

## Research topics

# Physical and Chemical Absorption Separation Systems

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### Abstract

The project develops new methods for the design of separation systems involving absorption. Physical absorption is a commonly used alternative to distillation for the separation of light gases. Chemical absorption is important for removal of acid gases and for chemicals production. The design methods consider structural design options and operating conditions to obtain energy-efficient, low-capital absorption flow sheets.

### Project description

Both physical and chemical absorption are commonly used separation processes. Physical absorption can be used as an alternative to distillation for the separation of light gases. For example, in petroleum refinery processes, absorption of light hydrocarbons in a heavy hydrocarbon fraction is used as an alternative to low temperature distillation. New methods have been developed for the design of such systems, considering the choice of absorbent, separation sequence and column operating conditions.

Chemical or reactive absorption is also an important separation process. A case of interest is gas sweetening (the removal of hydrogen sulphide and carbon dioxide in the refining, gas-processing and petrochemical industries). The conventional solvent for acid gas removal is an alkanolamine solution, which is then regenerated in a stripper. Process design is complicated by finite rates of mass transfer, the reactions of certain species and highly non-ideal vapour-liquid equilibrium relationships.

Existing shortcut methods for absorption column simulation and design cannot accommodate the complex features of reactive absorption processes. This restricts the opportunities for systematic generation and evaluation of flowsheet options. A new shortcut model, based on the classical Kremser model, but accounting for temperature effects, finite reaction and mass transfer rates and variation in vapour-liquid equilibrium behaviour through the column, has been developed. This model can represent both the absorption and stripping columns of a reactive absorption process, for example giving good agreement with published plant data for a gas sweetening plant.

This model will be used to evaluate reactive absorption flowsheets. A systematic approach to synthesis and design of chemical absorption systems is under development, and is expected to generate novel processing schemes, with high removal rates but relatively low energy demand.