Turbidity measurement: Same old problems... no longer

Here are five main reasons why turbidity measurement is challenging, but are issues no longer...

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PTV 1000 series instrument

As one of the key indicators in determining water quality, turbidity can be a complex measurement, especially in low-levels required in drinking water production.

Factors affecting the measurement include the size, shape and colour of the material scattering the light, the sample colour, and the particle size distribution of the material in the sample. These can result in different instruments giving different results on the same sample.

The common causes of variation in readings between instrumentation are well known, but it is worth listing some of them to understand how the new Lovibond® PTV 1000 instrument design sought to overcome each one.

1. Avoiding bubbles

Bubbles are the bane of turbidity measurement. They need not be visible for them to influence turbidity measurement sub 1NTU levels.

Turbidity measurement is carried out by measuring scattered light at 90o to the incident light, and at low levels of turbidity, the detector picks up a very small signal. Hence, the presence of bubbles, especially micro bubbles, can lead to a large amount of noise and the operator's accusation of "variable results".

To eliminate bubbles from entering the measurement chamber, Lovibond® PTV 1000 is designed to incorporate an integrated patented bubble trap mechanism. It uses both horizontal and vertical flow to trap and remove micro bubbles from the instrument prior to measurement.

2. Avoiding issues of glass measurement cells

Any surface contact that comes between the incident light and the detector is not ideal. Benchtop turbidity measurement is inherently prone to error due to defects on the cell caused by cleaning and use, which can cause false positive turbidity results.

So why use them in online instrumentation if you don't need to? Glass cells are prone to scratching and fouling and adding to this is the issue of condensation, a particular problem when using glass cells. Condensation can also affect online instruments when it builds up around the light source.

By submerging the detector into the measurement chamber, the use of glass cells is avoided. In addition, the new Lovibond® instrument also features heated optics to further prevent condensation. This design eliminates the need to use desiccant, something that is often required to minimise condensation in systems with glass measuring cells.

Integrated bubble trap: For cleaning purposes, the bubble trap device is accessible from the front of the instrument

3. Minimising stray light

Another issue which can reduce a well-thought-out instrument design is stray light.

Essentially, light that is detected by the instrument is not associated with the scattering by particles in the sample. Hence, very low-level turbidity measurement is prone to error even with the tiniest amounts of light reflected in the sample chamber.

The PTV 1000 is designed to remove stray light. The shape of the measurement chamber combined with advanced optical features captures stray light and prevents it from reflecting inside the measurement chamber, which eliminates false positive results.

4. Keeping it clean

It may seem obvious but one of the challenges of turbidity measurement is ensuring the sample chamber is kept clean; any surface in contact with water is prone to picking up dirt and microbiological fouling.

Specially designed wetted parts are used and the measurement

chamber design is completely smooth to minimise areas where sediment can build up. Additionally, the easily-accessible measurement chamber allows easy cleaning for operators, which is the key to avoiding contamination issues. No nooks or crannies.

5. Calibration and the hazards of formazin

Turbidity calibration is based around the response of the instrument to formazin, a polymer which has relatively consistent light scattering properties and is the only primary calibration standard available. Every other standard for turbidity instrument is secondary, which relates back to formazin.

Unfortunately, formazin has two major drawbacks: correct preparation of standards is difficult and low-level formazin standards are unstable. Given that drinking water works are below 1NTU, solutions used to calibrate would have to be made up fresh before use.

By using an LED light source, the instrument offers long and stable performance over time. In order to verify the optical system, a solid standard has been developed to enable operators to check their system, but the Lovibond® instrument takes a step further by enabling easy, accurate and safe calibration on the primary calibration solution for turbidity instrumentation, a stabilised formazin.

Due to the difficulties in preparing formazin standards and their instability at low concentrations, experts at Lovibond have developed the TCALplusTM standards. The packaging eliminates common interferences, guarantees accuracy of the diluted formazin and avoids direct exposure to the operator and the polymer. Simply squeeze and manipulate the bag for about a minute and it'll be ready for use – no dilution required. Following calibration, the solution can be completely removed from the sample chamber - all contained for proper disposal.

But that's not all

With over 100 years of skill, knowledge and comprehension of users' challenges, the Lovibond® team of experts has not only overcome many technical issues associated with turbidity measurement, but has also designed it with water treatment works in mind. Some of these are ensuring only small volumes of sample are required to reduce water consumption; easy servicing; and introducing an optional app-based interface to facilitate servicing, enable verification and downtime tracking, hence, allow meaningful reporting and, thereby, saving overall TOTEX costs. WWA

PTV 1000 measure head with intuitive touchscreen (example of possible views)