WHO KNEW?*
TEXAS CARBON MANAGEMENT PROGRAM

The Texas Carbon Management Program focuses on carbon capture from coal and natural gas power plant flue gas to help mitigate anthropogenic greenhouse gas emissions. The program investigates post-combustion amine scrubbing, which is a flexible, tail-end technology that can be retrofitted onto existing power plants or be included as part of a greenfield installation.

The program's goal is to understand and improve all aspects of amine scrubbing. There are currently sixteen graduate students working on collecting thermodynamic and rate measurements, testing amine degradation, mitigating nitrosamines, quantifying aerosol formation, creating process models, improving process design and efficiency, and understanding pilot plant results. These efforts have resulted in establishing the use of concentrated, aqueous piperazine (PZ) with an advanced flash stripper as the most efficient, open-literature amine scrubbing system.

Laboratory Studies

The lab has a wide variety of analytical equipment used to study all aspects of a solvent. Amine solvents are heated to high temperatures and sampled over the period of weeks to check for thermal stability. Degradation products are analyzed using in-house cation and anion chromatographs. This has shown that PZ is more stable than monoethanolamine (MEA), the previous solvent of choice.

Other studies include: using NMR to determine the amount of free amine and products in loaded solvents, using FTIR to determine amine volatility, and using the wetted-wall column with NO_2 to study nitrosamine formation kinetics.

Modeling Studies

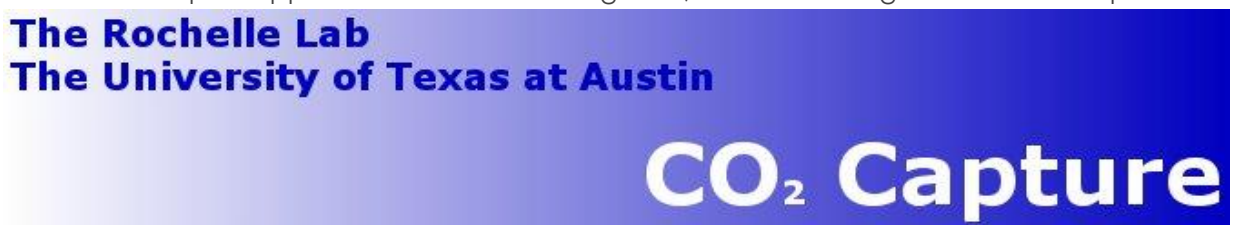
The experimental data collected in the group is regressed into a rigorous Aspen Plus® process model that can predict plant performance, design new process configurations, and understand the inner workings at a more detailed level than possible through experiments alone.

Rigorous models have been created for MEA, PZ, PZ/monodiethanolamine (MDEA), and PZ/2-amino-2-methyl-1-propanol (AMP). Using these models, it has been proven that a higher heat of absorption results in a lower cost of capture, an idea that is counterintuitive to minimizing energy performance.

While most of the modeling work focuses on steady state design and optimization, the group has also developed a dynamic model of the amine scrubbing process. Dynamic models are necessary to understand the effects of disturbances on process operation and for controller design.

Pilot Plant Studies

Located at the Pickle Research Center, the group's 0.1 MWe pilot plant provides data to validate models and explore other phenomena, such as aerosol emissions and corrosion. The pilot plant started with a simple stripper and absorber running MEA, and has changed solvents multiple times.



If you are interested in participating in the program, further details can be found here.

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