CTO OUTLOOK

Ramping up the war on energy in desal

LG Water Solutions has taken a sizeable chunk of the reverse osmosis membrane market over the last few years as it expands its product lines. Reducing energy consumption and looking beyond RO are its next priorities.

HOON HYUNG

VP of Engineering and Technical Service, LG Water Solutions

Dr. Hoon Hyung has served in his current position at LG Water Solutions, part of LG Chem, from June 2015. Hyung has more than 20 years' experience in the water industry with a strong background on desalination, advanced water and wastewater treatment. Prior to joining LG Chem, Dr. Hyung held senior technical positions covering the entire value chain of the water industry including at CDM Smith and Doosan Hydro.

What are the main elements of your technology strategy in terms of accelerating future growth?

One of the main strategies to grow our business further is to address the energy issue in desalination. Upon the start of the NanoH2O business in 2005, our slogan was "More Water, Less Energy". That statement emphasises how we embrace the importance of energy saving in desalination.

We have observed innovations in reverse osmosis (RO) membrane technology over the last few decades and LG Chem's NanoH2O membranes have made a great contribution towards energy saving. However, we still believe there is room for improvement. LG Chem just released its new generation membranes with a record-breaking 99.89% rejection, and we believe the products will greatly help to reduce the energy of seawater desalination further.

We are also trying to address technological challenges associated with wastewater reuse, where we see high growth potential in the future. In this application, it is critical to achieve a higher recovery RO system, thus minimising the brine stream and reducing the project cost. Addressing higher recovery is different from typical membrane performance parameters such as rejection and flow. This requires membrane manufacturers to look into other aspects of membrane properties such as physical and chemical durability and tolerance to higher fouling potentials.

How can we achieve that higher recovery with membranes?

To achieve a higher recovery, there are two main aspects to address from the RO membrane point of view. The first one is to make the membrane more resistant to fouling and the other one is to make the membrane more tolerant to higher feed pressure operation. As you increase the recovery, the feedwater gets more concentrated as it moves downstream and the potential for membrane fouling increases as the result. Greater fouling requires more frequent and harsher membrane cleaning. Hence, it is important to come up with technological solutions to make the membrane more resilient. ▶

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THE NEXT GENERATION

LG Water Solutions released the new generation of its seawater RO membranes in late 2018, followed by new brackish water products in early 2019.

Source: LG Water Solutions

RISING UP IN SEAWATER

In 2017 LG Water Solutions won the contract to supply its RO membranes to the 150,000 m³/d El Galalah desalination plant in Egypt, constructed by Metito.

Source: Metito

The higher recovery is also associated with operation at a higher feed pressure. The maximum feed pressure of the membrane element often restricts the system recovery and an enhanced mechanical integrity of the membrane element can provide improvements to recovery performance. The solutions to this issue should be evaluated in membrane element geometry and structure, as well as membrane chemistry. It is questionable that the spiral wound configuration, which is the standard for current RO technology, is the most optimised option to achieve the higher recovery; we may need to come up with different configurations.

What gaps do you see in LG Water Solutions' water technology portfolio that could be strengthened?

In the short term, we are focused on diversifying our product portfolio for brackish water RO membranes. We started our business in seawater RO and have a full product line with strong performance in seawater applications. We released the first brackish water RO product just three years ago and we have made great progress penetrating the market, winning recent high-profile membrane replacement projects like the Groundwater Replenishment System in Orange County and the West Basin Municipal Water District's water recycling facility. However, we still have a limited product offering for brackish water RO and we would like to expand the products to accommodate various client needs.

In the medium term, we are interested in expanding our portfolio to include nanofiltration (NF) membranes. We are seeing some industrial applications where NF membranes are more suitable than RO and there are also municipal applications where NF could be applied for groundwater and surface water treatments.

What continues to be the biggest issue the desalination industry still needs to solve?

I think the overarching theme in the desalination industry is reducing the energy cost. This has been a chronic issue for desalination and the cost is still perceived as high. Any innovations that can help to reduce the cost of desalination has a great impact. The industry has made great progress in the last decades reducing the cost of desalination by orders of magnitude. For instance, recent progress in technology development makes us think that 3 kWh/m³ energy consumption for seawater desalination is not unrealistic. However, there is still room for further improvement. Perhaps we need an outside-the-box idea other than the membrane process to make a quantum jump in energy saving.

You recently released a new generation of your membranes. What drove you to improve the salt rejection even further despite already having market leading performance?

Most of the seawater RO membranes in the market have 99.80% salt rejection while our products have 99.85%. With higher rejection membranes, we could use our loose (high flow) membranes to compete with tight (low flow) membranes from others and reduce energy while achieving similar product water quality.

The 0.05% advantage helped us to penetrate the market and win large projects, accruing more than 1,200 MLD seawater RO project backlog over the last two years. As a relative newcomer to the market, the new generation products with 99.89% rejection will give us even greater separation from our competition.

Which applications have most need for new or improved water technology in your view?

I can think of several areas and one of them is zero liquid discharge (ZLD). ZLD is becoming popular in a number of countries but the cost is still very expensive. It is necessary to reduce the volume of the water flowing to the downstream thermal process in order to improve the efficiency of that process and reduce the cost.

The technologies developed for the ZLD process might be able to be used in other applications such as flue gas desulphurisation (FGD) wastewater treatment in power generation and produced water treatment in the oil & gas industry.

What do you think will be the game changing technologies in the desalination sector in the next ten years?

One thing I would like to see, which could be huge, is innovation beyond the current RO technology based on polyamide chemistry. The polyamide RO membrane with the thin film composite structure was commercialised 40 years ago and it continues to serve its purpose well. However, it is not without limitations. The membrane performance in terms of flow and rejection has room for improvement.

Chemical and physical vulnerability is another issue. For instance, the polyamide membrane is not compatible with popular oxidants such as chlorine, which makes it difficult to better control bio- and organic fouling. Membranes with different chemistry, which can achieve better performance while compensating for the shortcomings of the polyamide chemistry, would be a big innovation. I am interested in seeing how new technologies such as graphene and carbon nanotube membranes will end up as it seems they exhibit great improvement in durability as well as performance. ■