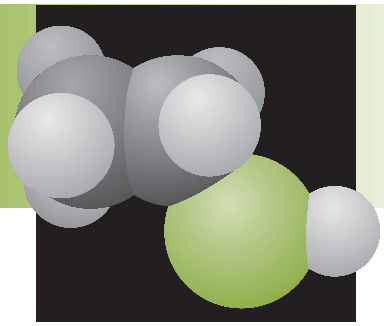
CHEMICALS
Project Fact Sheet



Olefin Recovery From Chemical Industry Waste Streams

Benefits

- Energy savings of 26.8 trillion Btu per year by 2020 from olefin-containing vent streams in the CPI
- Waste reduction of 1.16 billion pounds per year by 2020
- Recover over 0.68 billion pounds of olefins per year
- Material cost savings—refinery grade olefin feedstock is worth $0.15 per pound where as olefin used as a fuel is worth $0.04 per pound

Applications

Recovery of olefins is possible from many chemical processes, including production of polyethylene, acrylonitrile, polypropylene, and cumene. About 0.9 billion pounds of olefins are potentially recoverable in the United States. Other applications include recovery of propylene from refining streams. An estimated 80 percent of plants producing olefin-containing vent streams would ultimately adopt this technology, and new plant capacity is growing at 3.8 percent per year. Opportunity exists outside the United States where olefin recovery is currently considered cost prohibitive.

Membrane separation recovers olefins from gaseous waste streams for use as chemical feedstocks

Selective polymer membranes are being developed to allow recovery of olefins (compounds with carbon-carbon double bounds such as ethylene and propylene) from petrochemical by-product and vent streams. These streams are often flared or used as a fuel even though the olefin is more valuable as a chemical feedstock. The new separation technology will allow olefin separation and recycling within the process.

Currently, a major portion of the cost of producing ethylene and propylene (the two largest volume organic chemicals produced) is associated with olefin/paraffin separation (e.g., ethylene/ethane). This high-cost, energy consuming step is currently performed by large distillation columns. To manage the build-up of inert gases such as propane and ethane, an olefin/paraffin fraction is continuously removed. The olefin lost with the paraffin can represent 1 to 2 percent of the total feed to a polyolefin plant, with an annual value on the order of $1 million per plant. Unless an olefin/paraffin splitter is used to recover these by-products, the significant chemical feedstock value of the gas is wasted.

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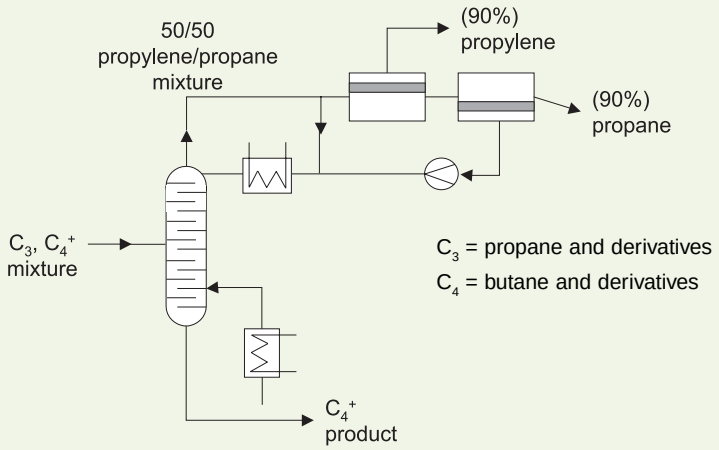


Olefin recovery from waste will use a propylene/propane membrane separation system installed on the overhead vapor from a refinery depropanizer column.

Project Description

Goal: Develop selective membranes to recover olefins in gaseous olefin/paraffin waste streams for use as in-process feedstock.

The technical challenge is to develop the technology to form glassy polymers into extremely thin, defect-free, multilayer composite membranes on a large scale and then to incorporate these membranes into high-surface-area membrane modules. The differing permeability rates based on size will be used to separate a gas or vapor mixture. Full-scale membrane modules will be fabricated that maintain permeation properties under field conditions.

The membrane selectivities already achieved in preliminary work are sufficient to make the process technically feasible. Membranes with improved selectivities will be required for membrane/distillation hybrid processes to separate olefin/parafin mixtures in refineries and olefin crackers.

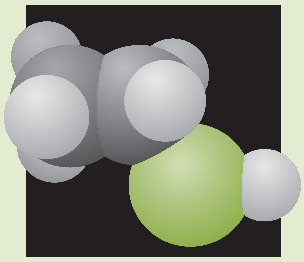
Progress and Milestones

This three-year project will include the following activities:

- Complete the development of polymeric olefin/paraffin selective membranes.
- Develop and test membrane modules in the laboratory with model gas mixtures and then with industrial process streams at sites provided by Amoco and Phillips. These real world conditions will provide reliability and efficiency data.
- Based on the data obtained, perform a realistic economic and technical analysis of the proposed technology to determine viability, energy savings and waste reduction potential.
- Build and install a demonstration unit at a user site to evaluate membranes and to promote industry acceptance.
- Market development and commercial system sales are expected in the last year of the project.

Awards

MTR received Chemical Engineering magazine's 1997 *Kirkpatrick Achievement Award* for developing a related membrane process for the separation of propylene/nitrogen and ethylene/nitrogen streams that are also produced in polyethylene and polypropylene production.



Project Partners

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