

CTO OUTLOOK

Introducing the future of tertiary treatment

Lenntech has been spearheading innovation in process recovery with its expertise spanning brine concentration to sludge management. David van Lennep discusses its diverse range of ongoing projects and the power of collaboration in the water technology sector.



DAVID VAN LENNEP

Owner and Managing Director, Lenntech

David van Lennep started his early career as a technical sales engineer in an environmental technology start-up company based in the Netherlands, whose main specialisation was advanced oxidation with ozone and catalysts. When the company hit rough times due to low-cost activated carbon from China reaching the market, van Lennep started his own company, Lenntech, almost 29 years ago. Today Lenntech is a recognised international systems integrator in the water treatment industry.

Can you introduce how Lenntech works with water technology providers and its role in testing new technologies or introducing them to market?

There are probably few industry sectors that are as fragmented as the water purification market. I think you could easily say that there could be 40 different key technologies, starting from a simple grid to the finest nuclear grade mixed bed ion exchanger. Assuming that there are probably three to five specialised manufacturers for each of these individual process technologies, this means that a solutions integrator/provider such as Lenntech needs to have thorough knowledge and experience in combining these technologies and their providers into a turn-key solution.

Lenntech cooperates with all technology providers on a case-by-case basis, which allows us to pair the best-case scenario for each customer's needs. We serve as a focal point for new processes which want to penetrate the market and the way that we usually work with them is by initially evaluating their TRL. Depending on the latter we can either offer them a part in the research projects that we're working on or in small to medium commercial projects. Our proven way to perform on the last point is through the 3-step approach: laboratory proof of principle, piloting and then the engineering and building of a full-scale system. We can quickly provide customers with a proof of concept and with the option of onsite testing with our mobile pilots. This builds the trust to our suggested solutions for the project to be completed with the building of a full-scale system.

What are the key projects you are currently looking at in your R&D activity and why?

Lenntech is gradually getting more and more traction in applied research of advanced separation and concentration processes, which results in all sorts of requests from academic institutions all the way to big industrial names and known innovation organisations. Currently we're cooperating with NASA trying to establish and potentially validate simple and efficient solutions to treat the wastewater streams of their planned Lunar or Mars habitation scheme.

Other projects include the valorisation

of brines either through dried salt production (zero liquid discharge) or through splitting the brines into chemicals, acids and caustics that can be reused onsite.

In the Netherlands, there is currently a large issue with ammonium/ammonia emissions in the agricultural sector. We are combining different (electro) membrane and gas recovery processes here to remove the ammonium from the manure. Finally, we are also proud to be building a new demonstration containerised sludge treatment system, to recover 'Kaumera' (a biopolymer) from the Nereda process.

Which solution or technology is Lenntech seeing most demand for currently and why do you think that is?

Water recycling and water footprint reduction have been hot for the last 20 years but in reality, the real requests and projects are only being placed in the last few years. Many plants already have primary and secondary wastewater treatment systems in place but are looking at the tertiary solutions, which is where Lenntech fits in well, as we do not primarily focus on sedimentation and biological processes. I believe the boardroom is now really feeling the pressure from its stakeholders to perform in this field. The more challenging requests we are seeing are for higher process recoveries and salts or nutrients recovery.

What is a major project you are working on related to desalination or brine concentration at the moment, and what impact will it have for clients?

As part of the Horizon 2020 Water Mining project, we are investigating and piloting nanofiltration and advanced high-pressure staged nanofiltration for multivalent removal and for NaCl brine concentration up to high double-digit TDS. The main impact for our clients is to prevent or delay evaporation/crystallisation as far as possible to prevent high capex and opex costs.

We have also successfully engineered, built, and implemented several closed-circuit reverse osmosis (CCRO) projects for industrial clients in Europe over the last years in collaboration with Desalitech. The main impact for our clients is the highest possible recovery and low biofouling. ►

How do you see the potential for recovery of materials from brines and how do we accelerate the economics?

Recovering salts and other materials of brines has been the topic of decades of effort in the water community but we're lucky enough to be in an era that has brought about many interesting technology options to do so. Material recovery from brine is all the rage in the academic community right now with many EU research projects running. There are also big efforts from large desalination users in the MENA region to valorise the brines from their plants and build their business cases. Certainly such efforts are not cheap and currently the costs involved require big capacities in order to produce a reasonable ROI. Each case must be thoroughly studied to see what produced materials make more commercial sense locally and what are the requested specifications.

To accelerate the economics, we have to find case studies where the purity of the recovered materials from brines is less mission critical and where the recovered materials or compounds/chemicals can be directly applied at the same plant location.

What is the current status of the LIFE BRINE-MINING project and what is Lenntech developing as part of that project?

As part of a European Life consortium project, we are applying ceramic ultrafiltration, nanofiltration, selective precipitation, ultra-high pressure RO (UHPRO) and electro-dialysis to coal mining wastewater brine. Other partners in our consortium are adding further evaporation and crystallisation to achieve full ZLD. In March 2022 we will be starting up the demonstration plant.

In which end-user market do you see the greatest need for new or enhanced water management solutions and why?

I would not say there is a specific industry sector attracting most attention. Outside factors such as permit limitations for extracting (ground) water and the public image or the willingness to strongly diminish the water footprint play large roles.

Another trend throughout different industries we see is the request to choose processes or solutions that consume less chemicals or produce as little chemical waste as possible. Energy consumption then only comes second as that can always be bought or produced green.

How is Lenntech looking at greater involvement in the digital water space? Are there particular solutions you are developing here to optimise the operation of the sys-

FROM THE LAB TO THE MOON

Laboratory-based proof of concept is a foundational pillar in Lenntech's approach to bringing new solutions to the market. A current collaboration with NASA seeks to validate wastewater systems for lunar habitation.



Source: Lenntech

tems that Lenntech supplies?

Lenntech supplies its systems with remote access and data logging solutions with 'in the cloud' access. In fact, we try to enforce it or make it critical for warranty and service. In reality, few companies or organisations encourage any access to on-site data so this can be quite a challenge.

Where are you looking for new ideas for innovation outside of Lenntech?

The interesting part is that industries are approaching us for treating their own process product streams or liquids, which are not necessarily classical water treatment cases. What we see is that any aqueous liquid can potentially be treated with our advanced separation and concentration technologies, whether they are pressure driven, electrochemically driven, sorption driven or thermally driven. For example, many organic rich solutions need to be de-acidified, desalinated or concentrated (dewatered). This forces us to stretch the process parameters we are used to applying in regular water treatment to the next level. The innovations then come from real life industrial applications we are testing on.

Also, constant interactions with specialised external technology providers from our partner network can be very beneficial here and, in that sense, I would always invite specialised technology providers in the separation and concentration field – whether start-ups or established industrial

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David van Lennep, Lenntech

entities – to reach out to us for collaboration. My belief is that the real know-how is in the right process application of the technologies and not so much in the manufacturing of a specific machine or filter.

What do you think will be the game changing technologies in the water sector in the next ten years? What is ripe for disruption?

For our market, all next step membrane recovery improvements such as UHPRO, high performance nanofiltration, solvent resistant membranes, variations of membrane distillation, advanced electro-membrane processes, very tight ceramic filtration and selective ion exchange resins. These may not necessarily be game-changing but hopefully our work will showcase major improvements in several of these innovative process applications. ■