The Future of Membrane Separation Technologies – A Peek Into the Crystal Ball

Peter Cartwright
Cartwright Consulting

The first practical reverse osmosis (RO) membrane polymer was developed at UCLA in the mid-fifties. Thin-film composite RO membranes, the current construction, were introduced by Filmtec Corp. in 1978. What we now know as microfiltration (MF) and ultrafiltration (UF) had been developed in Germany prior to WWII. These all operate as crossflow, pressure -driven membrane separate technologies. In other words, the driving force is pressure.

Although there are membranes and other technologies that utilize other forces to effect separation of contaminants from aqueous streams, this lecture will concentrate on those only employing pressure.

Growing populations, climate change and increased agricultural and industrial activity have placed significant stress on available fresh water supplies, estimated to be less than 0.01% of all the water on this planet. Seawater, comprising 97.5% of the global volume, represents the primary source of non-potable water in most areas of the world. It requires desalination, and RO is now the technology of choice for this. Seawater desalination produces about 100 million cubic meters per day, and is growing at almost 5% per year. Over 95% of this volume is produced by RO.

With over 20 manufacturers of RO membranes worldwide, this very competitive environment has resulted in remarkable improvement in these products. In the last 10 years, the production rate of membrane elements has increased over 25% while the system energy requirement has decreased by 65% compared to 30 years ago. These incremental improvements are detailed in this presentation. New membrane developments are also highlighted.

New membrane developments are also highlighted. These include forward osmosis, biomimetic, DNA templated and metal oxide infused hybrid membranes. The frenetic activity around graphene developments is also detailed.