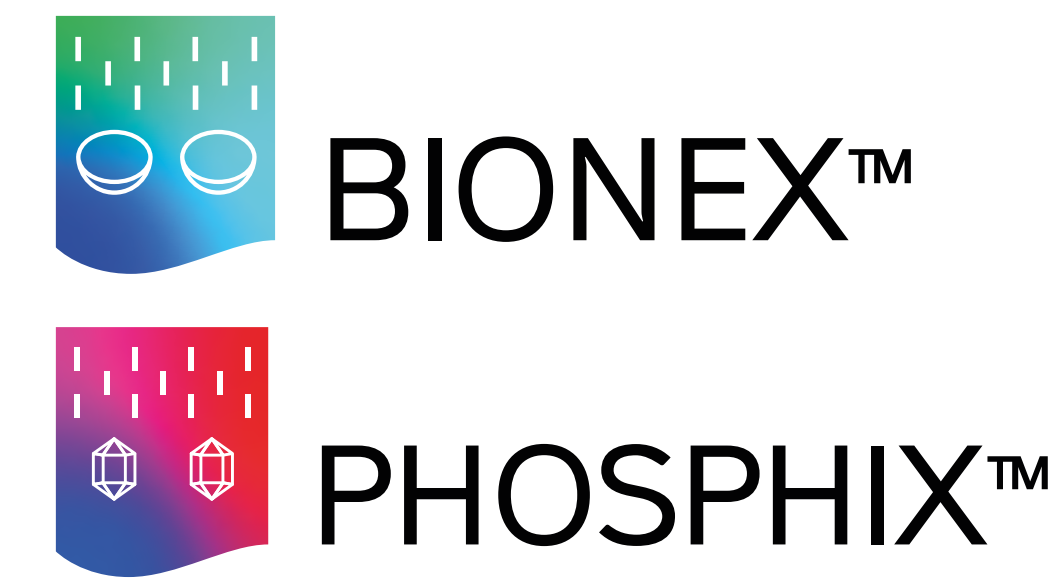


NITRATE AND PHOSPHATE REMOVAL AND RECYCLING WITHOUT WASTE BRINES

Continuous ion exchange is an innovative cleaner alternative



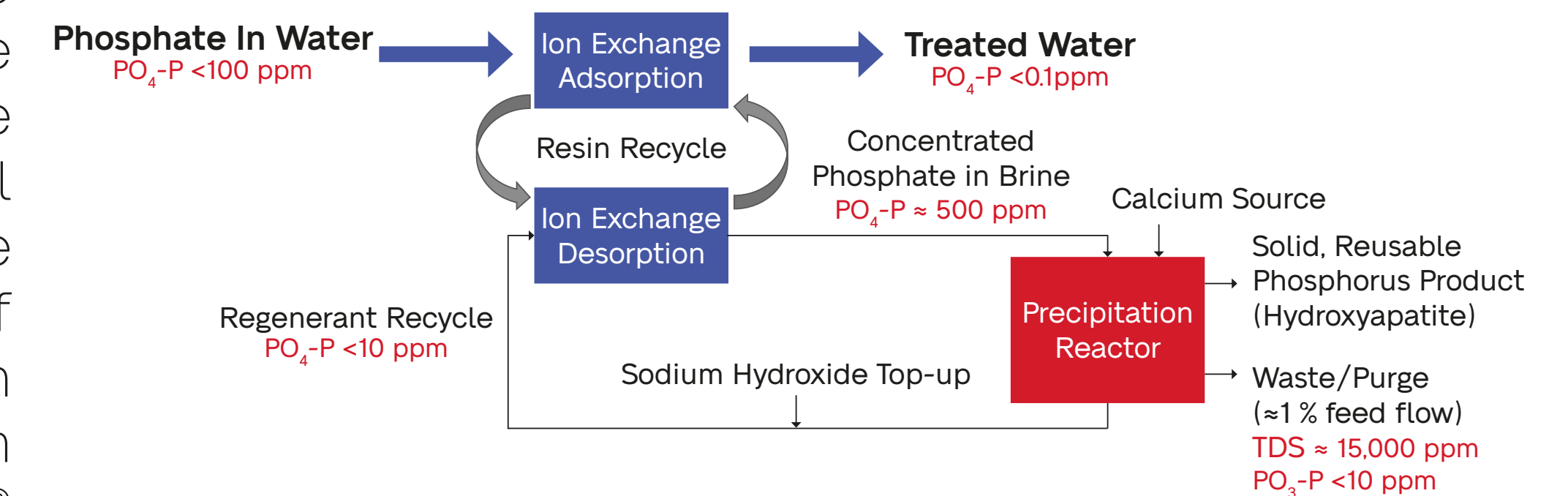
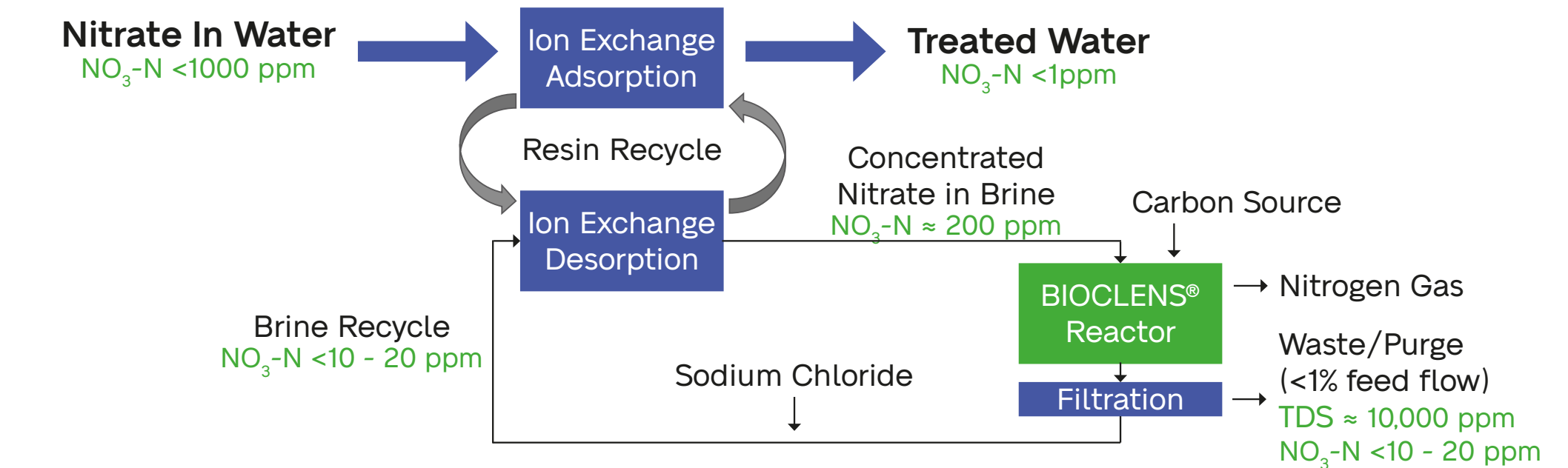
Case Study: Nitrate Polishing to <1 ppm at a Chinese Coal Mine



