White Paper – Water treatment for beverages and Soft drinks industry

Introduction

Beverage manufacturers and processors face unique challenges in the area of water treatment. Water sources, disinfection processes and treatment residuals can affect the taste and quality of the final product. Government regulations and industry standards can affect treatment technology options. As regulations become more stringent, beverage manufacturers must find ways to meet the new water standards.

Soft drink production starts with a pure source of water. Regular soft drinks contain 90 percent water, while diet soft drinks may contain up to 99 percent water. Drinking water often includes trace amounts of various ions that alter its taste. Bottlers use filtering and other treatment equipment to remove residual impurities and standardize the water used to make soft drinks, so that soft drinks taste the same nationwide.

For many beverage manufacturers, feed water is municipally sourced. Municipal water is treated according to EPA regulations or equivalent.
Health and safety in manufacturing and final product is vital for beverage manufacturers. Beverage manufacturers need to protect their consumers and their own employees.

As with other foods, soft drink beverage ingredients are approved and closely regulated by the U.S. Food and Drug Administration (FDA) or equivalent. Bottled water is also regulated as a packaged food product and must meet all applicable food packaging regulations.. The regulatory bodies are responsible for inspecting, sampling, analyzing, and approving water sources.

Since the chlorine levels in this application are very low (< 0.1 ppm), accuracy, resolution and response time are very important. HG-702 Blue I analyzer is able to provides high resolution, high accuracy and faster response time to changes in chlorine levels. Due to the pre-measurement automated self calibration for each reading the analyzer can adjust to changes in the process and increase system reliability. Likewise, the Blue I analyzer is able to provide measurements for both free chlorine and total chlorine measurements in a single system improving the management of the process.

Beverages and Soft drinks Water Treatment

Water purification system combines media filtration, reverse osmosis (RO), and ultra-filtration.
Typical System Components:

- Sediment and Carbon absorption Filters
- Reverse Osmosis (RO) - designed for medical applications
- Optional Storage Tank - provides continuous loop operation & allows for reduced pretreatment & RO size
- Final Filtration unit

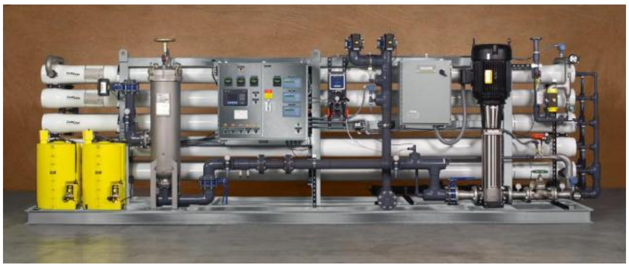
Figure 1: Water Treatment in the Beverage Industry

Beverages and Soft drinks water treatment system components detailed explanation (See figure 2):

Media Filters – Particle filters
Media Filters are used as pre-treatment to membrane systems for reducing the feed water silt density index (SDI) by reducing suspended solids in the 10-20 micron range and above.

Carbon Towers - Carbon Filtration:
Carbon Towers are used for removal of off-tastes, odors, chlorine, chloramines, low molecular-weight organics, and THM's (Trihalomethane. A type of toxic chemical, commonly formed when organic chemicals in water combine with chlorine) through the process of adsorption. Typical design includes manual controls for steam sanitization capability.
Adsorption is the process by which vapor, dissolved material or very small particle adheres to the surface of a solid. Carbon filtration capacity is commonly sized for the empty bed contact time (EBCT) required for removing chlorine and chloramines from the supply water.

Reverse Osmosis System:
Reverse Osmosis (RO) Systems are used for high rejection of monovalent and divalent ions (e.g. alkalinity, sodium, chloride, calcium, magnesium, etc.), viruses, bacteria, and pyrogens. Typical applications include low-sodium and low TDS soft drinks and bottled water.



Storage Tank:
A storage tank should be made of an inert material and opaque in color. It is of a sealed-top/coned-bottom design. The tank has a hydrophobic vent filter to control airborne bacteria from entering the tank.

Final Filtration:
Final Filtration of 0.05-micron or smaller is recommended for bacteria and endotoxin control. The final filter or ultra-filter should be the last component the purified water passes through before going out.

