common in the laboratory and in the field since absorbance at a given wavelength is proportional to the concentration of any substances in the water that are known to absorb light at the given wavelength.

Light at the 254nm wavelength is of particular interest since it is a wavelength that is very readily absorbed by organic matter in the water. Because the UV254 absorbance parameter is proportional to the concentration of organics in the water, it is a simple process to determine a linear correlation factor that relates the UV254 parameter to other water quality parameters that provide a measure of organic matter in the water. There are several such water quality parameters including total organic carbon (TOC), chemical oxygen demand (COD), biological oxygen demand (BOD) and color (Hazen). All these parameters have slightly different biases to different types of organic matter. UV254 can often be linearly correlated to all of these parameters.*

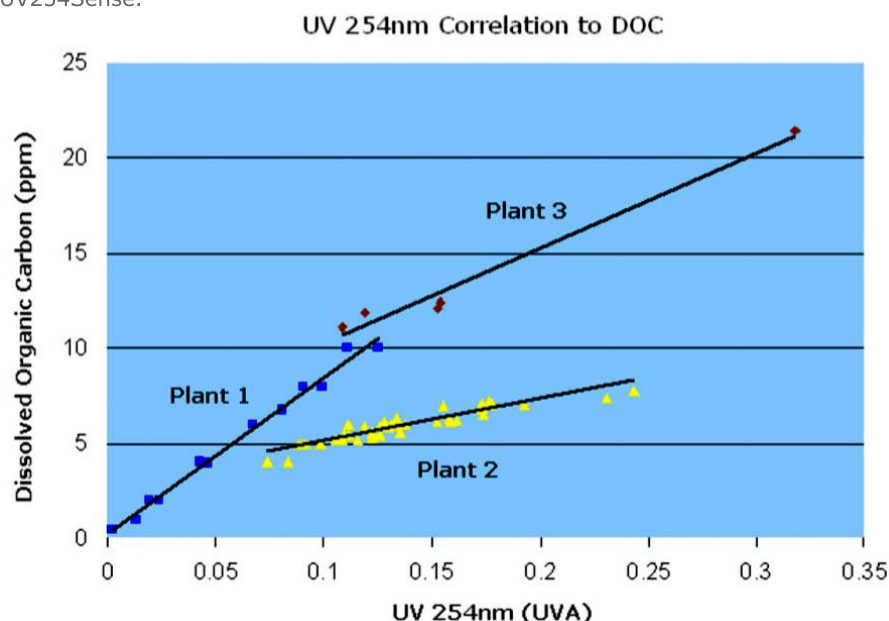
The correlation factor will depend on the particular organic water quality parameter being correlated to, and will also depend on the matrix of organics being measured. This means that correlations are site and application specific, and so the correlation factor must be determined at the measurement site.

Most natural water sources such as raw water for drinking water and municipal waste water have a good correlation between, for example TOC and UV254 absorption, and COD and UV254 absorption.

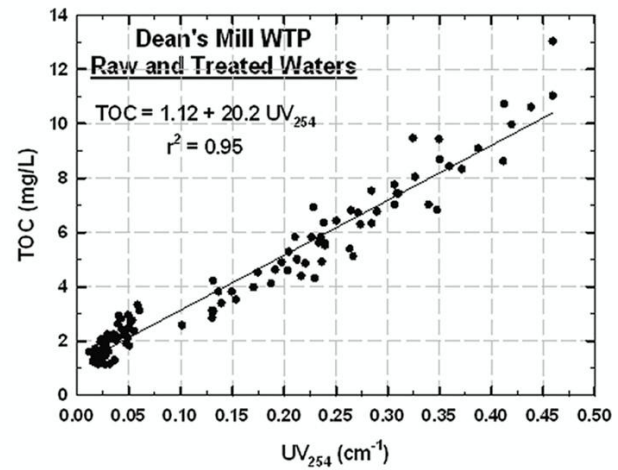
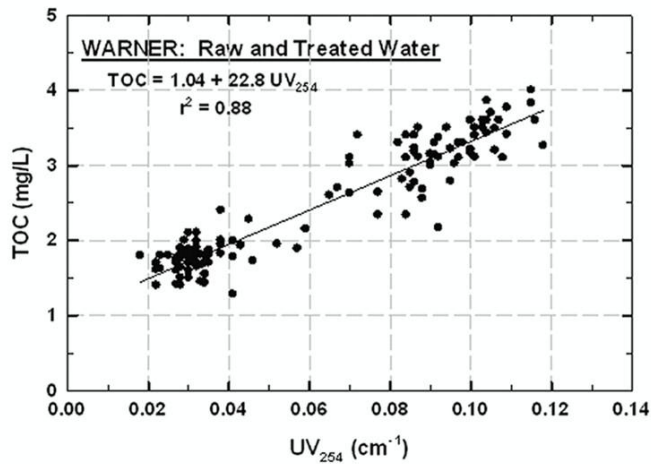
The way the Pi UV254Sense provides an output for a correlated parameter is by applying an offset and calibration to the UV254 measurement. This is related to the original UV254 measurement by use of a formula in the form of $y=mx+c$ where

