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AboutSustainabilityHydrogenProcess plantsPlant componentsServicesLinde PLANTSERV®News & MediaCareersContact

Process plants > Adsorption and membrane plants > Membrane Plants

HISELECT® membrane technologies



High-performance polymers provide membrane outstanding selectivity.

Membrane plants

HISELECT® powered by Evonik membranes expand our gas separation process portfolio with a highly efficient and robust membrane technology.

One-stop service offering spanning the full range of gas separation technologies

Complementing our market-leading cryogenic, absorption, pressure swing adsorption (PSA) and temperature swing adsorption (TSA) products, our HISELECT® powered by Evonik membrane processes complete our gas separation portfolio. Made from hollow fibers, HISELECT membranes are highly robust even under harsh conditions, offering excellent chemical resistance and high temperature tolerance.

HISELECT gas separation membranes are available as a standalone process or can be combined with other separation technologies to create fully integrated, customized hybrid solutions. Designed to optimize both operating and investment costs, these solutions are delivered as packaged, skid-mounted units for easy installation on site or as customized builds assembled on site.

Depending on the gas composition in question, we offer tailor-made solutions to remove impurities in the gas or concentrate specific components.

Various pre- and post-treatment steps such as PSA units for final purification, capturing of HISORP™ TSA units for HHC removal, refrigeration solutions for hydrocarbon dewpoint control as well as guard beds and filters can be individually combined. Our service experts advise customers on the best fit for individual needs, backing our plants up with operational and revamp support and general aftersales services.



Mock-up of gases flow through the hollow fiber membrane, where high-performance fibers provide excellent selectivity for all kinds of applications



It all started with the sweetening of natural gas ...

The HISELECT membrane was developed with a focus on the natural gas and process gas industries, where membranes are typically exposed to harsh conditions. As more and more natural gas resources with sour and acid fractions are being explored worldwide, membranes are an excellent alternative to conventional amine wash systems for acid removal.

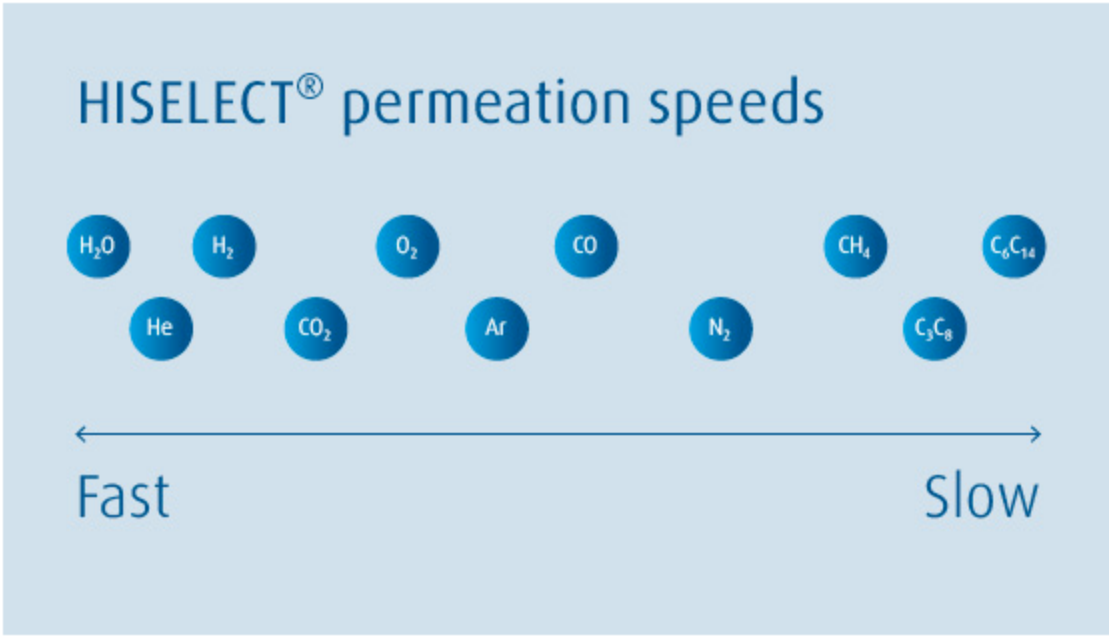
Linde Engineering and specialty chemicals company Evonik Industries joined forces to address this challenge, developing an innovative membrane technology that enables even natural gases rich in carbon dioxide (CO₂) to be processed in an energy-efficient way without the need for solvents and with a smaller footprint. HISELECT thus brings new levels of cost efficiency, selectivity, reliability and flexibility to a wider application spectrum. It can be combined, for instance, with pressure swing adsorption in a hybrid process to separate the valuable noble gas helium from a natural gas mix or used for the debottlenecking of existing CO₂ wash units.

