THE UNIVERSITY OF WESTERN AUSTRALIA

Research Development & Innovation

Design of Dual Reflux Swing Adsorption Systems

UWA technology licensing/ partnering opportunity

- **Novel design methodology**
- **Achieve optimal performance**
- **Eliminate trial & error**
- **High correlation between simulation and implementation**

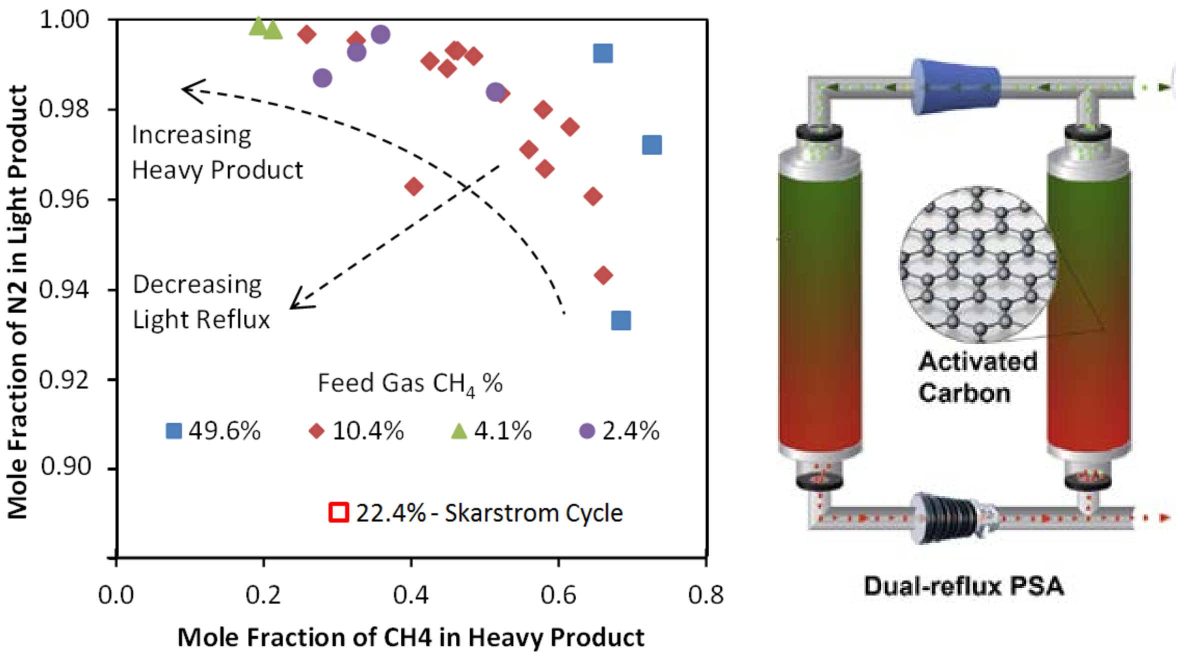


Fig 1: Separation performance with various feed compositions showing the effect of two of the main process variables: Light & Heavy Reflux flow rate and Heavy Product flow rate.

The Technology

To date Dual Reflux Pressure Swing Adsorption systems (DR-PSA) have not been adopted by industry, being viewed as an intellectual curiosity and unsuitable for commercial deployment.

Researchers at the University of Western Australia (UWA) have developed a novel design methodology for DR-PSA systems that leads directly to the optimum design for a set of given inputs with excellent correlation between simulation and implementation thus eliminating costly and time consuming trial & error.