Clean TeQ Water is an Australian listed company (ASX:CNQ) with offices & labs in China and Africa and completed projects around the world. Clean TeQ Water is currently commissioning a 12 MLD BIONEX™ plant at a coal mine in China. The plant has been designed to treat and remove nitrate from 12 MLD of coal mine pit water to bring the total nitrogen concentration from 6 ppm to below 1 ppm to comply with strict local regulations governing the disposal of mine water to surface water. The total footprint of the plant is 20m (W) x 12m (L) x 11m (H), and the small volume of waste purged from the brine loop will be blended with the effluent to provide a true ZLD solution.

Recycling IX Brines

BIONEX™ and PHOSPHIX™ use our CIF® (Continuous Ionic Filtration) technology to selectively remove nitrate and/or phosphate, creating a concentrated nitrate or phosphate stream. Instead of sending this brine to waste, the nitrate and phosphate are removed, allowing the brine to be reused. This greatly reduces chemical consumption, waste volumes, and the operating cost. The small volume of low TDS waste is often blended with the effluent or returned upstream to form a ZLD solution. BIOCLENS® encapsulation provides high bacterial activity, even in concentrated brines.



Species	Unit	Feed	Target
Ca	mg/L	75	-
Mg	mg/L	11	-
Cl	mg/L	252	-
SO ₄	mg/L	202	-
NH _x -N	mg/L	0.8	-
NO _x -N	mg/L	4.79	-
Organic N	mg/L	0	-
TN	mg/L	6.0	<1
TDS	mg/L	1012	-
TSS	mg/L	50	-

What Problems do BIONEX™ and PHOSPHIX™ Aim to Solve?

Nitrate and phosphate are often present in groundwater, surface water, and in municipal and industrial waste effluents. High concentrations lead to eutrophication of natural water bodies, causing algal blooms that severely harm the aquatic environment. Reverse osmosis (RO) and ion exchange (IX) are two commonly used water treatment methods to reach ultra low nutrient concentrations. Both RO and IX create secondary brines which are difficult and expensive to manage. Our alternative solutions recycle IX brines while also recovering the nutrients.

Phosphorus and Nitrate Recovery

The precipitation step in PHOSPHIX™ produces a reusable phosphorus product (hydroxyapatite) which can be used as a fertilizer. Nitrate can also be recovered when desired using potassium chloride to regenerate the IX resin, producing potassium nitrate. Alternatively, the nitrate can be reduced to nitrogen gas as occurs in the case study. Development work is ongoing for using the same IX resin in an integrated process for phosphate and nitrate removal.

- Consistent removal to <1 mg/L nitrate and <0.1 mg/L phosphate
- <1% brine usually blended with effluent or feed for ZLD
- Typically 50% lower OPEX than other removal methods
- Phosphate/nitrate easily converted to fertilizer
- Smaller site footprints due to IX and treatment of smaller side streams

