Membrane processes for gas conditioning

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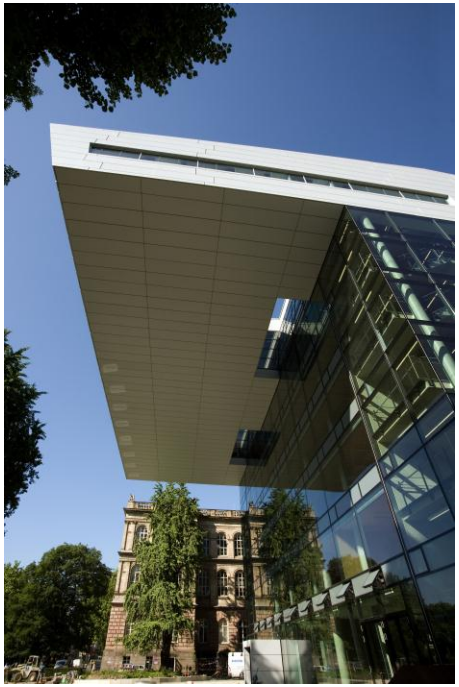
AVT.CVT - Chemical Process Engineering

Outline

- RWTH Aachen University and AVT.CVT
- Gas separation task in TyGRe
- Membrane process design
- Tools for process development
- Model validation
- Process design results
- Conclusion

RWTH Aachen University

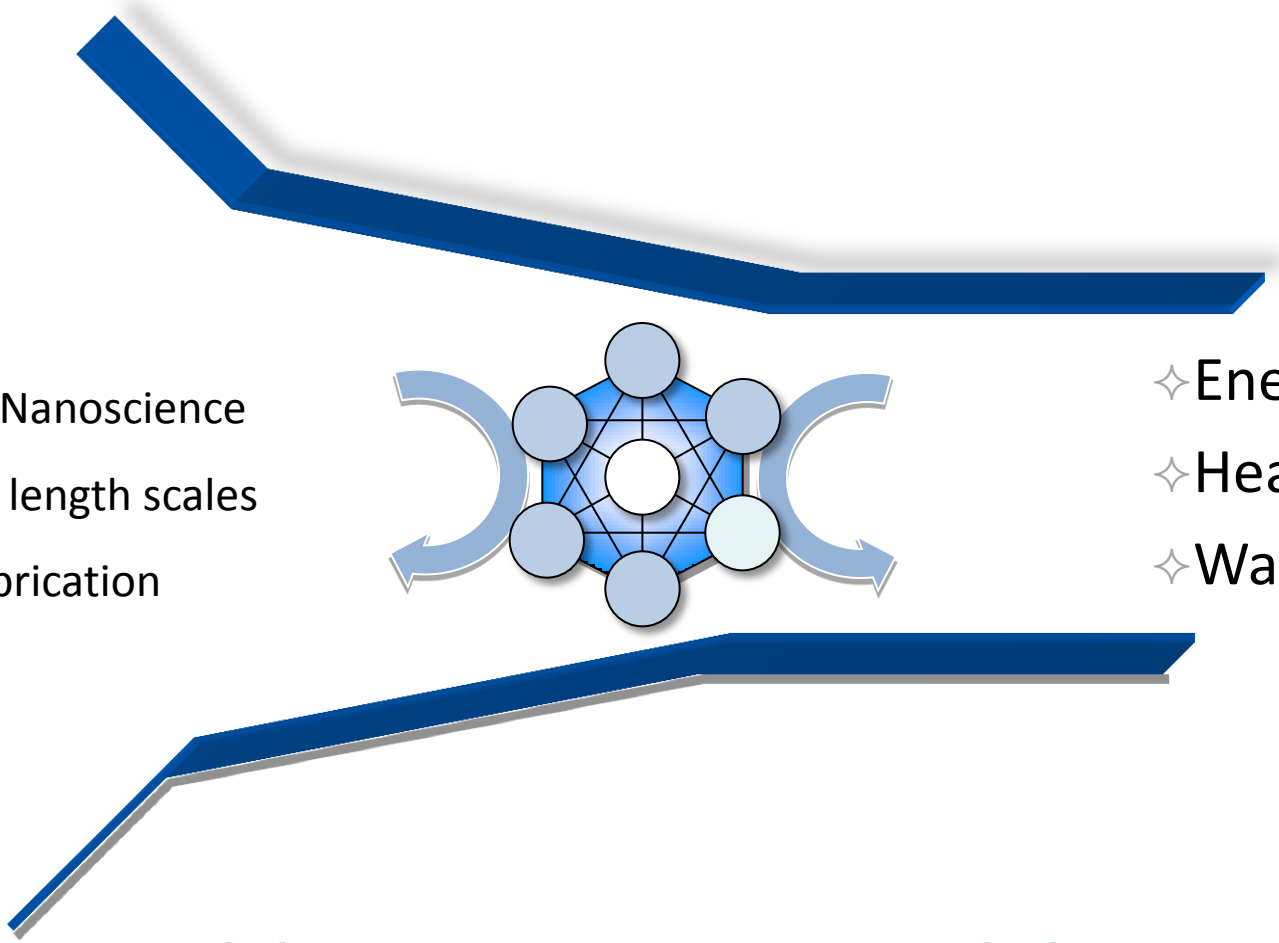
- Focus on Engineering, IT and Natural Sciences, but innovative research and scholarship in other fields of study as well
  - Mathematics, Computer Sciences & Natural Sciences
  - Civil Engineering
  - Georesources & Material Engineering
  - Mechanical Engineering
  - Arts and Humanities
  - Business & Economics
  - Medicine