Using innovative polymer materials in membrane technology

HISELECT technology is based on hollow-fiber polyimide membranes, specially developed by Evonik and tailored to various applications such as natural gas processing or hydrogen (H₂) recovery from synthesis plants or refinery and chemical plant off-gases. Driven by partial difference, this membrane works like a semi-permeable barrier and separates the feed gas into a low-pressure permeate, rich in the gas to be removed or recovered (such as CO₂ or H₂) and a high-pressure retentate, with a low content of these components.

In the case of natural gas, CO₂ molecules in the gas mix diffuse very rapidly through the thin polymer barrier, whereas the methane molecules have much more difficulty passing through (see permeability line on the right side). Heavier (slower) components like nitrogen (N₂) and HHCs are also rejected and remain in the retentate stream.

Superior membrane selectivity and high permeation ensure high recovery rates. This changes the established design rules applicable to membrane plants for many applications in favor of fewer and smaller membrane stages, reduced energy consumption and increased availability.



Dedicated HISELECT® powered by Evonik® membranes are tailored to variations in the permeation speed of different gas components

Supporting a broad scope of applications and process gases

Different HISELECT® membrane cartridges have been specially developed for specific use cases. These can be combined to create the perfect fit for individual purification needs.

- ✓ CO₂ removal (natural gas sweetening)

HISELECT membranes efficiently remove CO₂ from natural gas over a wide flow and concentration range. The membranes demonstrate superior selectivity for CO₂, irrespective of HHC content and CO₂ partial pressure. Additionally, strong resistance to unsaturated hydrocarbons, mechanical robustness and high resistance to hydrogen sulfide (H₂S) result in low maintenance effort and a rapid return on investment.
- ✓ Hydrogen recovery/separation
- ✓ Helium recovery and purification
- ✓ Hydrogen extraction from blended natural gas

Highlights of HISELECT® membranes at a glance

The combination of innovative polymer materials and state-of-the-art membrane technologies offers customers a number of compelling advantages

Optimized CAPEX and OPEX with excellent operational flexibility

- ✓ High separation capacity and outstanding selectivity enabling maximum recovery rates and highest purities
- ✓ Ability to tailor membrane capacity and selectivity to customer requirements
- ✓ Highest volume efficiency due to optimized packing of hollow fiber membranes
- ✓ Production flexibility with wide feed range supporting temperatures up to 90°C (194°F) and pressures up to 200 bara (3000 psia)
- ✓ Resistance to CO₂ partial pressure up to 50 bar
- ✓ Robust and stable performance over time under harsh operating conditions, reducing need for overdesign
- ✓ Reduced pre-treatment effort due to excellent resistance to heavy hydrocarbons and plasticization
- ✓ Mechanical resistance to process fluctuations during operation



First-of-its-kind helium purification facility with hybrid membrane/PSA technology

To revive the Canadian helium (He) industry, Weil Group Resources turned to Linde to help them separate and purify helium from the natural gas mix recovered at its Mankota well in Saskatchewan. This first-of-its-kind helium purification facility designed by Linde has been operational since 2016. It uses a hybrid process combining HISELECT® membranes with pressure swing adsorption (PSA) technology to enrich wellhead gas from a helium concentration of 1 mol% to 5.0 quality (99.999 mol%). The facility can process 10 million standard cubic feet of feed gas a day and supplies industrial customers in Canada and the western U.S.



