

Online Measurement Ensures Drinking Water Quality

Problem

The Langelier Saturation Index indicates the potential of drinking water to cause scaling or corrosion in a pipeline distribution network. Such events pose a challenge to the water quality at Sydsvattens Vomb drinking water treatment plant. Lack of correlation between simple online hardness monitoring and actual alkalinity concentration requires manual analysis and manual adjustment of process settings to maintain optimal operations at the plant.

Solution

Sydsvatten has tested and validated the EZ4004 Online Alkalinity Analyzer to automate process control and maintain stable alkalinity values in its drinking water. The analyzer provides 24/7 online results for alkalinity calculated as HCO_3 and ensures the correct dosing of softening chemicals based on actual online values after the softening process.

Benefits

The EZ Analyzer has provided stable online monitoring of alkalinity over a long period of time, allowing accurate calculation of values of the Langelier Saturation Index. As a result:

- The risk of corrosion/scaling is reduced significantly;
- Chemical dosing is under better control;
- Manual lab measurements are under better control.



The operational area of Sydsvatten stretches over a large area in southern Sweden.

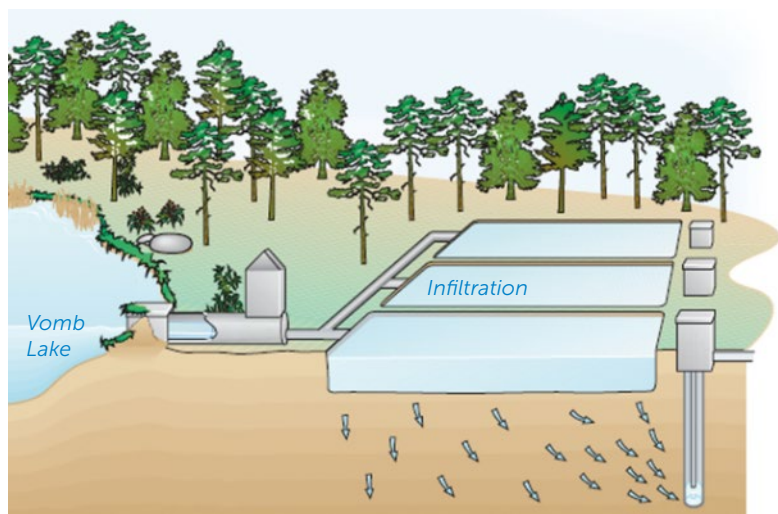
Background

Sydsvatten AB is a municipally owned drinking water company producing drinking water for 900,000 inhabitants in the region of Skåne, south Sweden, and ultimately distributes to 17 joint owner municipalities. Sydsvatten's first priority is to ensure the water quality to consumers. To accomplish this, Sydsvatten works to establish water protection areas in order to increase the protection of raw water sources. The establishment of redundancy of both raw water and drinking water in the whole of Sydsvatten's supply system is an ongoing process.

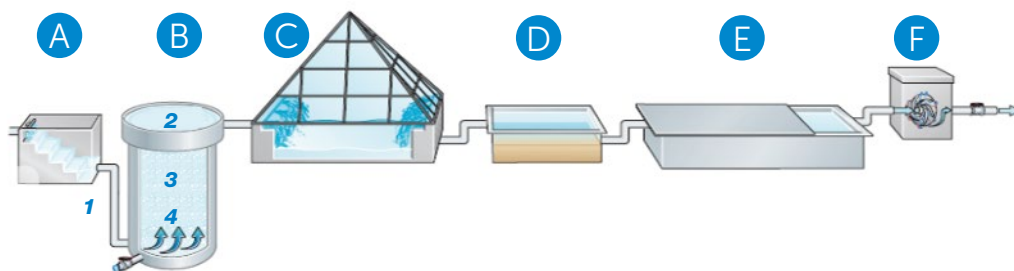
Sydsvatten currently takes raw surface water from two lakes in southwest Sweden: Lake Bolmen and Lake Vombsjön, with nearby Lake Ringsjön as a backup. To reach a sustainable supply of water in the future, water from Lake Bolmen will also be utilized at the Vomb Plant. This is a decision of great strategic importance for the future.

Drinking water treatment involves many control parameters, some related to public health, and others which are product/taste related, such as iron and manganese. One final production parameter often controlled by drinking water companies is the alkalinity of the produced drinking water. Not only does alkalinity affect the taste of drinking water, it is also important to the Langelier Saturation Index (LSI) of water being transported towards their customers. The LSI describes the tendency of water to cause calcium carbonate scaling or corrosion in pipeline networks, and is directly affected by the content of calcium-based salts in the water. In order to get this parameter under control, reliable monitoring of alkalinity is required.

