

TELEDYNE ANALYTICAL INSTRUMENTS

On-Line Detection of "Rouge" in Water Distribution Systems

The complexity of the rouging process requires that at least two variables be examined: 1) The presence of iron ions (Fe^{2+} or Fe^{3+}) and 2) the detection of iron containing particulates (hydroxides or oxides). In ultrapure water systems, the dissolved oxygen, pH, and temperature are sufficient to convert a majority of the Fe^{2+} into Fe^{3+} and the iron hydroxides into ferric oxide. Furthermore, the ultrapure water environment rapidly converts the free Fe^{3+} into ferric hydroxide or ferric oxide. Therefore, the two most important species to monitor in the process flow are Fe^{3+} and ferric oxide. Monitoring of these two species will help ultrapure water users identify when maintenance of the ultrapure water system is required.

Defining the Problem

Rouging is defined as a thin film, with colors ranging from green through yellow to reddish-brown, of iron oxide or hydroxide on an iron-containing surface. In ultrapure water systems rouging typically appears on stainless steel tubing, vessels, tanks, stills, pump housings, etc.

Rouge, as generally defined, only refers to ferric oxide (Fe_2O_3), but in reality may contain chromium, nickel, and non-oxide iron compounds, which may result in the broad range of colors observed in the pharmaceutical water. In general, rouge is more prevalent on mechanically polished stainless steel, but has also been observed on electropolished and passivated stainless steel.



Iron Oxide, Photo-X VIS, Suited for general purpose areas.

Photometric Transmitters

Teledyne offers a low cost UV or VIS

Photometric Transmitter that optically measures the amount of (Fe^{2+} , Fe^{3+} , or iron oxide in your process water stream.

The Teledyne Solution

Continuously monitoring for the precursors (Fe^{2+} , Fe^{3+}) to ferric oxide formation (Fe_2O_3) can offer customers a means of detecting the onset of "red water" in pharmaceutical water systems. The spectra below show the relationship between different iron species and wavelength.

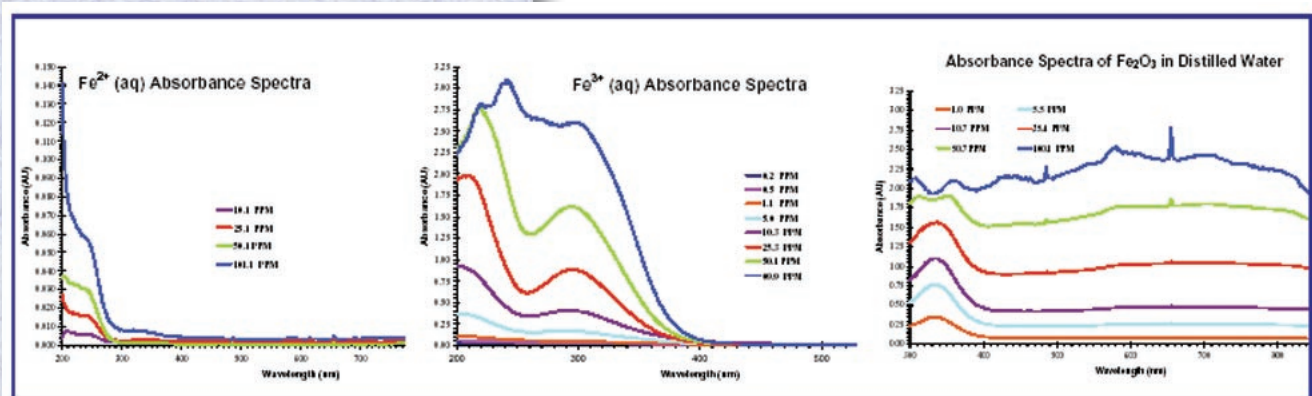


(Fe^{2+} or Fe^{3+} Photo-X UV, Suited for Class 1, Div 1 areas

Monitoring in the UV and Visible regions of the spectrum will provide customers with the ability to manage their passivation activities with a more effective strategy. Additionally, proper placement of the sensor may assist with pinpointing the origin of the problem (weld, impeller blades, piping, etc.).

Benefits of Teledyne's Iron Transmitter

- Continuously monitors the Fe^{2+} , Fe^{3+} or Fe_2O_3 in your process stream and produces output signals proportional to concentration
- 4-20mA range output
- Transmitter electronics separated from Process via fiber optic cables
- Unit is supplied with automatic insertion calibration filter and window fouling circuit



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PRODUCT SPECIFICATIONS

Transmitter

Measured parameter:	Iron Oxide, Iron +2 ion, or Iron +3 ion
Resolution:	0.02AU
Temperature range:	-40 to +300° C
Response time:	< 30 sec
Maximum Zero shift:	0.005AU (over +20 to +40° C)
Long term output drift:	<2% signal loss / year
Repeatability:	1% of range
Light source:	LED (guaranteed 9 year minimum life) or Xenon flash lamp (three year life)

User Display & Control

Type of display:	LED display
Display numerical format:	3-1/2 digits in user defined engineering units

Electrical

Power requirement:	24 VDC (9-32 VDC) If 110 / 220 VAC is available, Teledyne will supply an AC/DC power supply
Power consumption:	0.48 Watts (check with factory for specific unit selected)
Analog outputs:	4-20mA isolated
Analog loop resistance:	500 Ohms, maximum @ 24V
Alarms:	Optional
Certification:	Available upon request

Mechanical

Transmitter weight:	1 lb.
Enclosure:	Extruded aluminum (NEMA 4X optional) 8" H x 3-7/8" W x 1.5" D

Flow Cells

Materials:	316SS or Hastelloy C
Max temperature rating:	315.5° C (600° F)
Max pressure rating:	5000 psig

* Consult factory for specifications on pathlength and any sample handling systems required.

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Warranty

Instrument is warranted for 1 year against defects in material or workmanship. NOTE: Specifications and features will vary with application. The above are established and validated during design, but are not to be construed as test criteria for every product. All specifications and features are subject to change without notice.

