EXPLORE THE POSSIBILITIES

Online Analyzer Solutions for Desalination

Desalination Latin America: Why it matters to Hach

According to the International Desalination Association, an estimated 18,000 desalination plants are spread across 150 countries, with reverse osmosis being one of the leading membrane-based technologies to remove dissolved salts and other impurities from oceanic or underground sources.

Desalination plants, by definition manufacturing facilities, are continuously trying to improve performance or efficiency. The major operational issues of today's desalination facilities involve day-to-day monitoring of the complete process and careful preventive maintenance.

Hach designs and builds a full range of on-line water analyzers that can be used to achieve process transparency at all stages of the desalination process, particularly for sea water reverse osmosis (SWRO).

We invite you to take a closer look at our latest developments in this area, either in this newsletter or on our website

es.hach.com.

With analytical regards,

Hach

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Read more:

Discover the on-line analyzers suite at es.hach.com/ezseries

PRODUCT NEWS

Explore EZ 7300: EN

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EZ 7300: Fast assessment of microbial ATP for preventing biofouling in RO membranes

Using the well-known firefly assay, the EZ 7300 On-line Microbiology Analyzer is a unique alternative to current manual analysis methods for assessing microbiology in water, providing timely and accurate data.

In membrane type of desalination systems, controlling biological fouling in reverse osmosis (RO) at an early stage is very important for successful and efficient operation. Standard procedures or methods to monitor and predict biological fouling of RO membranes focus on controlling the AOC (Assimilable Organic Carbon) of the feed water, as it is directly related to the bacterial growth potential of the water.

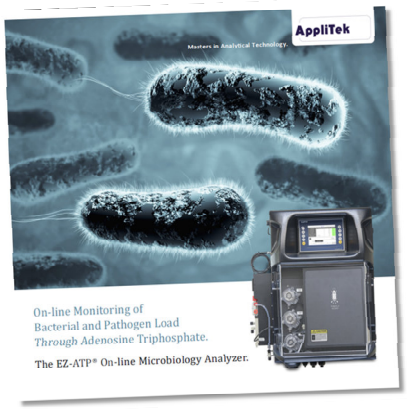
As microbial nuisance is ubiquitous, ATP (adenosine triphosphate) testing has become a popular alternative to time-consuming lab methods. However, the use of this promising method has its limits for sea water desalination. Current methods for ATP measurement are not applicable in sea water as the salt levels substantially reduce the luminescence during the enzymatic luciferase-luciferin reaction.

The newly developed **EZ 7300 Series** use proprietary enzymatic reagents from ATP experts **Promega**, that show superior stability without interference from salts present in sea water. On top of that, the quantification of the different ATP portions —total, intracellular and free ATP— allows to follow closely abnormalities in microbial levels and biocide programs.

The **EZ 7300 Series** are designed as automatic on-line analyzers to assess microbial contamination in a production area or treatment facility where the sample is presented to the analyzer from a pressurized line. In addition, the grab sample option allows laboratory staff to use the analyzer as a benchtop instrument and run samples manually.

EZ 7300 Series in 7 key features

- Complying with ASTM D4012-81 standard test method
- Detection of intracellular, extracellular and total ATP
- No bias from the composition of the growth medium such as with plate counting
- Rapid measurement: 10 - 15 minutes
- Low cost of analysis relative to a large number of results
- Low limit of detection (LOD): 0.05 ng/L (0.1 pM) ATP
- Low maintenance, easy replaceable Promega reagent kit



More Information

Download your copy of the technical brochure and find out more about the EZ 7300 On-line Microbiology Analyzer

Overview

Monitoring and control of water chemistry and biology in sea water desalination

Today's analytical technology can be used to monitor the water quality throughout the whole desalination process, from the raw water intake to the distribution of the finished product, the potable water. Monitoring and controlling critical process parameters contributes to process transparency and facilitates smart water management in your operations. The scheme below gives an overview of all the possibilities for implementing Hach on-line analyzers.

