

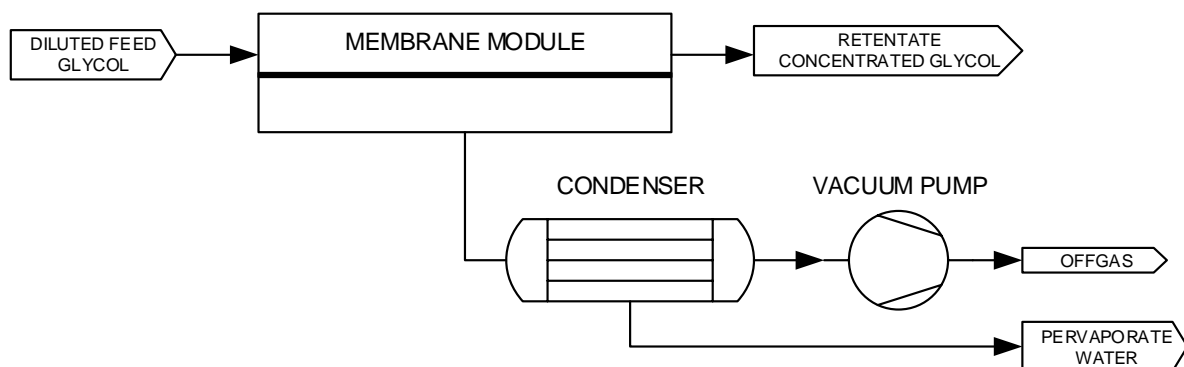
RECYCLE HIGH CONCENTRATION ANTIFREEZE AND REFRIGERANT WITH ADVANCED RALEX® ART

Basic principles of advanced RALEX® ART (Antifreeze Reuse Technology)

- Ralex ART is based on **electrodialysis** with pretreatment
- Electrodialysis does not remove water and produces a diluted product
- Low concentration of recycled glycols limits the recycling capacity and require the use of fresh glycol
- **Advanced Ralex ART** includes concentration step removing water from the product → water removal is performed by **membrane pervaporation process**
- Technology removes insolubles, heavy metals, oils, organic and inorganic salts and water
- The product is a concentrated aqueous solution of glycols or glycerol with a significantly reduced content of impurities and original additives (conductivity less than 0.3 mS/cm)
- Concentration of Cl⁻ meets ASTM D 3306-19 standard (< 25 ppm of Cl⁻)
- The final product can be directly reused

Principle of pervaporation

- Membrane process for separation of liquids with partial evaporation across the nonporous membrane
- Composition of the pervaporate stream (permeate) is mainly given by solubility and diffusion coefficients of the components and not by the liquid-vapour phase equilibrium
- Pervaporation is suitable for separation of thermally unstable mixtures, azeotropic mixtures, components with similar boiling points and for dewatering of organic compounds



Typical feed composition

| | |
|----------|--|
| 50% | Ethylene glycol (MEG, DEG, TEG), propylene glycol (PG), glycerol |
| 47 - 50% | Water |
| < 1.5% | Anticorrosion and buffering additives |
| < 0.1% | Decomposition products of glycols |
| < 1% | Inorganic ions (Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺ , Ba ²⁺ , Sr ²⁺ , SO ₄ ²⁻ , F ⁻ , HPO ₄ ²⁻) |
| < 0.2% | Heavy metals (Fe, Mn, Pb, Cu, Zn, Cr, Sn, Al) |
| < 0.2% | Oils and suspended solids |

ADVANCED RALEX® ART – Process flow diagram



Why choose advanced RALEX® ART?

- Allows to produce products based on “recycled only” glycols
- Lowers consumption of the fresh, concentrated glycols
- Small glycol loss < 0.4 % compared to the flash distillation (24 %)
- Reasonable energy consumption 1.9 kWh/kg of product (pervaporation)
- Economical and environmentally friendly process
- 30 years of proven industry experience of MEGA
- Aftersale service by MEGA Care



From feed to product (glycol mixture in different phases of purification)