# Color Monitoring in Water Treatment Plants

## Challenge

In the potable water production, starting from the raw water intake until the distribution of treated water, several parameters need to be continuously measured. This ensures that all treatment steps are being performed correctly and will produce the required product quality. Figure 1 below provides an overview of a typical water treatment plant.

Typical water treatment processes and their purpose:

- **Water intake and screening:** Remove large matter which could damage the facility
- **Coagulation:** Clump dirt particles and dissolved substances in order to be removed
- **Sedimentation:** Slow mixing so that clumped particles increase in size and sink to the bottom where they can be removed as sludge (flocculation)
- **Filtration:** Remaining particles in the water are removed through coal, sand and gravel beds
- **Disinfection:** Chlorine is added to kill bacteria and viruses. Ozone or Chloramines can be used instead of chlorine to avoid disinfection by-products
- **Storage and distribution:** Water is stored in water tanks and supplied to users

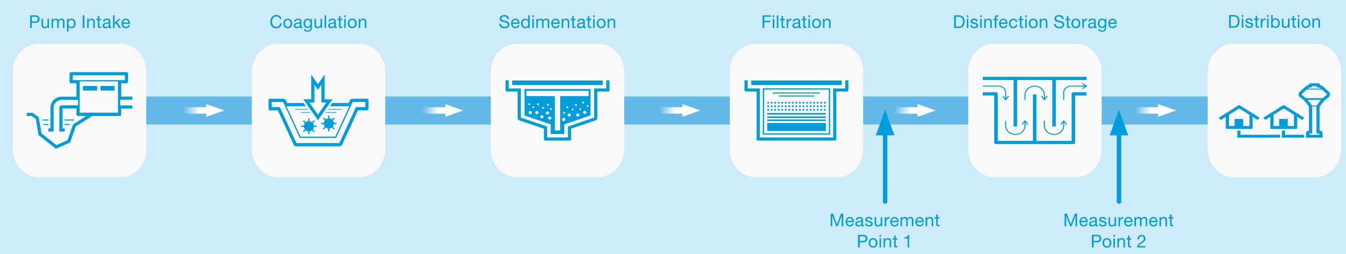


Figure 1: Example of processes in a typical water treatment plant

## Task

Beside the basic and key monitoring parameters which are well known such as chlorine, turbidity, dissolved oxygen, pH/ORP, SAC, ozone and conductivity, further measurements may be required to fulfill local governmental regulations or to account for plant specific requirements. These parameters might be: aluminum, iron, hardness, alkalinity, copper, manganese and color. In what follows we will focus on the color monitoring, based on a real customer application example.

## Sampling Point

As indicated in Figure 1, the plant operator wanted to monitor color both before and after chlorination. Using a two-channel color analyzer from the Seres OL Topaz family allowed the customer to monitor and compare both values accurately and reliably on the same instrument.

The initial color reading, measurement point 1, established a baseline. At this point in the treatment process filtration will have removed most color-causing agents from the partially treated water. Low readings are expected but there can be fluctuations.

After disinfection the water is ready for distribution or storage. The color measurement here is expected to comply with the 15 Hazen secondary drinking standard set by EPA.

The differential of measurement points 1 and 2 allows the operators to determine if fluctuations in the measurement at point 1 were the result in decreased filtration efficiency or changes in the disinfection process. Taken together the measurements provided increased confidence in the treatment processes, delivered improvements in customer satisfaction at the tap, and reduced consumer complaints.

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## Color Monitoring

Color is an important parameter for aesthetic purposes, effecting the appearance and taste of drinking water. Color in drinking water typically results from colored organic substances or natural metallic ions such as iron, manganese and copper. Monitoring and limiting color-forming organic substances is critical due to their potential for formation of disinfection by-products when combined with chlorine.

Another application for color monitoring is identified in industrial manufacturing. Large textile as well as pulp and paper industries are required to analyze the color of the wastewater for removal purposes and effluent monitoring. The wastewater from these manufacturing processes contain high levels of color which can cause environmental problems or impact subsequent public wastewater handling and treatment facilities.

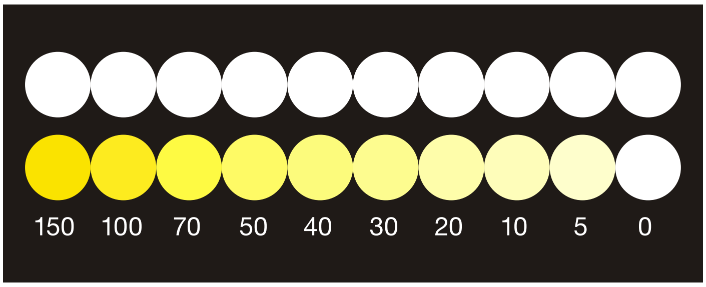


Figure: Visual comparison scale 0-150 Hazen
Source:
http://www.drcalderonlabs.com/Metodos/Analisis_De_Aguas/Analisis_de_%20Color1.htm

Over time, industries such as chemical, oil, plastics and pharmaceutical have developed various criteria to assess the color quality of their products. The description of the yellowish liquids was originally based on the visual comparison with dilutions of a platinum cobalt (Pt-Co) standard solution. A platinum-cobalt solution mimics waters natural color. This color scale is known under three different names: APHA color number Hazen units (HU) and Pt-Co (Cr-Co) color concentration (mg/l). APHA is a yellowing numerical index where each APHA value refers to the dilution of a standard platinum cobalt (Pt-Co) solution of 500 ppm. The scale ranges from zero for colorless distilled water to 500 for a dark amber yellow.

References:
- ASTM D 1209
- BS 5339
- ISO 2211
- DIN EN ISO 6271

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## Seres OL Topaz Color Analyzer

- For the continuous, absorptive online determination of color per ISO 7887 (Pt) / ISO 6271 (Cr-Co) / SO 6271:2015 (Pt-Co)
- Available in separate measuring ranges and measuring units: 0 to 50 (Hazen or mg/l Pt or mg/l Cr-Co) or 0 to 100 (Hazen or mg/l Pt or mg/l Cr-Co) or 0 to 250 (Hazen or mg/l Pt or mg/l Cr-Co)
- Automatic, electrical zero measurement prior to each measurement cycle
- Automatic cell cleaning