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Water Quality Monitoring at Water Treatment Plants

Industry: Water treatment plants
Products: Turbidity, Free Chlorine, pH and Conductivity Analyzers (FLXA402T, TB820D, FC800D)

Background

The primary purpose of water purification is to produce safe and clean drinking water by eliminating pathogenic micro-organisms and pollutants such as clay, silt nitrates, pesticides etc.

The Importance of Turbidity and Free Chlorine Measurements

The measurement of turbidity is an important indicator of water quality that will supply valuable information quickly, accurately and continuously. Turbidity can be affected by the presence of microscopic particles such as clay, silt and other fine undissolved matter. These microscopic particles can promote microorganism growth. This growth can harbor pathogens and also inhibit the chlorination process that helps disinfect and maintain purified drinking water in an area – thereby creating potential health hazards.

The presence of free chlorine in drinking water indicates whether sufficient amounts of chlorine were added initially to the water to deactivate the bacteria and some of the viruses, thus ensuring that the water is protected from recontamination during storage.

Therefore, it is an important to measure both for compliance with international regulations and for producing safe and clean drinking water.

Process Overview

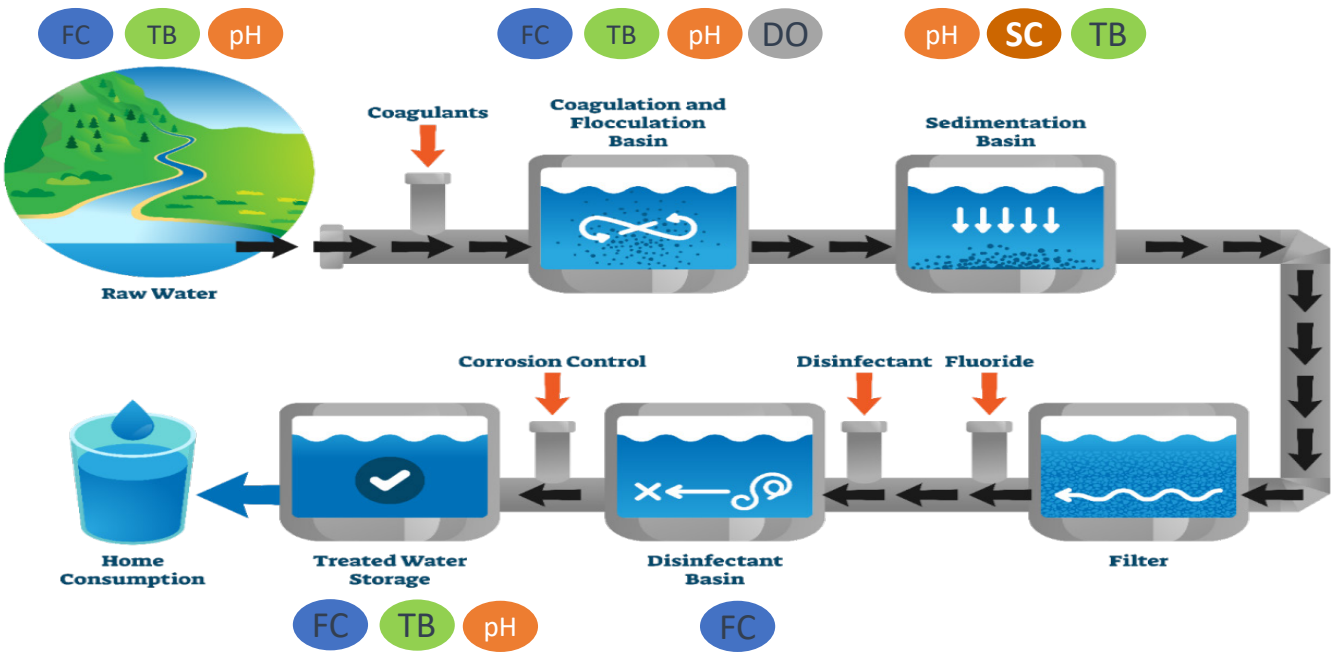
Raw water can be obtained from surface water, reservoirs, underground wells, or seawater. Treatment depends on the quality of the raw water. The turbidity and pH are monitored to indicate the raw water quality. The treatment process starts with the removal of large contaminants such as debris from the raw water.
The second step is known as coagulation. Coagulation is the process of the addition of chemicals to bind the contaminants to form solids. The water is then stirred so that the solids form what is referred to as floc. This step is required to remove particles that cannot be removed by sedimentation of filtration.