Helium membrane plant at Mankota, Canada



HISELECT® powered by Evonik membrane cartridges for natural gas, South America

HISELECT® enables a South American gas company to increase hydrocarbon recovery and purity at its existing natural gas sweetening plant

The customer was looking to reduce methane losses while simplifying operation and increasing stability without installing new separation units. With our HISELECT membrane cartridges for natural gas, the company managed to improve hydrocarbon recovery by more than 5% relative to the cellulose acetate membranes previously used for this purpose. Additionally, it significantly reduced annual operating expenses due to the lower recycle compressor duty (10% power savings), reduced membrane replacement frequency and increased on-stream time. The membrane performance remained remarkably stable from initial start-up through extended operation, despite increases in hydrocarbon concentrations in the feed.

HISELECT® for hydrogen to meet customer-specific needs

A petrochemical complex in Texas (USA) was keen to maximize methane (CH₄) recovery rates from highly variable process streams. We delivered a HISELECT for hydrogen membrane unit, which the customer installed downstream of its 1.8 MMTPA ethane steam cracker. The HISELECT process unit separates feed gas containing 81 mol% H₂ and 18 mol% CH₄ into a retentate gas stream containing as much as 95 mol% CH₄ and a H₂-enriched permeate gas stream. For ease of deployment, the fully prefabricated, pre-assembled and tested membrane unit was supplied on skids complete with hydrogen sulfide (H₂S) guard beds.



HISELECT® powered by Evonik membrane skid built for a petrochemical complex in Texas, United States of America



HISELECT® powered by Evonik membrane unit for hydrogen in Texas, United States of America

HISELECT® maximizes H₂ recovery from N₂ recycling loop

A polypropylene plant in Texas (USA) is equipped with an internal nitrogen (N₂) recycling process gas loop containing significant amounts of valuable H₂. The owner was looking to optimize the recovery of H₂ from a feed gas stream containing 20.5 mol% H₂, 54.7 mol% N₂ and 24.8 mol % and other trace components. With the HISELECT membrane, more than 85 % of the H₂ could be removed and recycled at high concentration. The unit is equipped with a heat exchanger to superheat the feed gas and prevent any condensation in the piping and inside the membranes.

Are you interested in a quote?

Send an RFP





Adsorption and membrane plants

Explore our adsorption plants portfolio →



Adsorption-based carbon capture and CO₂ recovery

The HISORP® CC adsorption-based carbon capture solution is the latest addition to Linde’s carbon capture portfolio. →



Nitrogen generation

Experience and expertise to deliver nitrogen pressure swing adsorption (PSA) plants for every industry need. →



Oxygen generation

Compact, energy-saving vacuum pressure swing adsorption (oxygen VPSA) plants by Linde Engineering: For easy, on-demand oxygen production. →



Hydrogen recovery and purification

Expertise and experience to deliver tailor-made hydrogen recovery plants offering outstanding quality, reliability and availability. →



Hydrogen on tap

Discover a mature, fully integrated solution delivering hydrogen via the natural gas pipeline →



Better way to process natural gas
Explore our new membrane to handle high CO₂ content →

Downloads

 HISELECT® powered by Evonik for ultra-efficient gas processing (PDF 646.0 KB)
 HISELECT® H2NG Membrane + HIPURE™ PSA Technology (PDF 717.0 KB)

 HISORP® TS hydrocarbon recovery unit (PDF 478.0 KB)

 H₂Tech article Q4 issue 2021 (PDF 147.0 KB)



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