Alkalinity in Drinking Water

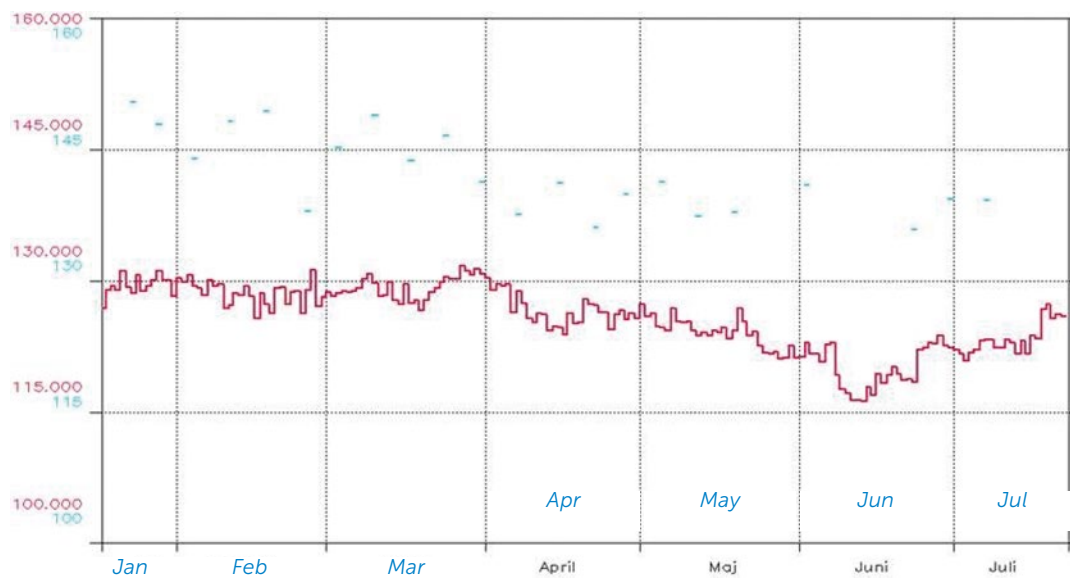


Artificial groundwater infiltration



Drinking water production process

- | | |
|------------------------------|--|
| A Aeration | 1 NaOH |
| B Softening reactor | 2 Softened water |
| C Mixing chamber | 3 Granules of precipitated lime |
| D Rapid sand filters | 4 Hard water |
| E Water reservoir | |
| F High pressure pumps | |



Data trend of the online analyser (red) and spot lab measurements (to be divided by 1.22)

Situation

At the Vomb water works, raw water from Lake Vombsjon is 'filtered' through a natural ground water storage basin and produced as if it were a normal ground water production setup. This process is called artificial groundwater infiltration.

After the water has been taken in from one of 114 wells, it is aerated to remove naturally occurring iron and manganese. After aeration, the water is treated in the softening reactors where the goal is to remove the naturally occurring calcium salts which cause alkalinity and hardness. This is done by adding sodium hydroxide so that calcium ions can be precipitated as lime on the grains of sand in the softening reactor. The softened water is released on top of the reactors.

To get better control of the process, Sydsvatten added an alkalinity analyzer to its online measuring array which already included a hardness analyzer. This existing online hardness measurement was not proven to be sufficient, as the hardness remains stable over time while alkalinity fluctuates significantly. Given that the alkalinity in this water is also caused by added hydroxides, it requires a more robust titration setup. This was achieved by using the EZ4004, which measures alkalinity in a chemical titration, titrating down to pH 4.3, and expressing values in mg/L CaCO_3 .

Sydsvatten prefers to use HCO_3 over CaCO_3 , as this is more convenient for their chemical dosing program. To cover for this difference, a factor of 1.22 is built in to correlate based on molar mass. These conversions can easily be done in the panel PC of the EZ Analyzer, which allows a user not



Aerial view of Vomb waterworks



Softening reactors at Vomb waterworks



Installation of the EZ4000 Total Alkalinity Analyser at Vomb waterworks

Conclusions

- Sydsvatten tested and validated the EZ4004 Total Alkalinity Analyzer on its Vomb waterworks in a range between 130 and 150 mg/L CaCO_3 for well over a year. Output data of the analyzer in Calcium Carbonate (CaCO_3) is confirmed by manual lab measurements and converted to Hydrogen Carbonate (HCO_3) using a stable chemical factor, so that the output data can be used to control Sydsvatten's drinking water production process safely.
- A change of process control at the plant is upcoming; the use of manual data for process control will be changed to automated control using online measurement values. This will result in a far more stable and safe operation.
- Successful operation of the EZ4004 Total Alkalinity Analyzer at the Vomb waterworks has convinced Sydsvatten to purchase a second EZ4004 Analyzer for operation at the Ringsjo plant, where ranges will be between 30 and 50 mg/L CaCO_3 .

Images and illustrations courtesy of Sydsvatten.

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