cess known as reverse osmosis. This process is a "sleeper". Reverse osmosis already has been used to take the dissolved salt out of sea-water and to make brackish and even sewage water drinkable, yet so far it has realized only a small fraction of its potential. In principle, reverse osmosis can be used to separate any substance in liquid or gaseous solution. In other words, dissolved particles, too small to see, can be separated leaving the solvent in an almost pure state, pure enough to drink in the case of sea-water.

"It was NRC who helped us realize the potential of reverse osmosis through Canadian Patents and Development Limited," says Ronald Webb, Program Development Coordinator of the reverse osmosis project at Electrohome.

The prime objective of Canadian Patents and Development Limited (CPDL), a wholly-owned subsidiary of NRC, is to make licensable products of publicly-financed research or development more available to the public, through industry.

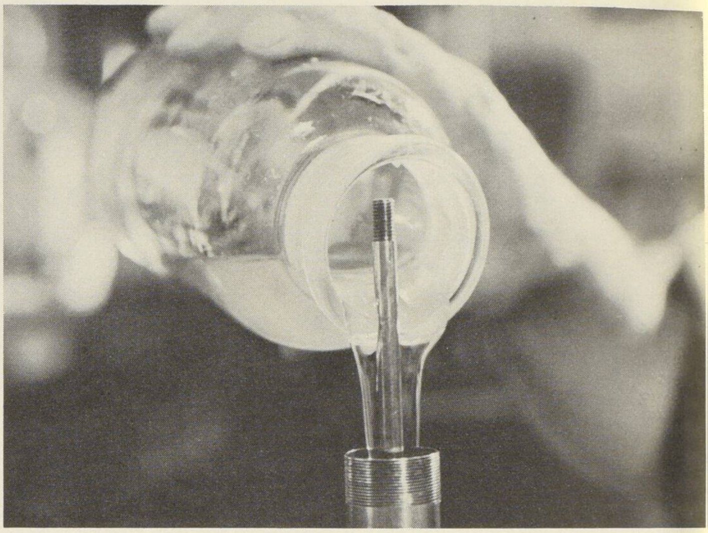
"CPDL exhibits its wares in trade shows and the reverse osmosis display at one of these shows caught our eye," explains Mr. Webb. "We previously had considered this process, but the CPDL display brought home to us the tremendous advances in membrane technology on which reverse osmosis is based and showed us the potential for putting it on an economic footing. We already were interested in reverse osmosis for many reasons, one being its use in desalting water for our humidifiers and in cleaning industrial waste water. Reverse osmosis was one of the few methods capable of separating dissolved solids without having to change the original form of the material."

Although CPDL assists in patenting and licensing inventions for practically all federal government departments in Canada, the products and techniques which attracted Electrohome's interest at the reverse osmosis display were to the credit of NRC researchers in the Chemical Engineering Section of NRC's Division of Chemistry. The Section, headed by W.S. Peterson, is investigating the physical chemistry of separations involving reverse osmosis, porous membrane technology, transport through membranes and specific separation processes of industrial interest. The latter include waste recovery, water pollution control, salt water conversion and the concentration of industrial solutions.

A very thin, porous membrane of cellulose acetate is the key to these and many other experiments in reverse osmosis. Called the Loeb-Sourirajan type, this membrane was originally developed 14 years ago from the pioneering work of Dr. Srinivasa Sourirajan in collaboration with Dr. Sidney Loeb. Dr. Sourirajan is a chemical engineer in charge of reverse osmosis at NRC and an internationally recognized authority on this subject. An important new technique for making ("casting") these membranes in the form of long seamless tubes also was developed at NRC by W.L. Thayer, L. Pageau and Dr. Sourirajan.

"NRC's Chemical Engineering Section helped us a great deal in setting up our laboratory and getting us to the point where we could cast our own Loeb-Sourirajan type membranes," says Mr. Webb. "This was very important for us because we had originally counted on a supply of commercially-available membranes. The supplier discontinued membrane production and, in the aftermath, we realized that we needed to be masters of our own destiny."

The reverse osmosis process depends on these and other thin membranes. In principle, a separation by reverse osmosis consists in allowing a solution to flow across the membrane under pressure. The pure solvent can thus be separated from the mixed solution. With this method salt can be removed from seawater to produce nearly pure, drinkable water at room temperature using a pressure of 1,500 pounds per square inch. No heat is required and the final product undergoes no change of phase in this separation process.



Filling of film casting unit with cellulose acetate solution.

Remplissage d'une unité de moulage en film par une solution d'acétate de cellulose.

Reverse osmosis works because, on the one hand, the chemical nature of the membrane is such that it repels the unwanted dissolved particles or attracts the desired substance, and on the other, its physical nature permits the desired fluid to flow through it.

Electrohome's aim is to produce and utilize these membranes and the reverse osmosis process to solve industrial problems. Supports for the membranes are being developed and modules, as well as operational units, control devices and protective devices are being designed by Electrohome engineers. But Mr. Webb stresses that it is a long way from the membrane to a saleable product.

One of the pollution problems already tackled by Electrohome involved the high BOD of waste solutions in the food industries. BOD stands for "biochemical oxygen demand" and is a measure of the oxygen needed to oxidize biochemically polluting organic material once it is dumped into a body of water. The more oxygen is used for this task, the less it becomes available for fish and other aquatic life. Waste solutions with high BOD must be treated to bring the counts within acceptable limits.

Instead of attempting to duplicate actual conditions in the laboratory (an impossible task in view of the rapid chemical changes), Electrohome engineers worked on an actual BOD problem in an industrial plant. They installed a reverse osmosis development unit and after three months of testing, found that the reverse osmosis system succeeded in cleaning up test effluent from the food plant and the waste collected could easily be disposed of by burning or disposal on land or even processed to reclaim useful byproducts. After reverse osmosis treatment of the waste solution the water was well below