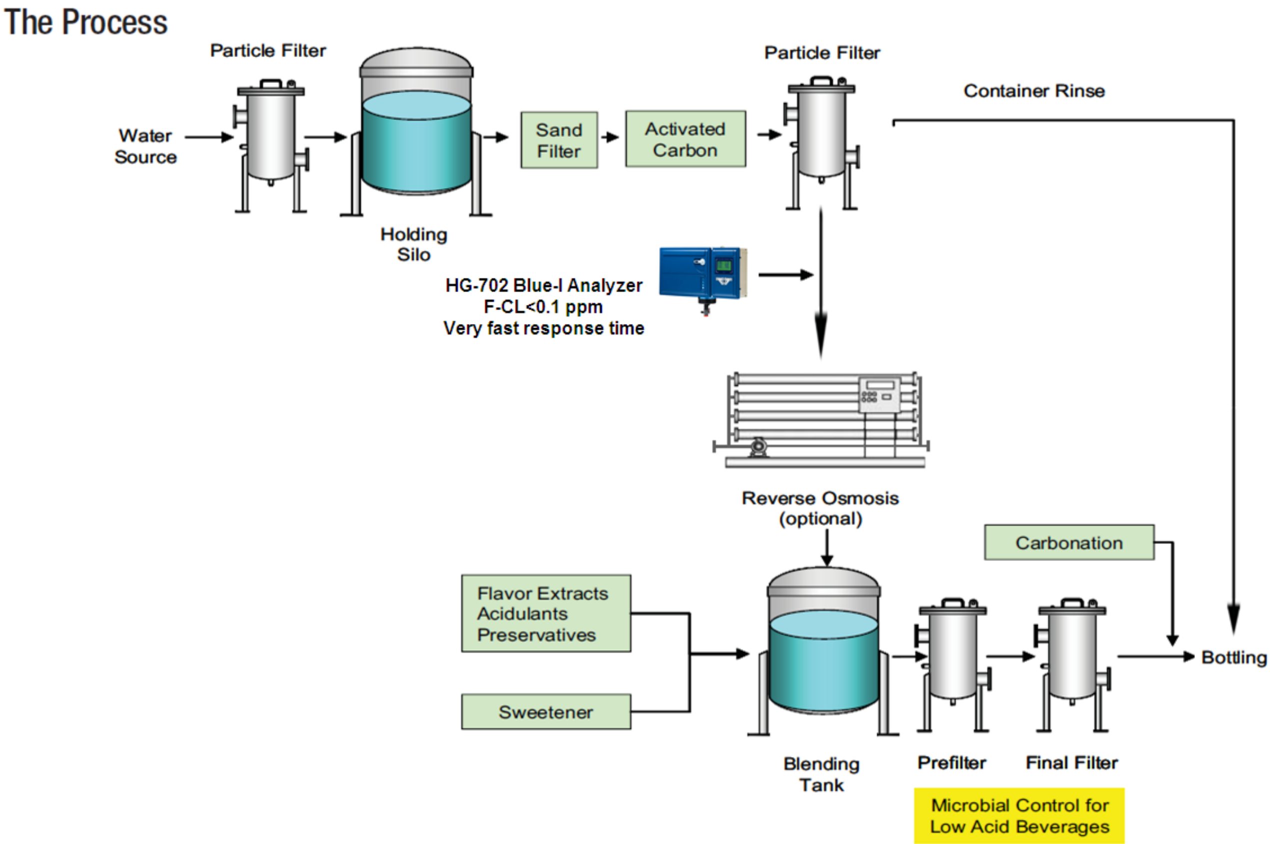


Figure 2: Typical Soft Drink Water Treatment Process

Application Overview

Water supplied to the drinking water bottling and beverages industry goes though several chemical and filtration steps before entering the filling and bottling process. Chlorine is added during one of the initial steps to ensure that the water remains safe and clean; Calcium hypochlorite is the most common chemical disinfectant used in the system. Plants that utilize municipal water sources minimize the use of chemicals by adopting in-line flocculation, eventually using Ion Exchange resins, as carbonated soft drinks require low alkalinity water. Other plants use conventional chemical treatment technologies, eventually adding lime in the reaction tank to achieve the required alkalinity control. Some plants may also require ion exchange to remove individual contaminants, such as boron or arsenic.

However, all of the chlorine must be removed before the water enters the filling and bottling process. The water must be constantly monitored to confirm that all of the chlorine has been removed by the activated carbon filter.

Blue-I Solution:

Technology:

Multi-parameter analyzer based on DPD colorimetric method

Objective:

- Measurement of free and/or total chlorine with high resolution (0.01ppm) and accuracy
- Identify zero level chlorine with high accuracy and repeatability
  - Suited for chlorine measurements in post carbon filter (GAC) water
  - Suited for chlorine measurements in pre RO water

Technology Description:

The method of determining chlorine employed in our analyzer relies on a color indicator, usually N, N-diethyl-p-phenylene-diamine, denoted in its short and known term 'DPD'. In the presence of chlorine, DPD reacts rapidly to form a red color, the intensity of which is an indicator of chlorine concentration. When the absorbance is low it means that the chlorine concentration is low. Though the photochemical reaction is pH sensitive, DPD/chlorine system typically appears in a red color, measured at about 515 nm. At a near neutral pH, the primary oxidation product is a semi-quinoid cationic compound known as a Wurster dye. The DPD Wurster dye color has been measured photo-metrically at wavelengths ranging from 490 to 555 nm.

The analyzer comprise of a novel spectrophotometric measuring cell, useful for automated reagent mixing and for hands free physical cleansing. The measuring cell is characterized by that whereat fluids and/or reagents are filling the measuring tube; they are effectively mixed by to obtain a homogenized solution. In this way, a tedious necessity of manually cleansing routine is thus avoided. A detector is used, which has means to measure the emission of the solution and determine the chlorine concentration with high accuracy and repeatability.

Figure 3: Analyzer schematics

Technology benefits

- Maintenance advantages
    - Very low reagents consumption (~0.03mL/sample)
    - Self calibration and true zero with every measurement without any need for initial calibration
    - Automatic self cleaning photocell by a build in piston in each unit (patent pending)
- Performances advantages
    - Measurement range: 0-10 ppm
    - Measurement interval: 2 to 10 minutes
    - Measurement accuracy (+/- 5%)
- System benefits
    - Six independent relays for equipment control
    - Having means to measure additional parameters such as pH, Redox, conductivity, turbidity and temperature.

Summary

Online automated monitoring of chlorine is essential and critical for water treatment applications for beverages and bottled water.

Since the chlorine levels in this application are very low (< 0.1 ppm), accuracy, resolution and response time are very important. HG-702 Blue I analyzer is able to provides high resolution, high accuracy and faster response time to changes in chlorine levels. Due to the pre-measurement automated self calibration for each reading the analyzer can adjust to changes in the process and increase system reliability. Likewise, the Blue I analyzer is able to provide measurements for both free chlorine and total chlorine measurements in a single system improving the management of the process.

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