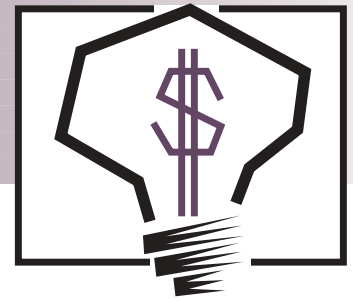


INVENTIONS & INNOVATION

Project Fact Sheet



MEMBRANE TECHNOLOGY TO SELECTIVELY REMOVE ENTRAPPED GASES FROM PROCESSES

UNIQUE MEMBRANE SYSTEM FOR REMOVING NONCONDENSABLE GASES FROM AMMONIA REFRIGERATION SYSTEMS REDUCES COSTS AND TOXIC WASTES

Benefits

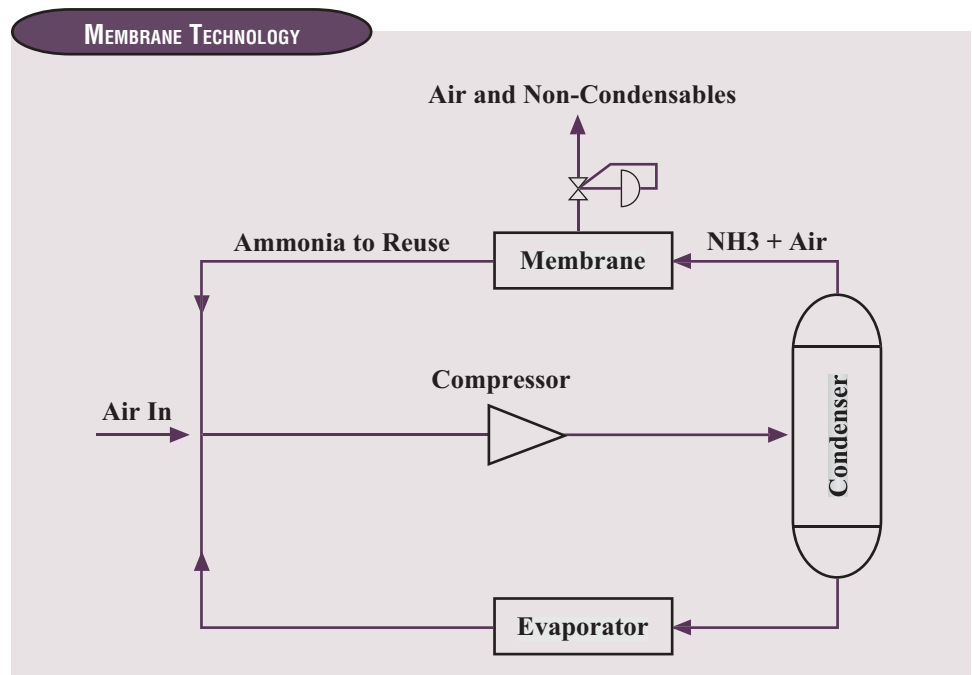
- Saves approximately 360,000 kWh of electricity per 1000 tons of cooling capacity per year for ammonia refrigeration systems
- Minimizes energy consumption by continuously removing air
- Saves 1.22 tons of ammonia per year per 100 ton unit by recovering and reusing virtually all ammonia
- Produces no waste
- Offers a simple, nonmechanical membrane system
- Long life, low maintenance costs
- Competitively priced

Applications

The primary application for this technology is the refrigeration industry. However, research has identified many additional applications in the petrochemical and pharmaceuticals industries, including ammonia storage plants and for detecting ammonia in water-removal systems. When used in combination with the company's N₂ removal membrane, this technology will work with fuel cells to lengthen cell stack life.

Ammonia refrigeration systems operate more efficiently when noncondensable gases, primarily air, are removed. The presence of these noncondensable gases results in higher condensing pressures, greater electrical power consumption, reduced refrigeration capacity, and longer compressor running time.

Since the early part of the twentieth century, industry has routinely removed air and other noncondensables from the working fluid in refrigeration systems. A new system, referred to as "membrane technology," is expected to outperform the electronically controlled mechanical air purgers currently on the market. The benefits of this new technology include higher recovery and reuse of ammonia, reduced maintenance costs, and greater reliability at a competitive cost.



New membrane technology offers greater efficiency in ammonia refrigeration systems by removing noncondensable gases, such as air, during the refrigeration process.



Project Description

Goal: Test membrane technology for ammonia-air separation and optimize it for commercialization.

The membrane is made using a commercially available polymer to coat microporous fibers highly selective to ammonia. In the system, the high-pressure ammonia vapor containing noncondensable gases is fed to one side of the membrane. The ammonia vapor then diffuses through the membrane to the low-pressure side of the system while the noncondensable gases are collected on the high-pressure side of the membrane and vented without treatment to the atmosphere.

Enerfex developed this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Preliminary laboratory tests have been performed on the membrane with favorable results.
- U.S. patent 6,128,916 has been issued for the process. A second patent may be sought on the proprietary coating process.

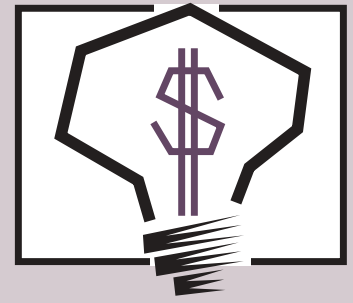
Economics and Commercial Potential

Membrane technologies are being developed and tested in industrial applications where separation of gases is desired. Using membrane technology in large (over 100 tons) ammonia refrigeration systems would be a major technological advancement over current mechanically based purging systems.

Within North America, sales potential of purging-type equipment for use in ammonia refrigeration systems is estimated to be \$1 million to \$2 million annually. Worldwide sales are estimated to be around \$10 million. Although these are relatively small markets, the need for the removal of noncondensables from ammonia refrigeration is well-established.

Refrigeration system designers constantly seek longer life, lower maintenance costs, and higher reliability in their systems. Membrane technology is expected to meet these expectations, as well as provide greater recapture and reuse of ammonia than has previously been possible through traditional mechanical purgers.

The economic benefits and market potential for membrane technology far exceed applications for the ammonia refrigeration industry. Because of its ability to remove noncondensable gases, as well as serve as the basis of a chemical-sensing device, this invention has commercial potential in petrochemical and pharmaceutical industries. Other applications are likely to be discovered as the full potential of membrane technology is understood.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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