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**Mitsubishi Chemical, Taiyo Nippon Sanso Team up to Market
Zeolite Membranes for Bioethanol Production in the U.S.**

Mitsubishi Chemical Corporation
Taiyo Nippon Sanso Corporation

Mitsubishi Chemical Holdings Group companies Mitsubishi Chemical Corporation (MCC; Head office: Chiyoda-ku, Tokyo; President: Hiroaki Ishizuka) and Taiyo Nippon Sanso Corporation (TNSC; Head office: Shinagawa-ku, Tokyo; President: Yujiro Ichihara) today announced plans to jointly market a dehydration system using the MCC-developed ZEBREX™ zeolite membranes for bioethanol production processes in the U.S.

MCC provides the zeolite membranes and modules and its group company, Mitsubishi Chemical Engineering Corporation, manufactures the dehydration system. TNSC will support marketing and business development activities via its wholly-owned U.S. subsidiary, Matheson Tri-Gas, Inc. (MTG).

Bioethanol is made mostly from biomass such as sugar cane and corn. It has become widespread as a fuel all over the world, particularly in the U.S. and Brazil, in step with efforts to reduce CO₂ emissions and promote the carbon neutral movement. The U.S. now has 215 bioethanol plants in operation, with a combined annual capacity of 50 million kl, backed by increasing demand as a gasoline additive due to the enactment of the 1990 revised Clean Air Act and 2005 Energy Policy, and more plants are slated for construction.

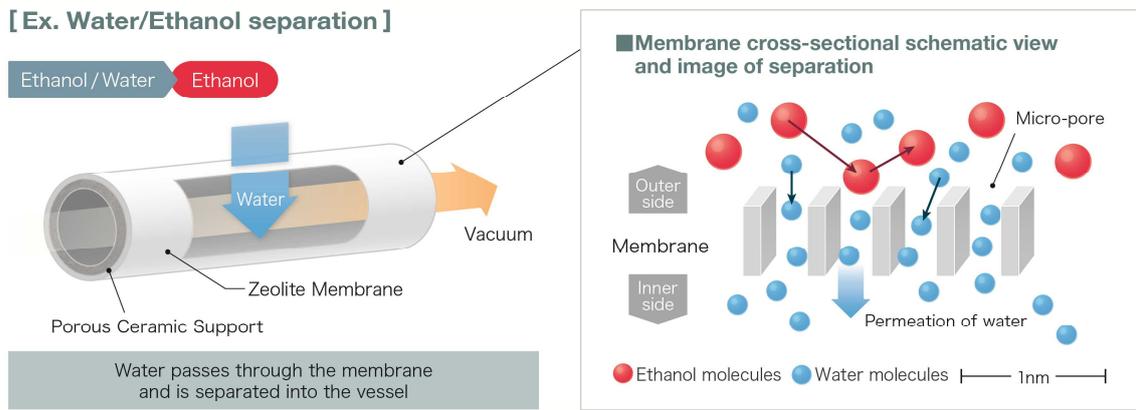
The bioethanol production process includes preliminary treatment such as pulverization of the raw materials, conversion to sugar, fermentation, refining (distillation), and water removal. The raw materials have high water content, so the distillation process in particular requires a large facility and considerable energy. Producers in California and other West Coast states face high energy costs, making energy-saving processes a critical element.

ZEBREX™ is a chabazite zeolite, the world's first to succeed in making zeolite into a membrane, in which all pores are a uniform 3.8Å in size, increasing separation capacity. This allows higher production efficiency (Fig.1). It also has higher water resistance compared to conventional zeolite membranes, which allows it to separate ethanol and isopropanol from water in high-water-content environments that deteriorate conventional zeolite membranes.

A dehydration system using ZEBREX™ membrane in the bioethanol production process has the potential to reduce energy consumption by 5% to 10% and boost production by 10% compared to distillation and use of conventional zeolite membranes now in use at many plants.

TNSC consolidated its U.S. subsidiaries Matheson Gas Products, Inc. and Tri-Gas, Inc. into MTG in 1999. Through mergers and acquisitions, as well as construction of air separation units, it established a business network that covers the major industrial gas markets. MCC and TNSC will draw upon that network to develop the dehydration system for bioethanol production processes.

Fig. 1: Separation of ethanol and water using a zeolite membrane



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