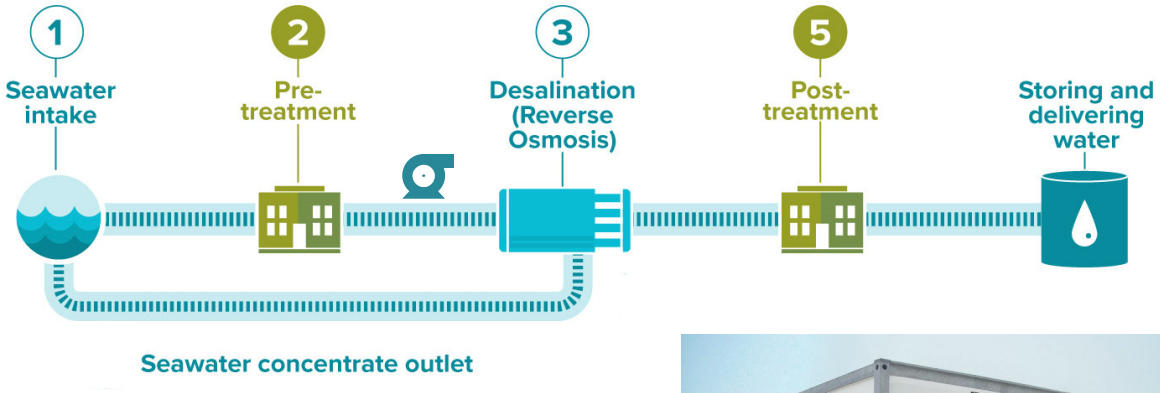


Image:

Desert-proof analyzer shelter commissioned for a major customer in Saudi Arabia.

1 Sea water intake

Naturally occurring constituents in sea water are often present in such quantities that they require additional actions for removal in the desalination process, in order to meet quality requirements for human consumption. Unwanted residues or byproducts can result from the carryover of these constituents to the RO stage.

Parameters of interest: pH, conductivity, TDS, salinity, bromide, bromate, boron

5 Post treatment

The quality of the distributed water is of paramount importance as it concerns human health. Drinking water quality criteria require often a large set of physico-chemical and biological analyses which are conducted prior to distribution by the local authority.

Parameters of interest: pH, chloride, manganese, iron, fluoride, nitrate, aluminium, hardness, boron, total chlorine, free chlorine, monochloramine

2 3 Pretreatment - feed water

Feed water pretreatment in desalination facilities is necessary to improve the quality of the feed water to the level of reliable operation of the RO membranes. Uncontrolled fouling or clogging of the membranes leads to increased maintenance, higher energy costs and a short membrane life.

Parameters of interest: pH, conductivity, TOC, hardness, alkalinity, silica, sulphate, ATP

Process: Pretreatment

Scaling and membrane life issues: Solutions for smart water management and feed water pretreatment in desalination.

Feed water pretreatment in desalination facilities is necessary to improve the quality of the feed water to the level of reliable operation of the RO membranes. Uncontrolled fouling or clogging of the membranes leads to increased maintenance, higher energy costs and a short membrane life, leading to a significant increase in recurring operational costs. On-line monitoring of both chemical and biological key parameters allows you to take your process to the next level, while cutting back on unwanted expenses.

Total hardness - Alkalinity

Total hardness levels can be an important water quality index in the feed water chemistry, as well as for finetuning the dosing of antiscalants. Often conductivity sensors are used to monitor the saturation point of the feed water. Although conductivity does correlate to the level of all dissolved solids, it cannot provide a exact concentrations of calcium and/or magnesium ions. The Hach **EZ 1000 Series** can be employed for determination of hardness levels, with specific measuring ranges (ppb/ppm) and corresponding standard methods. If desired, hardness analysis can be combined with alkalinity in one single **EZ 5000** (*see image above*). Alkalinity values can come from carbonate or bicarbonate ions, and can also be indicative of increased scaling risks in reverse osmosis.

Silica - Sulphate

Silica can be a critical parameter in the performance of a RO system. Silica forms hard and difficult to remove silica deposits which are difficult to remove from the membrane surface. Silica scaling occurs when the concentration of dissolved silica exceeds the solubility limit at the temperature and pH of solution. The silica configuration of the **EZ 1000 Series** (*see image above*) is optimized for measuring Si in pure waters, by means of a sensitive colorimetric measurement using a molybdate solution.

