

Cleaner industry with carbon capture

Tuticorin Alkali Chemical and Fertilizers Ltd. (TFL), Chennai, India capture 60,000 tonnes of CO₂ per year from a coal plant. Using gasketed plate heat exchangers from Alfa Laval and a newly developed chemical solvent, TFL became the world's first low-cost industrial scale carbon capture and utilization (CCU) plant.

An eco-friendly dual-manufacturing process

Originally opened in 1981, TFL produces ammonium chloride fertilizer at its facilities, using waste CO₂ from the neighbouring SPIC Fertilizer plant. As southern India's sole producer of soda ash, the 10 MW facility also converts CO₂ into this vital ingredient for household cleaners, glass, and other products. Thanks to stringent controls, TFL's soda ash has the highest quality rating in the industry.

"We use CO₂ as a raw material for soda ash production. When our previous supplier was no longer able to deliver the quantities we required, we tested several solutions and finally selected this process, which allows us to capture and reuse our own CO₂ gas," says Mr. Ramachandran, Managing Director at TFL. "At this point, we capture 174 tonnes of CO₂ per day, or approximately 60,000 tonnes per year."



Transition to CCU generates energy savings and reduced costs

Faced with the challenge of reducing CO₂ emissions to the levels required by the Paris Agreement, heavy industries such as TFL are embracing CCU technology at an ever-increasing rate. Most commonly, CO₂ is removed from flue gases and process streams using a solvent-based absorption/stripping system, which requires several cooling, heating, condensing, and re-boiling steps – all of which use large quantities of energy. Alfa Laval's broad portfolio of highly efficient gasketed plate heat exchangers (GPHEs) are designed to meet the energy-intensive demands of CCU applications like those at TFL. The plate heat exchangers are saving energy, reducing costs, making the process more compact and commercially viable, as depicted in the illustration below.

A. Absorption

In the absorber, the solvent extracts CO₂ from the feed gas.

B. Heating

CO₂-rich solvent is further heated in exchanger using hot lean solvent from the desorber.

C. Separation

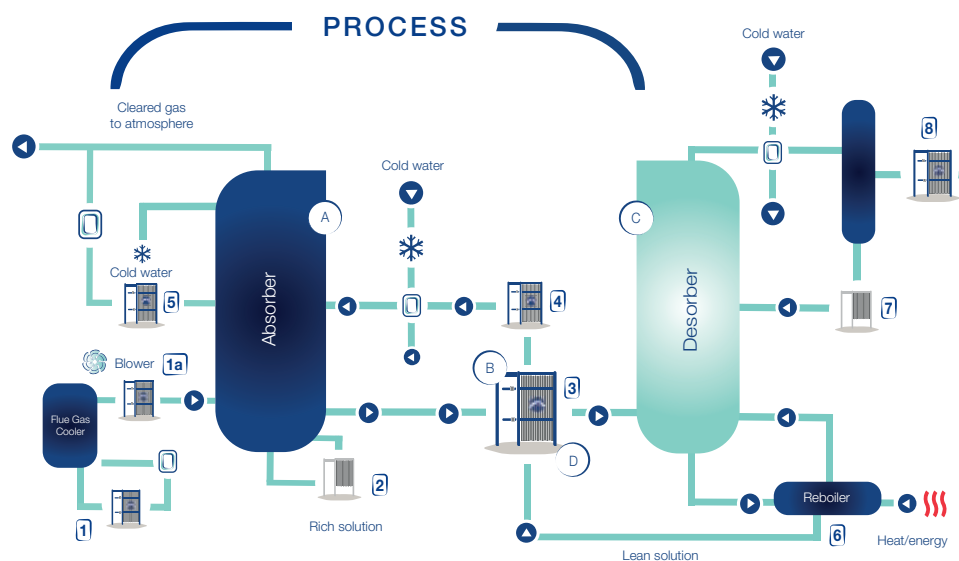
CO₂-rich solvent further heated within the desorber, where CO₂ molecules are released from the solvent.

D. Regeneration

CO₂-lean solvent passes back through the exchanger to the absorber for reuse.

E. Reuse

The CO₂ is reused as raw material for TFL's own soda ash production.



1. Quench Water Cooler (DCC Circulation Cooler)

1A. Gas Cooler

2. Rich Solvent Cooler

3. Lean/Rich Solvent Interchanger

4. Lean Solvent Cooler

5. Wash Water Cooler

6. Reboiler

7. CO₂ Condenser

8. Interstage Cooler

A cleaner solvent for a sustainable process

Compared with amine, the chemical most used in carbon capture processes, the solvent TFL work with is more efficient, less expensive, and less corrosive. A 5-month pilot test in Norway showed that it captured more than 25,000 tonnes of CO₂, while demonstrating solvent emissions of only parts per billion, compared with parts per million for traditional solvents. Aerosol emissions were 80 % lower than the permissible limit.

Adding to the benefits of this technology, Alfa Laval's gasketed plate heat exchangers are engineered for superior reliability and performance under challenging conditions, while requiring less energy and space. They offer significantly higher thermal efficiency than traditional shell-and-tube solutions, in a compact design that is easy to install and service, making them a perfect fit for these installations.

“For all our critical services, we have used Alfa Laval plate heat exchangers. Our experience has given us confidence in the brand. They have helped us through the design phase, project execution, and beyond. We're happy with the continuous interaction and their willingness to fine-tune the design to optimize our selection. We're also really happy with the cost.”

Mr. Ramachandran, Managing Director at TFL



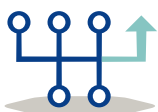
Emissions savings

174 tonnes of CO₂ per day, or approximately 60,000 tonnes per year.



Energy savings

50 % reduction in energy consumption compared to conventional solvents.



Technology shift

The world's first low-cost industrial CCU plant.



The Tuticorin Alkali Chemicals and Fertilizers Limited plant uses six medium-sized Alfa Laval Gasketed Plate Heat exchangers, in the following positions:

- Direct circulation cooler (DCC)
- Interstage cooler
- Lean/raich amine interchanger
- Lean solvent cooler
- Water wash circulation cooler
- Gas cooler

Making CO₂ capture more efficient

In addition to highly efficient heat exchangers, Alfa Laval offers the broadest range of gaskets on the market, capable of withstanding the solvents used in the absorption process. Alfa Laval solutions minimize the need for energy and cooling water, while simultaneously maximizing the efficiency of the CO₂ capture, and reducing the cost of running other processing equipment.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com.

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Alfa Laval reserves the right to change specifications without prior notification.