Instran®

Online measurement of boron in desalination plants. Instran ® Online Analyzer

Boron for health

The concentration of boron in drinking water is controlled because a high consumption is harmful to health and can even be lethal. Directive 98/83/EC therefore established a concentration limit of 1 mg/L. Subsequently, Directive 2003/40/EC no longer sets any limit for boron, and the limits are set by the countries themselves, based, inter alia, on the recommendations of the World Health Organisation. The World Health Organisation initially set a limit of 0.5 mg/L (2008), which was increased to 2.4 mg/L in the document '*Boron in Drinking-water. Background document for development of WHO Guidelines for Drinking-water Quality'*. However, there are still many countries that set the regulation below 1 mg/L.

Boron in water

Boron is mainly present in brackish water, in concentrations of 4 to 5.5 mg/L, the content being higher in seas with high salinity. These are seas with very warm climates, such as the Red Sea, the Persian Gulf, the Eastern Mediterranean Sea or the Caribbean Sea.
This is why desalination plants are subject to an obligation to reduce the boron concentration before they can supply drinking water to the public supply system.

Boron removal in saline water

Boron is usually found as borate ion or as a more neutral complex such as boric acid. Reverse osmosis (RO) membrane treatment is efficient for the removal of borate ion, but is less effective if it is found as boric acid. By adjusting the pH, one substance will be converted into another, and 60-90% of the borate content can be removed. In turn, temperature is another parameter on which removal depends, since the higher the temperature, the lower the removal capacity.
There are two possible processes to remove the boron content:

A. 2-stage reverse osmosis: caustic soda is dosed to adjust the pH and it is possible that, depending on the inlet and outlet conditions, a second stage may be necessary to reduce the content.

B. Reverse osmosis + ion exchange resin: in this process up to 98% of the boron content can be removed under optimal conditions. The resin used will be automatically regenerated by the addition of caustic soda and subsequently hydrochloric acid.

Benefits of boron concentration monitoring

Knowing the boron concentration online has several advantages, the main one being the economic aspect. Having an analyzer that controls the concentration after the first stage of reverse osmosis makes it possible to regulate the by-pass flow that will be necessary to separate for a second process, saving money due to the high energy

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consumption if method A is used or the wear of the resins (and consequent dosing of NaOH and HCl) if method B is followed. In addition, knowing the concentration of the element at the beginning of the process allows for better control of the plant and monitoring of the first reverse osmosis process, thus avoiding that due to a malfunction the concentration of boron is not correctly eliminated and all the water is wasted. Finally, knowing the values at the end of the different processes allows compliance with current legislation.

Boron Analyzer - Instran ®

One of the main handicaps of online boron measurement at ppm levels is the Azomethine reagent. This reacts with boron to produce a colour proportional to its concentration. The **reagent has to be kept at a temperature of 4°C**. Furthermore, this reagent is very sensitive to temperature and light and can degrade in just a few minutes.

The Instran® analyzer allows the incorporation of a refrigerator that **maintains the temperature of the reagent**. On the other hand, the reagent that remains in the tube, but outside the refrigerator, can easily degrade between two consecutive analyses, losing efficiency and providing poor precision and repeatability in the measurement. However, the innovation of the Instran® analyzer allows the **reagent that is introduced into the measuring chamber to always be fresh**, **ensuring repeatability and precision in the measurement**.

This is how the Instran® boron analyzer allows reliable and accurate results to be obtained for the control of boron in the plant, optimising the boron elimination processes, either by a second osmosis process or with ion exchange resins, and as a final consequence, **the economic savings derived from this optimisation**.

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