

Capturing a greener future

by Laura Langh-Lagerlöf, *Commercial Director, Langh Tech*

Innovation is at the core of Langh Tech. Since our founding a decade ago, we have seen several new rules and regulations enter force to make the maritime industry more sustainable, which have all played their part in shaping Langh Tech into what it is today. Originally, the company was founded as a solution to the 2015 designation of much of Northern Europe as a sulphur emission control area, aiming to provide a more efficient scrubber system to sister company Langh Ship's fleet than the other options on the market at that time. Since then, we have kept challenging ourselves to help the industry become greener, expanding our portfolio with several other tech products, with onboard carbon capture (OCC) being the latest project.

With OCC, it has been important for us to get ahead of the regulations and take action pre-emptively. Carbon capture is emerging as a key technology in the transition of shipping towards net zero as it provides a cost-effective addition to other decarbonisation options. There are no established solutions on the market yet, which is why we wanted to take on this ambitious project of paving the way and getting the innovation race started.

After the decision was made to start the R&D process, it didn't take long to go from an idea brainstormed at a meeting to a finished, commercialised product. From pilot trials in 2024 to the first commercial project being scheduled for installation this year, the project glided with great success.

Unique design

Langh Tech's OCC system utilises a unique circular approach. Unlike many other carbon capture technologies, ours does not apply an absorption-desorption cycle, which results in a significantly lower increase in energy requirements than most amine-based systems. Instead, our system utilises a post-combustion technique, only including the first part of the conventional two-step process where the ship's exhaust gases containing CO₂ are directed into a capture unit.

The CO₂ in the exhaust gas dissolves into the liquid containing sodium hydroxide (NaOH), commonly known as caustic soda. Thanks to a counter-currently flowing solution and maximised reaction surface area within the unit, the highest possible carbon capture rates can be achieved. Following several consecutive reactions, the CO₂ is eventually chemically bound into the thermodynamically stable product of sodium carbonate.

After the capture step, the sodium carbonate that is dissolved in a liquid phase is transported into a storage unit for offloading at the port. This enables avoiding the typically applied second step of regeneration, where the CO₂ is released from the solution and further compressed and liquefied. This significantly reduces the additional energy requirements for the system and, thus, a higher increase in fuel consumption. Once the vessel arrives at the seaport, the liquid containing sodium carbonate can be offloaded by pumping and further utilised in land-based industries, contributing to the circular economy.

Langh Tech's OCC systems are designed with flexibility in mind, both considering the ease of use and the design. The size can be adapted and scaled according to the specific needs of each vessel. This approach ensures a seamless integration of the technology into the existing ship

infrastructure, offering a practical solution for a wide range of ship types.

Sustainability from beginning to end

Throughout the product development, it was important to make every step of the process sustainable, from the reagents required to the end product generated.

The capture reagent, sodium hydroxide, was selected due to several of its qualities. On top of its advantages in chemical properties, sodium hydroxide can be produced via the electrolysis of sodium chloride (NaCl), i.e. table salt, using renewable energy sources. This ensures a substantial reduction in emissions and maximises the overall environmental benefits throughout the product's life cycle.

As for the end product, the sodium carbonate can be further utilised by a variety of other industries, including the manufacturing of glass and detergents. Currently, the sodium carbonate sector predominantly relies on extracting ores from the Earth's crust. The low-carbon alternative that the OCC process provides thereby contributes to the decarbonisation of these related industries as well.

Langh Tech's OCC system allows simple operation processes which do not require new specialised equipment. The used chemical has already been applied and is well-established in the maritime industry.



From functional to optimised

With a ship-owning company within our group, we have always had the shipping point of view as a driving force, and with that in mind, we have seen the changes affecting the industry as a challenge to improve our own fleet. This has also provided us with a good test platform for our products before taking them to a wider market, which is also where our OCC trials were conducted.

In the spring of 2024, after several months of land-based testing, the first pilot system was installed on board *Laura*, one of Langh Ship's freighters. The initial testing phase was a valuable learning experience, which led to an even deeper understanding of the system and its chemistry. Several improvements were made before finalising a product that could be put on the market.

The testing period last year was highly successful, proving that the pilot system's performance corresponded with the theoretical estimates. But while it's good to have a functional system, it's even better to have an optimised one! That is why we fully utilised the pilot installation to push the system to even better performance. The system's performance is a compromise between several factors, including capture efficiency, energy requirements, and product quality aspects. During testing, we gained the confidence to bring maximum momentary capture rates up to 90% from the exhaust gas coming into the system while ensuring the capture product fulfils purity requirements.

Since the pilot, the design of the OCC system itself has also been iterated. Several end-product storage solutions have also been considered throughout the process, landing at choosing each solution



Photos: Langh Tech

individually for the client's needs. We are also continuously working on improving the performance even further by, for example, conducting research on increasing the reaction area within the system to improve capture efficiency.

What's next?

Besides the first commercial installation later this year, Langh Tech will also be

installing the OCC systems on three of its sister company Langh Ship's newbuildings that will be delivered starting spring 2025.

We are also looking forward to engaging in different kinds of projects, which will generate new ideas on how to even further improve the system and fit the diverse needs of various vessels. We are excited to see what kind of opportunities 2025 will bring along to push our innovative skills even further! ■



Langh Tech

The Finnish, Piikkiö-headquartered Langh Tech designs and produces scrubbers for SO_x removal from exhaust gases, water treatment units for closed-loop scrubbers, as well as ballast water management systems. In addition to component delivery, the company takes care of commissioning and offers installation supervision, crew training, and after-sales services. In 2024, Langh Tech added an innovative onboard carbon capture system to its portfolio to aid shipping in the industry's decarbonisation efforts. Sail to langhtech.com to discover more.