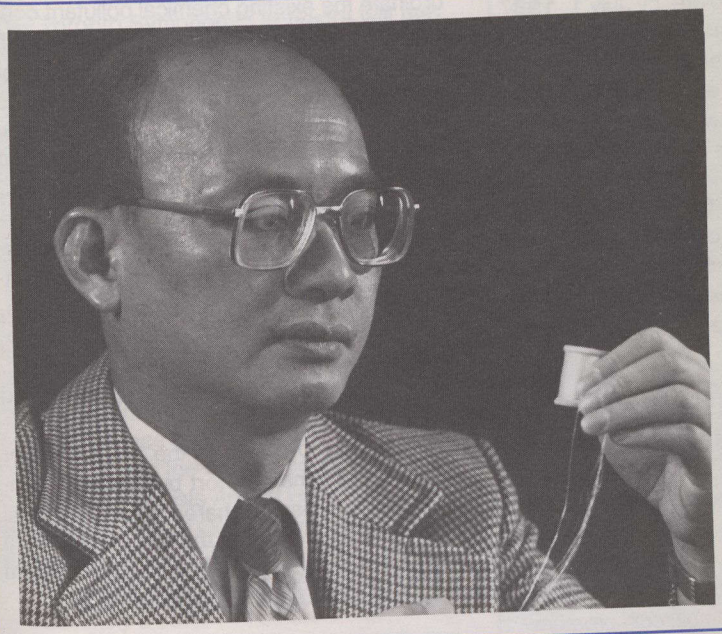
Separating gases through membranes



John Gertz (*left photo*) and Leslie Lorinezi

Dr. Pan compares strands of gas permeable membrane (close up right photo) *with thread.*

Scientists at the Alberta Research Council (ARC) have adapted a method of desalinating seawater through membranes into a gas-separation process that can remove carbon dioxide from natural gas or separate hydrogen from industrial waste gases. The new technology is being marketed by International Permeation Inc. of Calgary.

Hydrogen sulphide is toxic and must be removed before natural gas can be used safely as fuel, and carbon dioxide is a non-combustible gas which is often injected into oil-wells to enhance production.

David Mitchell, ARC regional vice president, said the membrane process requires less energy than gas-refining processes based on absorption, chemical reactions, or cryogenic compression.

The membranes are bundles of hollow fibres made from cellulose acetate, a polymer that can be formed into thin membranes. The walls of the microscopic, hairlike tubules are porous, and some substances can diffuse through them faster than others.

In a desalination plant, the fibres are used to recover pure water from undrinkable brackish water because water molecules pass through the tube walls more easily than dissolved salt. Fresh water is collected in a vessel that surrounds the fibre bundle while the concentrated brine emerges outside the vessel from the ends of the tubes.

New procedure

To separate mixtures of gases by the same technique, special procedures must be followed or the membranes that are dried for use with gas become too fragile for commercial applications, said ARC project leader Chuen Pan. The water adhering to the fibres is replaced by one solvent, then with a second that is only weakly attracted to cellulose acetate and leaves the membrane structure intact when it evaporates.

The technique for treating membranes also ensures large differences in the rates at which different gases diffuse through the fibre walls. The greater this difference, or "membrane selectivity", the more efficient and cheaper is the gas-separation process, said Dr. Pan.

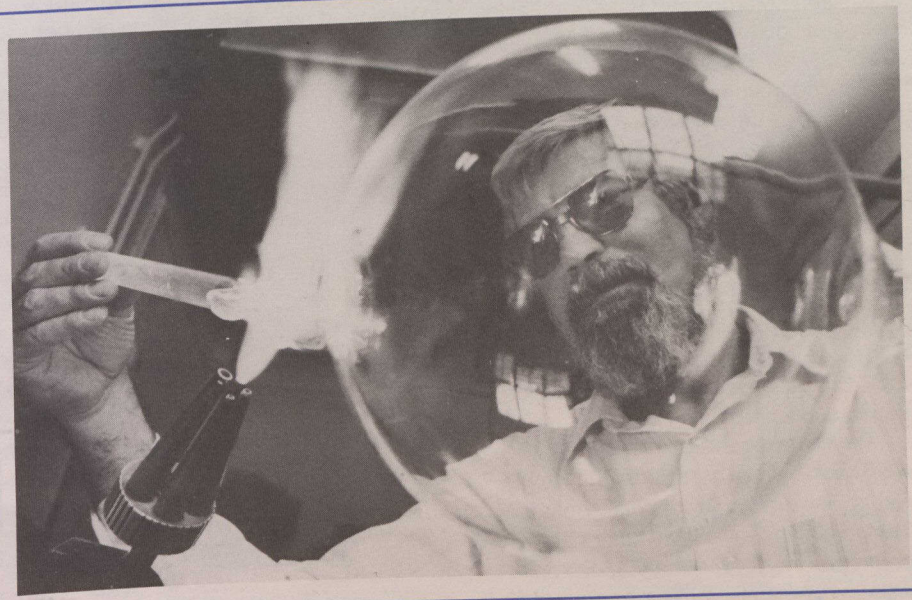
Gases such as hydrogen and helium are quicker because their molecules are smaller. Other fast-diffusing gases, such as hydrogen sulphide and carbon dioxide, interact with the membrane material and, in effect, dissolve in the membrane. Larger, non-reactive molecules of gases such as nitrogen or methane diffuse through at a much slower rate. The fibre bundles can therefore be effective in separating both hydrogen sulphide and carbon dioxide from methane, the predominant component of natural gas.

Glassblower honoured

Jack Vandenhoff, considered by many as the best scientific glassblower in Canada, has been honoured by the Canadian Society for Chemical Technology for his contribution to chemical technology and research.

While most scientific equipment is mass-produced, highly skilled glassblowers are needed to make specialized equipment for complicated experiments.

Mr. Vandenhoff has been a master glassblower at the National Research Council (NRC) for some 32 years and has designed and blown some of the most complicated and intricate scientific glass equipment in the country. Ranging in size from two metres to only fractions of a millimetre, the apparatus includes tubes, coils, cylinders and flasks. Some of the designs incorporate other materials as well, such as platinum electrodes, lasers and magnets.



Lynn Ball, *The Citizen*

Jack Vandenhoff applies heat to one of his designs.