- 30000 students, 450 professorships, 4000 academic staff, 3000 non-academic staff

AVT.CVT

- Catalysis
- Interface science
- (Macro)molecular Nanoscience
- Simulations across length scales
- Micro and Nanofabrication
- Physics of Fluids

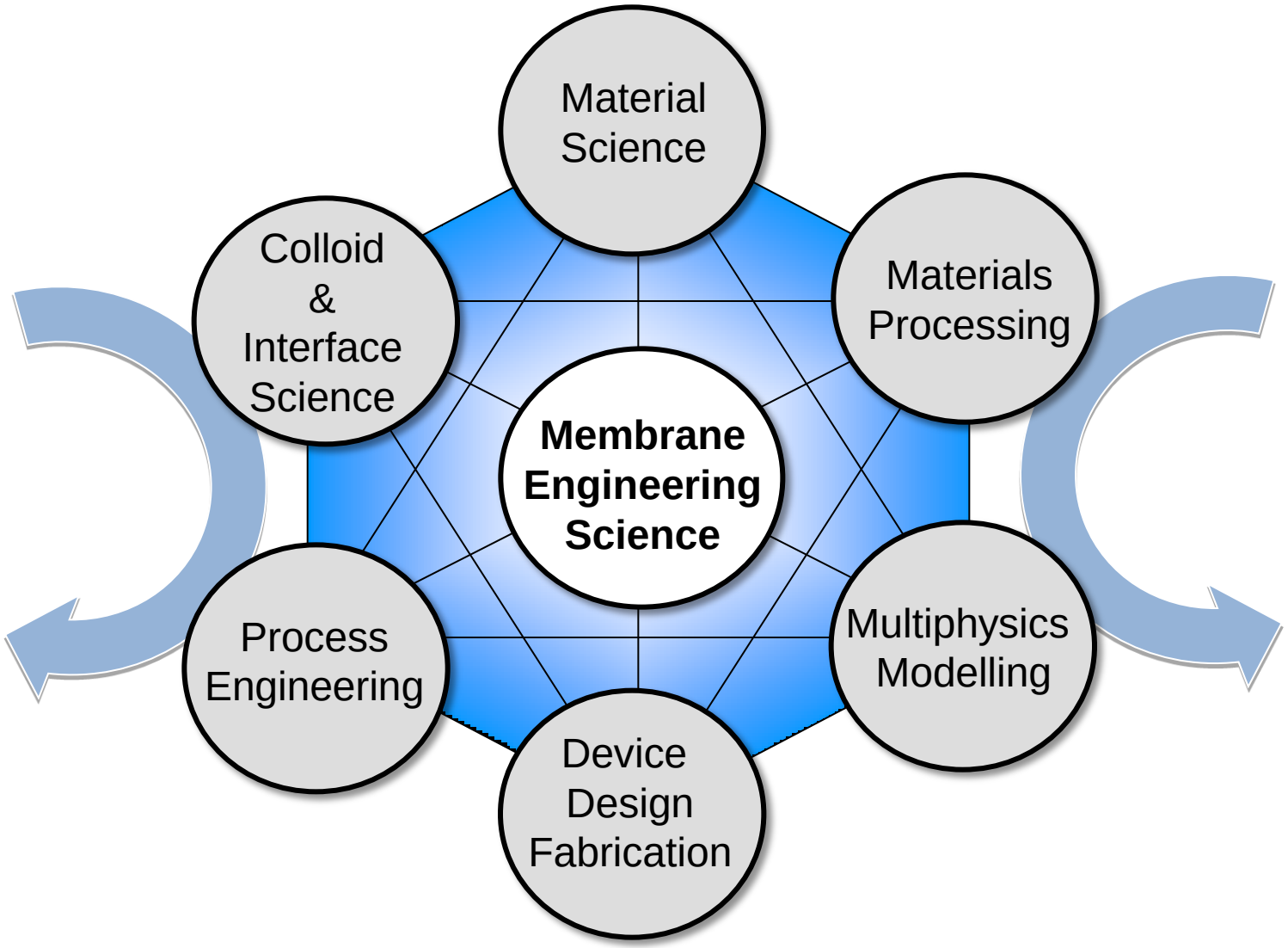


- Energy
- Health
