ARIONEX water treatment

ZERO WASTE

WATER DEMINERALISATION

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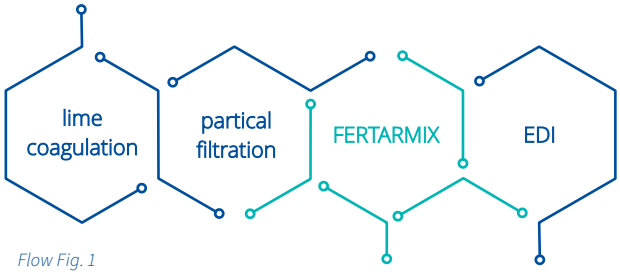
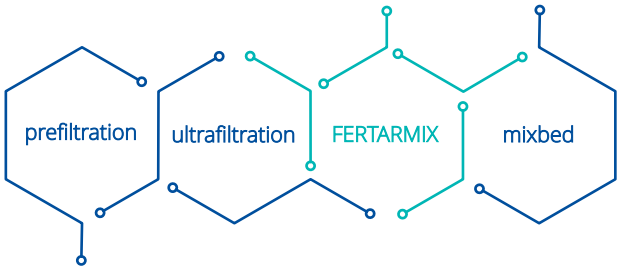
An electrodeionisation plant, 5 x 100 m³/h

PROCESS

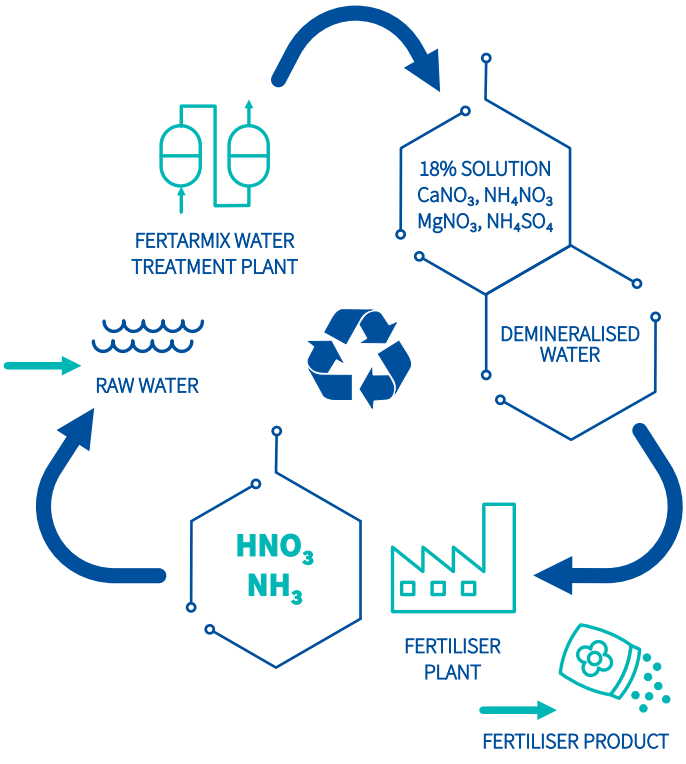
The FERTARMIX process is similar to the conventional ion exchange process. It involves cation and anion filters, chemical regeneration stations, tanks for water, chemicals, and end products. FERTARMIX uses pre-treated water, which can be done in different ways: conventional sedimentation and filtration technologies, or membrane ultrafiltration technology. The quality of water produced with FERTARMIX is 5–30 µS/cm, which usually is not sufficient for the use as a feed water for high-pressure boilers, so final water treatment is done using the MIXCAT ion-exchange mixed technology (regeneration with HNO_3 and KOH) (*see Fig. 2 for a flow example*), or the electrodeionisation (EDI) technology (concentrate from EDI is recycled in the process) (*see Fig. 1 for a flow example*).



Flow Fig. 1



Flow Fig. 2



HOW DOES IT WORK?

The cation resin, loaded with Ca, Mg, Na, etc., is regenerated with 50–60% HNO_3. The cation resin regeneration effluent with HNO3 excess is neutralized with NH_3 and the resultant 15–18% TDS solution containing mainly NH_4NO_3 and small amounts of $Ca(NO_3)_2$, $Mg(NO_3)_2$, $NaNO_3$, etc., is sent for recovery to the complex fertilisers plant. The anion resin, loaded with SO_4, Cl, NO_3, HCO_3 etc., is regenerated with 15–20% NH_3. The anion resin regeneration effluent with NH_3 excess is neutralized with HNO_3 and the resultant 18–22% TDS solution containing mainly NH_4NO_3 and small amounts of $(NH_4)_2SO_4$, NH_4CL, NH_4HCO_3, etc., is also send to the complex fertilisers plant.

An Arionex demineralisation plant, 950 m³/h

The new Arionex FERTARMIX "zero discharge" ion-exchange demineralisation process produces high quality demineralised water through desalination of pre-treated surface water. For environmental and economical reasons, instead of being discharged to the environment, the effluents from demineralisation are used in production of complex mineral fertilizers as raw material.

ECONOMICAL ISSUES

Compared to the conventional ion-exchange process, FERTARMIX offers a significant degree of cost-efficiency, because regenerating chemicals NaOH and HCl or H_2SO_4 are substitute to NH_3 and HNO_3, which are collected and reused in fertiliser production after the process is completed. That way, such a plant would pay off in 1 to 3 years. Compared to the reverse osmosis process, which produces 20–25% concentrated salt wastewater, FERTARMIX does not produce any wastewater at all.

The pilot plant

CUSTOMERS

The process could be easily implemented in fertiliser plants, as they have or can adjust their production sites to use regeneration effluents containing more than 50% nitrogen compounds. Other customers should either make their own fertilisers/liquid fertilisers, or have a possibility to cooperate with fertiliser plants.

HOW WE CAN WORK?

In order to test the FERTARMIX process with different water compositions, a research pilot plant (*see the photo above*) was installed at ARIONEX LT, Lithuania. If necessary, a pilot plant installed in container could be deployed for testing the FERTARMIX process with the client's local pre-treated water.

LIMITATIONS

Due to economical aspects of the process, raw water salinity is limited so that raw water TDS needs to be under 12,000 ppm. As salts removed from the water are used in complex fertiliser production, the heavy metal concentration is limited, as it is in fertiliser products.

OUR EXPERIENCE

Nicolai Arion, inventor and founder of Arionex, started the development of this process more than 40 years ago. It was successfully used for recovering condensates contaminated with ammonium nitrate. This process has been used in 7 plants. Developing the FERTARMIX process for surface water treatment was driven by our customers' needs to reduce or avoid wastewater from water demineralisation due to the tighter environmental requirements and the rising gas prices.

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