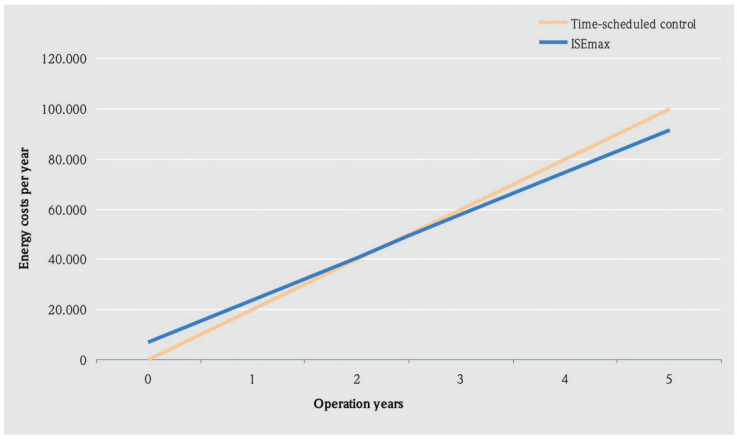
In Control of Nitrification and Denitrification with Continuous Ammonium and Nitrate Measurement

Endress+Hauser's new ISEmax CAS40/CAM40 system for measuring ammonium and nitrate is based on potentiometric measurement with ion-selective electrodes. It makes the processes of nitrification and denitrification transparent particularly in the area of wastewater treatment. It also visibly reduces the costs for power used in aeration systems.

ISEmax measures the concen-tration of ammonium and nitrate quickly and continuously in mu-nicipal waste water treatment plants. The very robust in-situ measurement takes place di-rectly in the process, with several parameters being measured simultaneously with one sensor. A distinguishing feature of ISEmax is its short response time. The rapid trend display sup-ports the early control and regulation of the processes. The unit is easy to use: the measuring system does not use any chemicals, is low-maintenance and does not require external sampling. Furthermore, integrated automatic compressed-air cleaning prevents the membranes from fouling.

ISEmax covers a large measuring range:

- Ammonium-nitrogen: 0.1 - 1000 mg/l NH4-N
- Nitrate-nitrogen: 0.1 - 1000 mg/l NO3-N



Depending on the size and type of the plant, the ROI is reached after approximately two years.

Typical applications in municipal waste water treatment plants include measuring the concen-tration of ammonium and nitrate directly during sludge activation, measuring the ammonium (pH-compensated) load in the inlet to sludge activation, and load-dependent aeration control.

Up to three ion-selective electrodes simultaneously measure ammonium, nitrate and other measured variables, like potassium, chloride or pH, if required by the customer. They exhibit easily replaceable membrane caps which are selective for the ion to be measured. A membrane kit with easy-to-use replacement caps is also available as an accessory. The innovative mem-branes are very robust and can be used for up to six months. Thanks to the integrated compressed-air cleaning system, they are kept free from fouling and contamination and are thus always operational.

ISEmax used in the activated sludge basin of a municipal waste water treatment plant.

The municipal waste water treatment plant ARA Region Luzern (Switzerland), with 170000 PE aimed to optimize the aeration process. Therefore the plant was equipped with four ISE-max systems to measure ammonium and nitrate in each aeration basin. The installation of the new measurement equipment leads to a higher degree of automation, better reproducibility of the measured values and lower costs. With the concerted combi-nation of measuring devices, the customers save costs for energy and staff as well as for public charges. E.g. a waste water treatment plant for 10000 PE pays in Europe 20000 Euro/year for energy costs of the blower system. The cost savings with ISEmax account 4000 Euro which means savings of approximately 22 tons of CO_2. The diagram shows that the ROI is reached after approximately two years.

The ISEmax sensor consists of ion-selective electrodes and a reference electrode which are installed in an immersion assembly with automatic compressed-air cleaning and a pre-amplifier

Membrane caps that are quick and easy to replace are available as an accessory kit.

Info box:

Potentiometric measurement using ionselective electrodes is performed similar to pH measurement: as a result of charged ions "migrating", a pot-ential difference occurs between the measuring electrode and the reference electrode. This difference in potential is measured and is proportional to the ion concentration.

Measuring principle in detail

The heart of the ion-selective electrode is a membrane which is selective for the particular ion to be measured and where ionophores are stored. These ionophors facilitate the selective "mi-gration" of the ions to the inside of the electrode and this change in charge causes an electro-chemical potential - which is in proportion to the ion concentration - to be built up via the membrane. The potential is transmitted to the metal lead of the electrode by means of the inner electrolyte and measured against a separate reference electrode with a constant potential. The difference in voltage is then converted to a substance-specific concentra-tion using the Nernst equation.

In this measuring principle, the color and turbidity of the measuring solution does not affect the measurement result. Since the ISE is immersed directly into the meas-uring solution and exhibits rapid response behavior, the measuring system responds very quickly to changes in the concentration. The measuring signal and concentration of the measuring ions are directly related over a very broad range in such a way that these systems can cover a very wide measuring range.

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