- Water

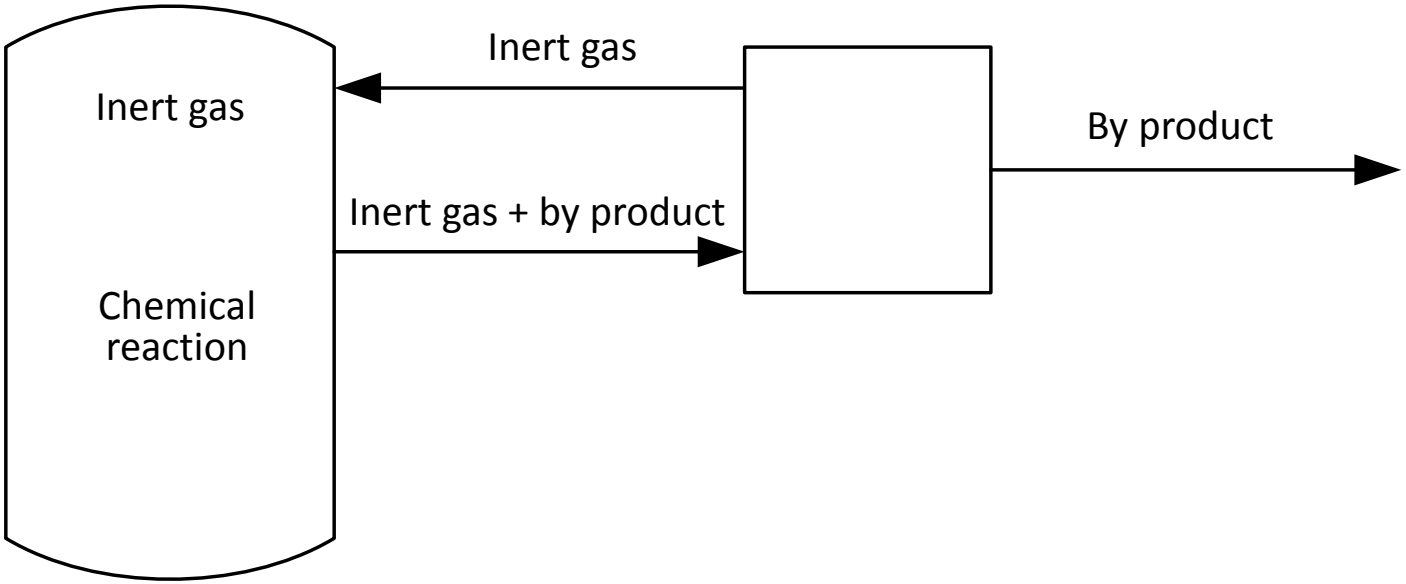
Fundamental Sciences

Chemical Process engineering

Global Challenges

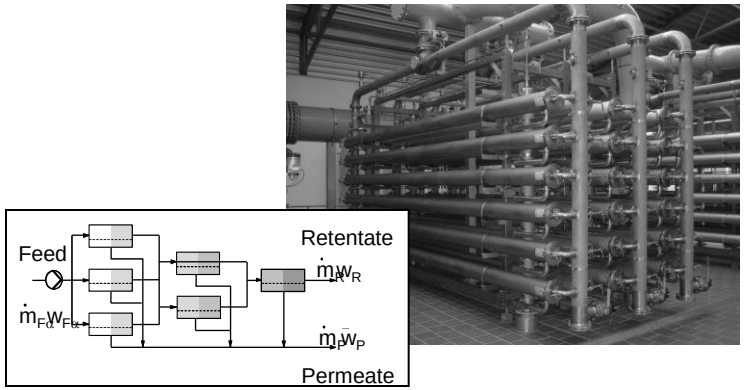

Material Science
Colloid & Interface Science
Materials Processing
Membrane Engineering Science
Process Engineering
Multiphysics Modelling