Sulphate is naturally present in sea water and may lead to precipitation of calcium, strontium or barium salts. Monitoring sulphate levels by means of the **EZ 1000** improves control over potential scaling risks and decreases overuse of antiscalants, saving on operational costs.

Process: Pretreatment

ATP

TOC

Bacterial load by ATP

Measurement of bacterial load by means of ATP (adenosine triphosphate) is a promising method to control biological fouling of the membranes and to finetune biocides programs. ATP is a high energy molecule found inside and around living cells used to activate biological functions. The **EZ 7300** (*see image above*) uses proprietary ASTM compliant technology to measure levels of free and intracellular ATP, data that can be used to interpret the presence of viable biomass.

For more information, please refer to page 2 of this newsletter.

Total Organic Carbon

Total Organic Carbon analysis is classified as a non-specific analysis method to determine the organic compounds in water. Its inherent accuracy and speed, combined with a low cost of ownership make it a preferred analysis method for process applications. Field-tested for many years in a wide range of applications and environments, the compact **EZ 7100** (*see image above*) uses a discontinuous analysis cycle to economize on reagents and is a fast method to measure organics in dirty to pure waters.

Short specifications

Total Hardness/Ca/Mg	Alkalinity	Silica	Sulphate	Total Organic Carbon	ATP
Conform with APHA 2340 (C)	**Conform with** APHA 2320 (B)	**Conform with** APHA 4500-SiO2 (C)	**Conform with** N.A.	**Conform with** ISO 8245 USEPA 415.2	**Conform with** ASTM 4012-81 ("firefly assay")
Measuring ranges Several ranges available	**Measuring ranges** Several ranges available	**Measuring ranges** 0 - 100 µg/L Si 0 - 1000 µg/L Si	**Measuring ranges** Several ranges available	**Measuring ranges** Several ranges starting from 0 - 5 mg/L C	**Measuring ranges** 0.5 - 200 pg/mL ATP
Detection limit ≤ 5 µg/L / Depending	**Detection limit** Depending	**Detection limit** ≤ 0.1 µg/L / ≤ 1 µg/L	**Detection limit** ≤ 0.25 mg/L	**Detection limit** ≤ 250 µg/L	**Detection limit** ≤ 1 pg/mL
Cycle time 10 minutes / 15 minutes	**Cycle time** 10 minutes	**Cycle time** 10 minutes	**Cycle time** 10 minutes	**Cycle time** 10 minutes	**Cycle time incl. lysis** 10 - 15 minutes

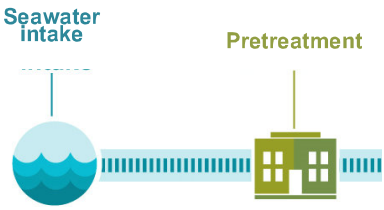
Boron and bromide monitoring in sea water reverse osmosis

Naturally occurring constituents in sea water are often present in such quantities that they require additional actions for removal in the desalination process, in order to meet quality requirements for human consumption. Boron and bromide are typical examples of these and can leave residues in the end product, the tap water, or generate unwanted byproducts further downstream the process.

Bromide

Sea water has an average concentration of dissolved solids of 35,000 mg/l, with bromide levels ranging up to 80 mg/L. Bromide is a particular concern in this case, since disinfection by chlorination will not only lead to the formation of bromate, but also other carcinogenic byproducts such as trihalomethanes (TMHs). Even high rejection rates for bromide in the SWRO system will lead to carryover of bromide to an order of 1 or several milligrams per liter of bromide in the finished water.

While on-line water analyzers can provide us transparency on bromide/bromate levels, pH, conductivity and turbidity can serve as basic instrumentation for the raw water intake. Our **Application department** offers personalized advice on the right analytical solution for your application.



Boron

The requirement for low boron levels in drinking water presents a challenge to SWRO systems. Boron levels after single-pass RO often exceed the guidelines imposed by the WHO (< 0.5 mg/L), Often additional costs such as special membranes are associated with its removal. Unlike most elements in sea water, boron is not ionized at neutral pH, which makes it particularly difficult to remove by reverse osmosis. The borate ion, however, is much better for removal but is only possible at higher pH (> 9.2) requiring the use of multi-pass systems. Therefore it is recommend to monitor on-line boron levels to optimize the boron removal.

