

Minnesota Maple News

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The Minnesota Connection to the Origins of Reverse Osmosis in the Maple Industry

by Matthew M. Thomas

Minnesota has a unique place in the history of the use of reverse osmosis (RO) technology for processing maple sap by the maple syrup industry. Reverse osmosis as a general technology was developed over the late 1950s and early 1960s by a group of researchers led by Sidney Loeb and Srinivasa Sourirajan at UCLA trying to create better ways to desalinate sea water. Soon after, in 1965, the first RO membranes were developed for commercial use, and researchers began to consider other applications of RO including as a tool to concentrate solids in liquid solutions. This led to the idea that RO technology might be applied to the concentration of maple sap.

In 1965, while Dr. Sourirajan was visiting an engineering lab at Dartmouth College, an undergraduate student by the name of Dean Spatz, who had begun experimenting with a small table-top RO in the lab, asked Dr. Sourirajan if he thought RO could be used for processing maple sap. Sourirajan replied that he did not see why not. This exchange was not forgotten and later that year, unbeknownst to each other, both Dean Spatz and Dr. Sourirajan conducted simple experiments processing maple sap in their small lab-based RO units. Sourirajan published his experimental work in 1967, but it was his only research with maple sap, while Spatz set aside his results to focus on graduate school and completing his Dartmouth education.

At the same time, another research group led by Dr. Willits at the USDA's Eastern Utilization Regional Research and Development Division, popularly known as the Eastern Research Lab, near Philadelphia, began similar lab

experiments with maple sap and a small RO in 1966. This work led to a series of experimental prototype RO units and eventually construction and testing of the first operational reverse osmosis machine for use in a sugarbush in 1968. Dr. Willits retired from the Eastern Research Lab in 1969 and, despite USDA's extensive outreach efforts and promotion of RO as the future of maple production, USDA research into RO applications were discontinued a couple of years later.

However, despite the end of research by Sourirajan and the Eastern Regional Lab, their results along with the experiences of Dean Spatz, were not in vain. In fact, upon graduation from Dartmouth, Dean Spatz immediately moved to Minnesota and created a reverse osmosis manufacturing company called Osmonics. The company started in 1969 in Spatz's garage in Hopkins before later moving to Minnetonka, and by 1970 the first Osmonics RO membrane was available for commercial use.

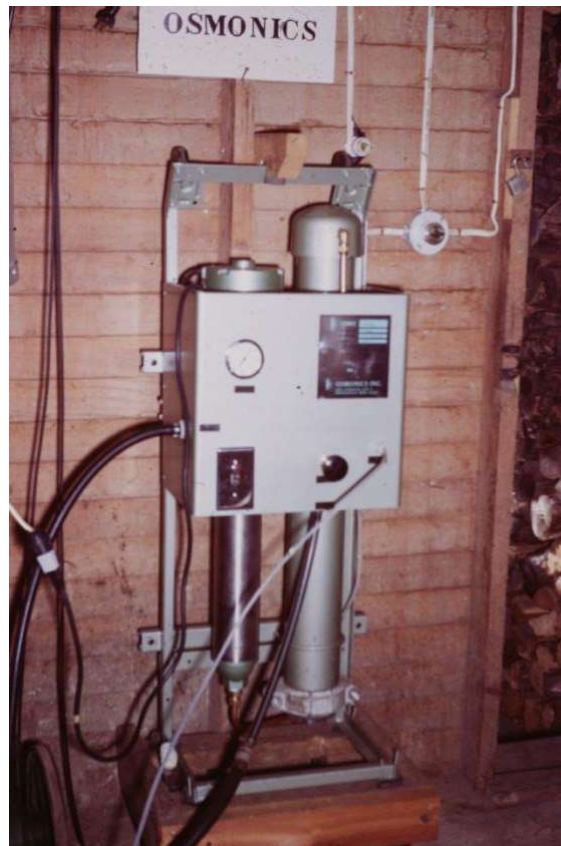


Figure 1. Small Osmonics reverse osmosis unit tested by Rex Alwin in his Mound, Minnesota sugarbush in 1971. Image courtesy M. Thomas.

Osmonics began testing the waters of using its RO system for maple sap when Dean Spatz contacted Leroy "Rex" Alwin, an engineer and maple syrup maker he knew from Mound, Minnesota, to see if Alwin would be interested in testing a small single membrane, 200 psi Osmonics RO unit in the 1971 sugaring season. Although he never used RO again in his sugarbush, Alwin kept careful records from the testing efforts and in the autumn of 1971 presented and published the successful results of his testing of the Osmonics RO Unit at the Eighth Conference on Maple Products in Michigan. As noted, earlier efforts by USDA researchers had primed the maple industry for the potential of RO and with Alwin's report of results from a commercially available RO unit, syrup makers from around the US and Québec began purchasing Osmonics ROs for their sugarbushes.

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In the beginning, the Osmonics machines, which were enormous and expensive, would concentrate sap from 2% brix to about 6% brix using a series of four-inch horizontal membranes. The machines were very loud, the pump often overheated, and the industry was still working out the best tools and protocols to clean and rinse the membranes. By 1974, there were a handful of Osmonics units operating in sugarhouses in New England, Québec, and Michigan. Osmonics stepped up its sales to maple producers in 1976 when it began advertising in the *Maple Syrup Digest* and partnered with the Small Brothers Evaporator Company out of Dunham, Québec to be their exclusive dealer. In the early 1980s, the Canadian companies of Electrohome and Memtek got into the RO business for processing maple sap, but they did not last with Electrohome selling their maple RO section to Osmonics in 1982

and Memtek going bankrupt and sold to Hiniker/Coster Engineering out of Mankato in 1985.

After 1985, improvements in RO design and the new availability of high-pressure membranes saw most maple equipment manufacturers enter the RO market, leading to further growth of RO technologies and models designed specifically for use in processing maple sap. At this same time, Osmonics was increasingly focused on large scale water system applications for their ROs. Although the manufacturing and use of RO in the maple industry was strengthening, Osmonics made the decision to get out of the relatively small market of manufacturing RO for maple producers and put that portion of their business in the hands of their RO dealer, Small Brothers, Inc., with their Sap Brother line of RO machines. Osmonics continued to grow as an RO company manufacturing membranes and building water filtration systems in their Minnetonka plant, before being sold to General Electric in 2002 for a value of \$270 million.

In the history of the use of reverse osmosis in the maple industry, the Osmonics company was really the only RO manufacturer for all the 1970s, and the most established company in the first half of the 1980s. It was Osmonics, a Minnesota company, which carried

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Figure 2. Advertisement from October 1980 issue of *Maple Syrup Digest* for Small Brothers sale of Osmonics reverse osmosis machines. Image courtesy M. Thomas.

the RO technology for the maple industry from its infancy to early adulthood and gave it a starting point for what it has evolved into today. Despite the Osmonics manufacturing facilities being located in Minnesota, the first use of reverse osmosis in a sugarbush in Minnesota was not until around 1996 or 1997 when Mark Waletzko installed a Sap Brother RO unit for six hundred taps in his sugarbush.