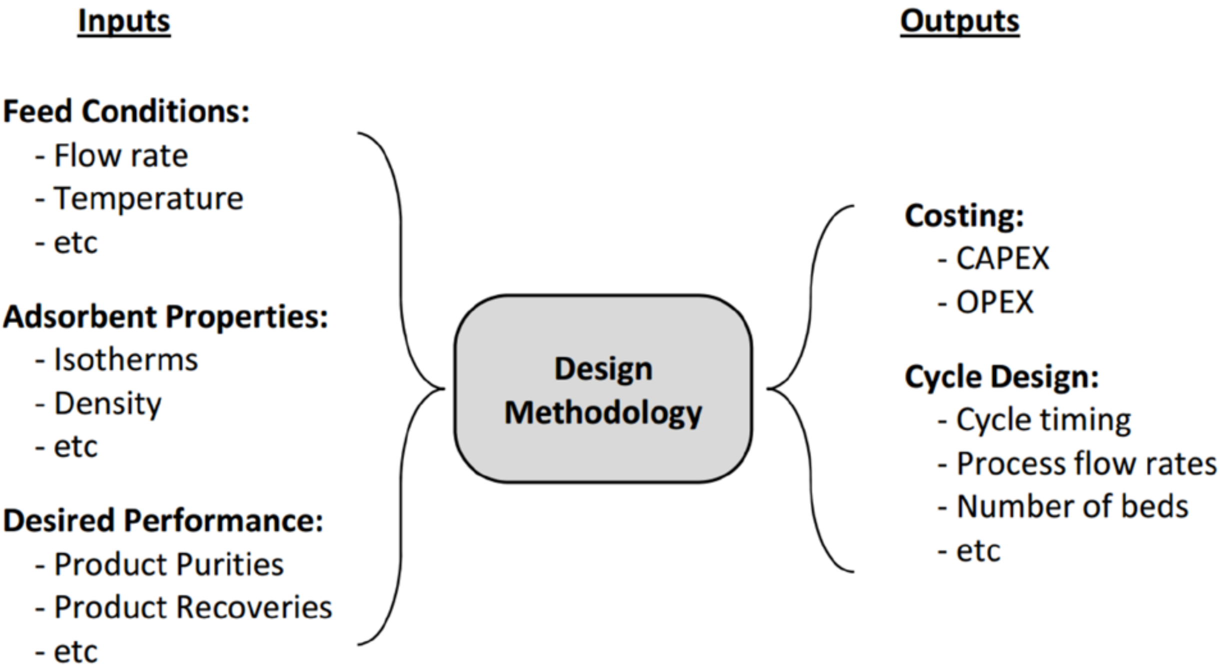
The DR-PSA process (also known as duplex PSA) overcomes a key limitation of the traditional PSA process: PSA processes are rarely able to produce both a high-purity light product (raffinate) from the adsorption step and an enriched secondary product (extract) during the regeneration step.

The DR-PSA process combines the stripping and enriching PSA cycles into a single system where the separation performance is independent of the pressure ratio of the adsorption and desorption steps.

The operation of the DR-PSA process is similar to that of a distillation column where the separation performance is controlled through the reflux rates rather than the pressure ratio like in traditional PSA processes.

The superior performance of the DR-PSA process is illustrated in Fig. 1 by the inclusion of one data point for a conventional PSA (Skarstrom) cycle (hollow red square) obtained on the same DR-PSA test rig.

Fig 2: DR-PSA test rig



Benefits of the Technology

- Ease of design, assessing technical and economic factors, predictability of outcome
- Eliminating trial & error
- Ability to economically concentrate very low grade methane streams when combined with UWA's novel Zeolite adsorbent.

State of Development

We have demonstrated the validity of our design method by applying it to the separation of methane from nitrogen (which is a common industrial application in conventional gas processing as well as for unconventional sources including coal seam gas, biogas).

Combining the design methodology with our novel Zeolite adsorbent (please refer to separate Technology Brief document), we demonstrated generation of a greenhouse gas (GHG) free nitrogen vent stream (100% purity) from an input feed consisting of 97.4% nitrogen and 2.6% methane. Achieving such an outcome in a single step process has never been achieved before.

Commercial Opportunity

UWA is seeking expressions of interest from industry for applying the new design methodology to DR-PSA systems.

The Research Team

Prof. Eric May – Chevron Chair in Gas Process Engineering
Dr Kevin Li – ARC DECRA Research Fellow

The University of Western Australia

UWA is a research-intensive university ranked 96th in the world (Shanghai Jiao Tong University's internationally recognised Academic Ranking of World Universities – August 2016), and one of the internationally recognised Australian Group of Eight Universities.

References

"Demonstration and Optimisation of the Four Dual-Reflux Pressure Swing Adsorption Configurations", Separation and Purification Technology, (2016).

"Non-isothermal numerical simulations of dual reflux pressure swing adsorption cycles for separating N2 + CH4", Chemical Engineering Journal, 292 (2016)

"Capture of low grade methane from nitrogen gas using dual-reflux pressure swing adsorption", Chemical Engineering Journal, 281 (2015)

Intellectual Property

Patent protection has been applied for.

Further Information

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