Device Design Fabrication

Separation task

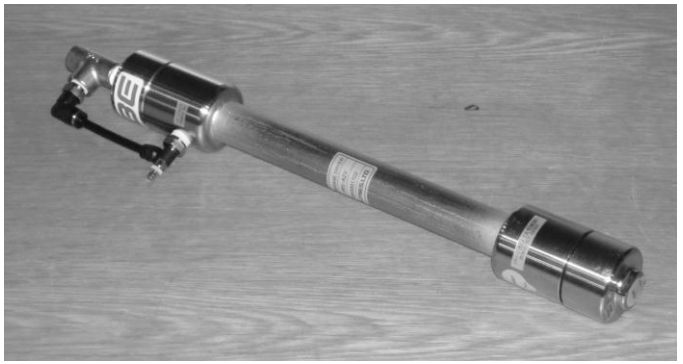


Membrane process design

Prototype plant



Module configuration



Module

Membrane

Tools for process development

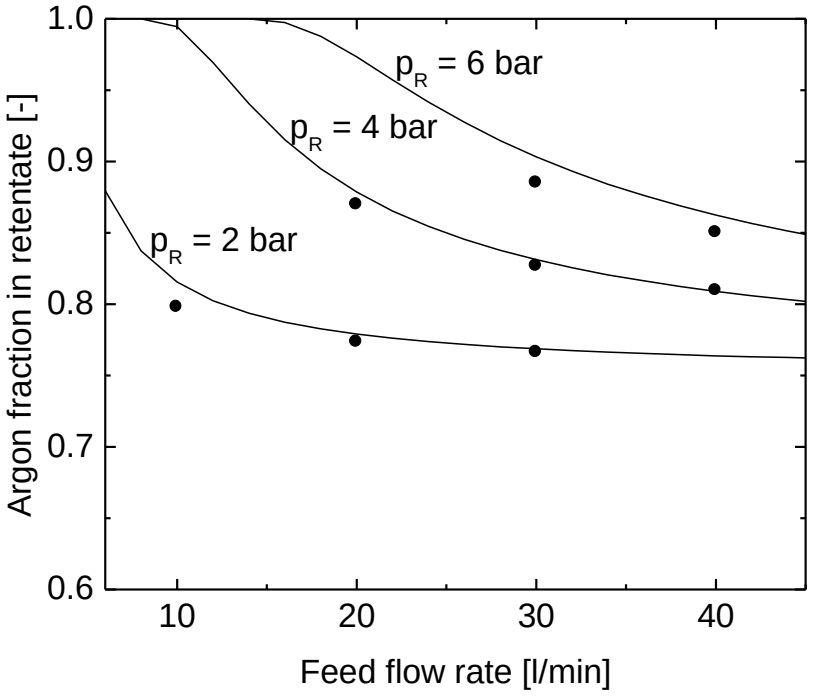
1) Multifunctional gas permeation testing facility

