Turbidity: Monitoring Applications

Often Maligned Analysis Gains Widespread Appeal

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Maligned?

- What is an NTU?
  - # particles? No
  - mg/L solids? No
  - optical density? No
  - No direct correlation to a NIST SRM or equivalent standard
  - Formazin standard
  - NTU or FTU has been used no matter the technology …light source/detector arrangement

Maligned?

- Optical measurement dependent on:
  - Particle shape, size, distribution
  - Particle color or darkness
  - Optical properties of water and dissolved matter imparting light absorbing or scattering effects.
  - Bubble interference

Maligned?

- Aren't there better, NIST traceable analyses available?:
  - Particle counters?
  - Particle size analysis?
  - Gravimetric determination of TSS or SSC?
  - Even UV/Vis for %T / Optical Density?
    - Traceable standards
    - Spectrophotometers are all generally the same
      - Not sensitive to very small concentrations of particles

Maligned?

- No detailed industry standard or mandated optical configuration
  - USEPA and ISO design parameters allow for various interpretations or wide enough specifications for inherent differences in sensor outputs.
  - How should one choose a sensor?
    - 90 degree scatter, forward scatter, back scatter?
    - With or without multiple detectors/ratio method?
    - Visible spectrum light source or NIR?

Widespread Appeal

- Relatively inexpensive analyzers for determining low concentrations of very small particles in treated water.
- Expensive technologies aren’t foolproof
- Surrogate for costly, labor intensive sampling and testing.
- Inline and in-situ monitoring provide real time / online analysis.

Widespread Appeal

- Ease of calibration routine
- Ease of sensor manipulation for data collection.
  - External data logger connection
  - Internal data logger
  - Even direct interface with PC for online communication w/ Windows® Hyperterminal

Applications – Water Quality

- Drinking water production
  - In process / treatment - coagulation
  - Source water / plant influent
  - Filtration efficiency
- Wastewater
  - As suspended solids – TSS
    - In process
    - As effluent to surface water

Applications – Water Quality

- Surface waters
  - Light penetration
  - Point source pollution
  - Non-point source pollution
  - Natural erosion
  - Man influenced erosion
  - From acid mine drainage

Applications - Sediments

- Surrogate for suspended sediment concentration
  - Sediment influx, upwelling, transport and deposition
    - Flowing waters and associated discharge points
    - Dredging and drilling operations
    - Beach erosion

Applications - Industry

- Process water
- Dissolution
- Crystallization
- Filtration efficiency
- Waste stream

Applications – Food/Beverage

- Bottled water
- Beer, wine, spirits
- Soda, juice
- Dairy

Applications - Biotech

- Including pharmaceutical, biomedical and bacteriological industry
  - Process water
  - Dissolution testing
  - In-vitro diagnostics
  - Cell culturing

Applications – Non-aqueous

- Diesel fuels
- Chemical processing
- Pulp and paper

Conclusion

- Turbidity monitoring sensors:
  - Are very sensitive water analysis tools
  - Are relatively inexpensive
  - Save time and money from very labor intensive tasks such as sampling and analysis
  - Can be utilized in a wide variety of studies
  - Are used in many non-aqueous applications as a direct result of popularity in water analysis.