The water is then transported to a sedimentation basin where the suspended solids sink to the bottom as sediment, allowing for removal with a mechanical sludge scraping device. Alternatively, a flotation basin can be used where gas bubbles are used to increase the suspended solids' buoyancy. The particles rise and float on the top and are removed mechanically using a skimmer.

The partially treated water still contains fine organic and inorganic materials. These are removed by passing the water through a slow sand filter or a rapid gravity sand filter, at which point all the particles are removed. Still, it is impossible to guarantee the complete removal of all potentially pathogenic microorganisms by sedimentation and filtration. The final step to ensure clean drinking water is disinfection. Disinfection reduces the number of bacteria present to an acceptable level. The most popular disinfection agent is chlorine, although the use of ozone also has become more widespread.

After passing through water treatment, the clean and safe water flows to service reservoirs, which act to buffer variations in consumption over a 24-hour demand period. Distribution mains then take it from the service reservoirs to the consumers. During this distribution and storage, the water quality is monitored using turbidity, free chlorine, and pH. The below graph can be seen when turbidity measurements are used to ensure safe and clean drinking water. Additional water quality measurements like pH and free chlorine are also added.

The diagram, below, shows the locations of measurements including free chlorine (FC), turbidity (TB), pH, dissolved oxygen (DO), and contacting conductivity (SC).



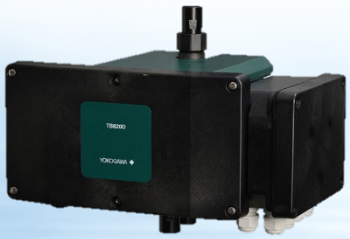
Challenges

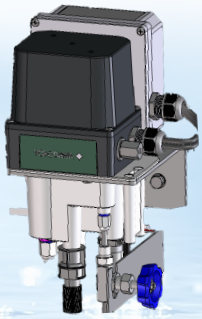
One of the main concerns when measuring the turbidity at water treatment plants is the drift of the measurement value caused by dirt build-up. Additionally, the required maintenance costs combined with the number of units within a plant can be high.

Hypochlorous acid (HClO), Hypochlorite (ClO^-) and Chlorine (Cl_2) are known as "Free Chlorine." The concentration of each of these two forms is determined by the pH of the water it is added to.

The hypochlorous acid has the most disinfectant power whereas hypochlorite is much less powerful.

As pH determines how much of each of these forms will be present, pH is an important factor in making sure the "free chlorine" is an effective disinfectant.





Turbidity Solution

The TB820D is a low maintenance unit with advanced diagnostics. The measuring cell structure has been optimized for easy cleaning and changing of parts. Time to replace the light source has been reduced dramatically and total maintenance time has been reduced by a factor of two-thirds.
This will not only result in a significant reduction of the maintenance and operating costs, but the increased reliability of the measurement will enable more stable and efficient process control. That, in turn, reduces additional costs such as dosing of chemicals and reduction of unexpected shutdowns.
The TB820D ensures the safety and high quality of the drinking water before it is distributed to consumers.

Chlorine Solution

The FC800D is also a low maintenance unit with advanced diagnostics. The measuring cell structure has been optimized for easy cleaning and changing of parts. Motor replacement time has been reduced dramatically and total maintenance time has been reduced by a factor of two-thirds.
The measurement's increased reliability enables more stable and efficient process control, which reduces additional expenses such as dosing chemicals, and reducing unexpected shutdowns.
Additional pH or conductivity measurements can be connected to the FLXA402T analyzer and the FC800D for full control. Those ensure the safety and high-quality of the drinking water before it is distributed to consumers.

Analyzer Solution

The FLXA402T is a Multi-Input/Multi-Parameter Analyzer and is part of YOKOGAWA's SENCOM 4.0 SMART sensor platform.
To facilitate optimal processes and improve personnel efficiency, Yokogawa has placed a strong focus on our Digital SMART Sensor SENCOM 4.0 Platform. This innovative analyzer platform provides full visualization and enhanced process uptime by optimizing maintenance, reducing configuration time, and simplifying in-field maintenance and calibration.

