

Energy Efficient Ethanol Dehydration

ethanol dehydration through membrane technology

“Greenbelt has the most extensive knowledge of using membrane technology in the ethanol dehydration process in the U.S. ”

Dr. Masanobu Aizawa, GM of Research & Development Strategy, Hitachi Zosen

Greenbelt Resources Corporation designs highly efficient zeolite membrane-based solutions for ethanol production and solvent recovery. Able to be integrated into a wide array of uses, the patent pending dehydration modules by Greenbelt are capable of rapid deployment and quick installation due to their modular design.

- Fully automated systems, maximize energy and water efficiency
- Retrofits to efficiently increase anhydrous capacity (which can work in parallel with existing systems)
- Module is delivered ready to operate with minimal setup
- Automated process controls come with 24/7 remote monitoring services and available tech support



Benefits

- Up to 50% energy savings possible in dehydration process
- Continuous process, not batch
- Modular: plug and play
- Limited annual maintenance
- From 80% ethanol up to 99.95% in a single continuous step
- No added chemicals, no regeneration

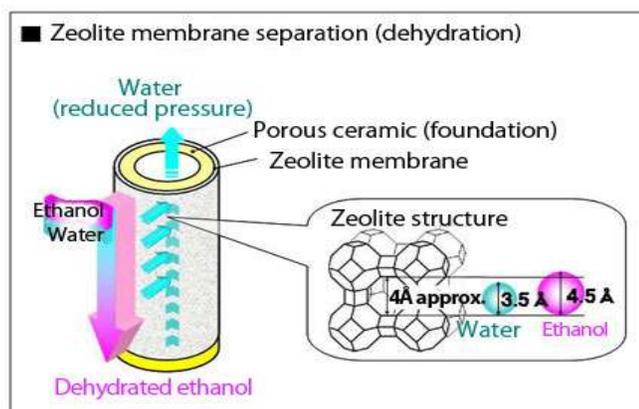
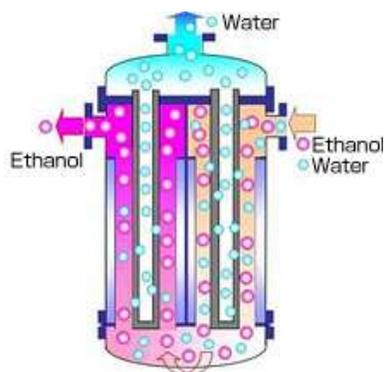


CAPABILITIES – INPUTS/OUTPUTS

- Capable of processing vapor or liquid feed
- Minimal electricity consumption and steam use
- Air cooling standard (water cooling optional)
- Separates water from ethanol to achieve purity of >99%
- Flexible product output: biofuel to industrial grade (200 proof)
- Adaptable for recycling applications: such as organic solvent regeneration
- Fully scalable: from 5,000 GPY to 5,000,000 GPY

HOW IT WORKS

The Greenbelt Resources zeolite membrane module features outstanding durability resulting from its seal-less integrated structure, while the optimized membrane microstructure exercises superior dehydration capabilities over conventional dehydration membranes. The diagram below demonstrates conceptually how hydrous ethanol is passed by the outside of the ethanol phobic membrane exterior while a light vacuum draws the water through the hydrophilic zeolite.



HISTORY

Low-energy chemical separation is an indispensable technology for reducing CO₂ emissions and boosting economic viability. One of the most promising forms of this technology is the dehydration capability of the zeolite separation membrane. The dehydration module from Greenbelt Resources uses a specially designed high-performance zeolite membrane to extract high-purity dehydrated ethanol from hydrous ethanol.

The first commercially deployed zeolite separation membranes for ethanol dehydration from Hitachi Zosen were installed at Hokkaido Bioethanol Co., Ltd. in March 2009. That system is still operating smoothly today.



Membrane Characteristics:

- Water tolerant
- Resistant to fusel oils
- Operating pressure range up to 87 psi
- Operating temperature range up to 320°F

Benefits of Zeolite Membranes in Greenbelt Resources Dehydration Module

- At least 20% more energy efficient than conventional distillation and PSA (adsorption) methods.
- Rapid transmission through membrane virtually eliminates contamination by impurities.
- Combination of all-ceramic (inorganic) materials and seal-less design improves durability and minimizes operating costs.

About Greenbelt Resources Corporation: Greenbelt Resources Corporation™ is an award-winning provider of sustainable energy production systems focused on delivering modular solutions that enable localized processing of locally generated waste into locally consumed products. The Company designs, develops and implements technology that makes production of advanced biofuel reliable, practical and efficient. Controlled by proprietary automated controls, the Company's small-scale, end-to-end modular systems convert food, beverage and other cellulosic wastes into commercially viable advanced biofuels (bio-ethanol), animal feed, fertilizer and filtered water. For more information visit www.greenbeltresources.com.