- y* is the correlated water parameter (eg. TOC, COD)
- x* is the UV254 absorption
- m* is a factor to be applied to *x* (changing the slope)
- c* is an offset.

In order to calculate *m* and *c*, sufficient data must be collected over time to generate a graph similar to the following graphs. A spreadsheet program can then fit a straight line to the data and provide a formula in the form $y=mx+c$ in order for it to be entered into the Pi UV254Sense.



UV254 and TOC



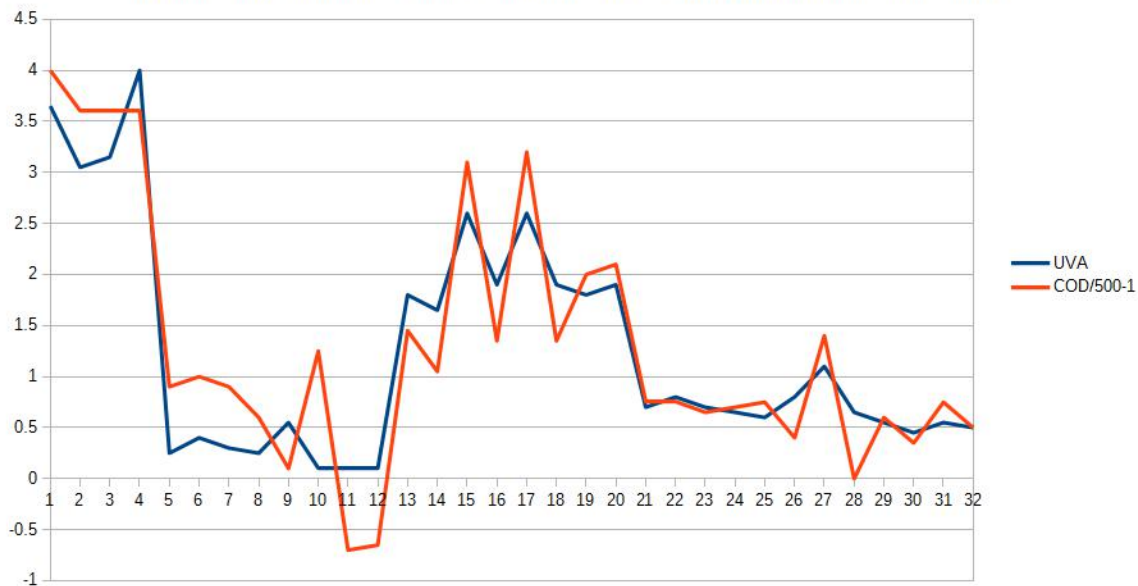
Edzwald, J. K. & Kaminski, G. S. A Practical Method for Water Plants to Select Coagulant Dosing (<http://www.cec-online.com/site/technical/coagdose.pdf>).

Notes

In order to derive a correlation between TOC, DOC, BOD, or COD and UVA, data will need to be gathered using both parameters over a period of time.

- It is recommended to record the UVA numbers daily/weekly/monthly (depending on how frequently the water quality changes, the more often data is collected the more accurate the correlation will be).
- Compare these UVA results to your other organic test parameter values (TOC, DOC, BOD, or COD) over the same period of time and graph the results to determine the relationship between the two parameters.
- Keep in mind that the relationship will be different for every water source i.e. the same correlation from one site could not be used on another site.
- Once the correlation has been determined, the relationship can then be entered into the UV254Sense to output the value of your correlated parameter such as TOC or COD.

Correlation Study between COD and UV absorbance (UV254) using industrial wastewater samples



*Please note that it is possible for there to be no correlation between UV254 absorbance and other water quality parameters if that parameter on a particular water source does not contain UV254 absorbing substances. An example of this would be a water supply counting a lot of dissolved sugar, as sugar won't absorb UV254 but will have a high Chemical Oxygen Demand (COD).