The FLXA402(T) series is a single analyzer that can measure multiple measurements simultaneously, thus reducing CAPEX and OPEX.
The intuitive menu structure, along with easy-to-understand alarm settings and straightforward information on troubleshooting, enable the credibility and reliability of online process measurements.
Real-time diagnostics and a sensor wellness function provide proactive maintenance by predicting the timing for the next maintenance service, sensor or lamp replacement, and early detection of sensor failure.
SMART sensor platform accelerates time-to-value of new technology and provides the flexibility, simplicity, and efficiency to move data and workloads seamlessly on an ongoing basis.

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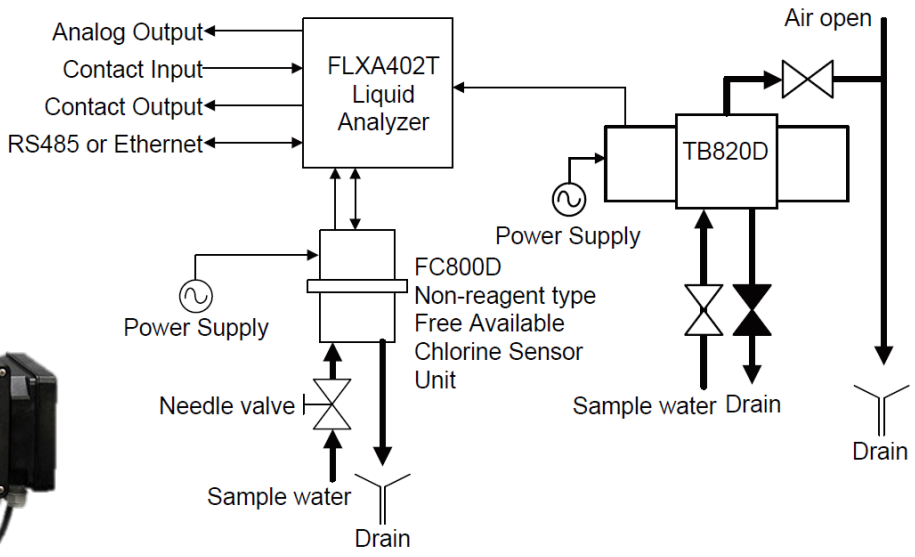
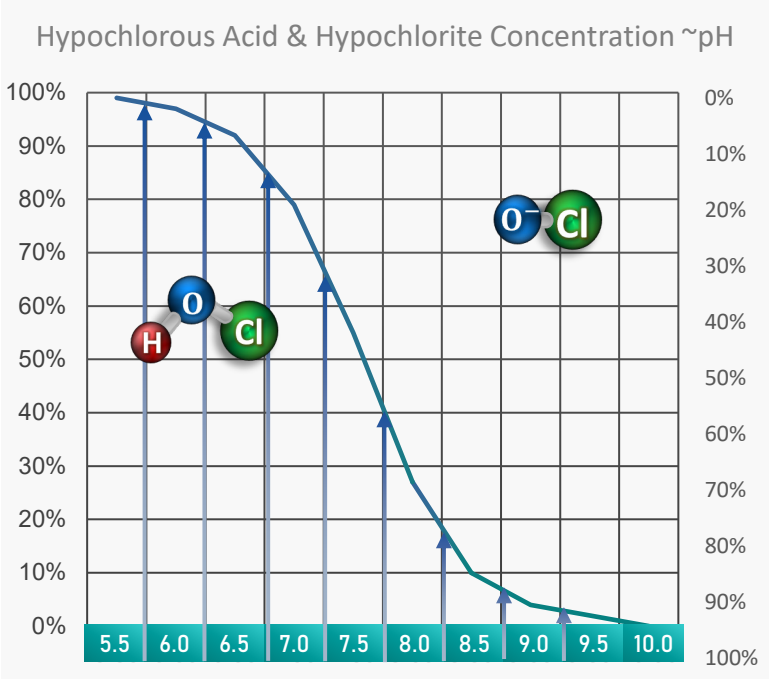
Chlorine and Turbidity 2 in 1 System Configuration



Key Advantages

To produce safe and clean water, essential functions for water purification are:

- Removal of suspended matter and production of clean and colorless water that has no disagreeable taste and odor
- Disinfection of the water so that the bacteria content is reduced to an appropriate level
- Removal of chemicals harmful to health and reduction to low levels of chemicals that might otherwise interfere with domestic and industrial requirements
- Reduction of corrosive properties of the water and protection of the pipe supply system
- Minimizing the amount of material passing into the supply system, which might encourage biological growth.



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