Boron can also be measured in post treatment (*see page 7*) as a water quality index, in addition the routine lab measurements on chemical and biological parameters.

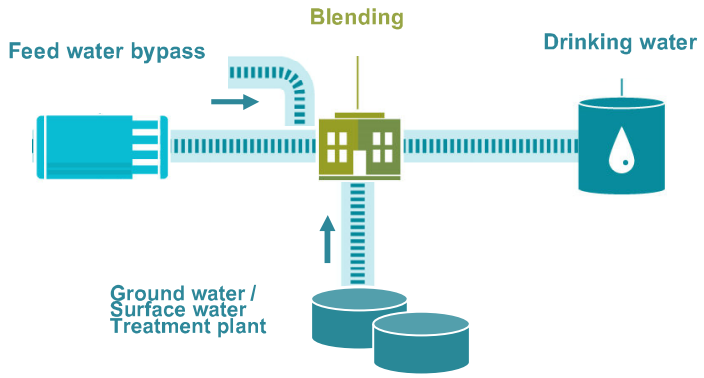
Post treatment

Explore EZ 1000: EN

Explore EZ 1000: ES

EZ 1000 Series: Focus on disinfection issues and water quality

The quality of the distributed water is of paramount importance as it concerns human health. Drinking water quality criteria require often a large set of physico-chemical and biological analyses which are conducted prior to distribution by the local authority. On-line water quality monitoring complements routine laboratory tasks, with target parameters that empower operators to focus on their process with their typical water chemistry.

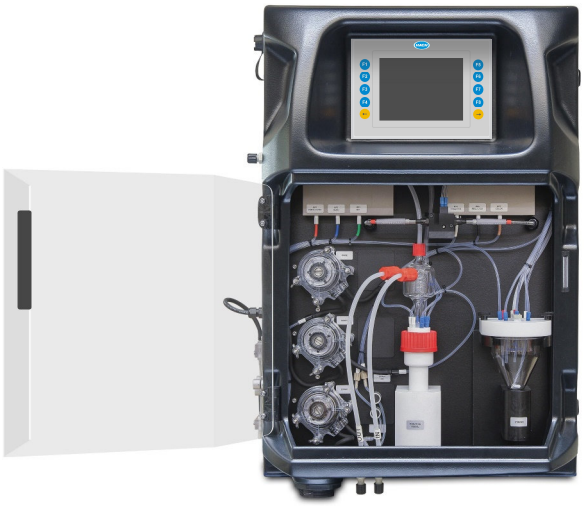


Scheme:

Remineralization of the RO permeate through injection of specific minerals and/or blending with treated ground water or surface water. A small amount (1 - 10%) of feed water is sometimes bypassed to adjust for taste.

Disinfection by chlorination

Chlorination is one of the essential steps to achieve safe water and commonly used in post treatment. Disinfection by chlorine, however, produces several byproducts known as DPS including trihalomethanes. Chloramine can be used as an alternative biocide by adding ammonia but requires a specific ratio of ammonia to free chlorine, which can't be controlled by the measurement of free chlorine or even free ammonia alone. For this reason AppliTek developed a special configuration of the **EZ Series**, combining all critical parameters total chlorine, free chorine and monochloramine, which permits to keep control of the correct ammonia : chlorine ratio. If necessary, analysis of ATP values by **EZ 7300**) allows to control microbial nuisance similar to the feed water pretreatment stage.



EZ Series Free Cl, Total Cl + Monochloramine

Blending and remineralization

Prior to distribution, desalinated water (RO permeate) needs to be stabilized by blending with ground water and even specific minerals that are injected, in order to replenish the loss of electrolytes and essential trace elements during the desalination process. Hach is your trusted resource for a large portfolio of water analyzers to control a number of **target parameters** of the fresh water: chloride, manganese, iron, fluoride, nitrate, aluminium, hardness, boron (by **EZ 1000 Series**), in addition to the routine lab measurements.