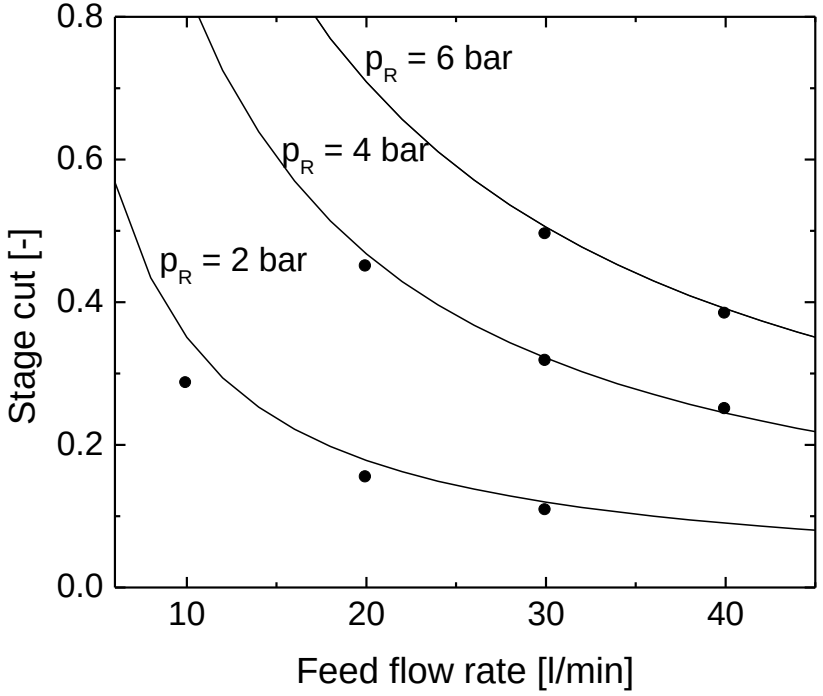
- Single gas permeances
- Gas mixture separation performance

2) Module simulations with Aspen

- Mass balances
- Mass transfer through the membrane
- Pressure losses in feed and permeate
- No concentration polarisation

Model validation

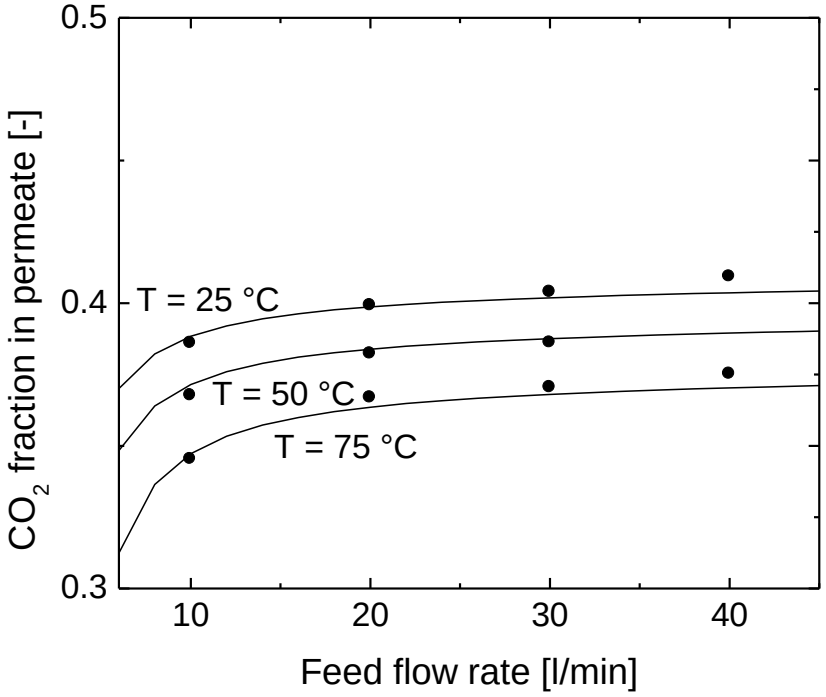


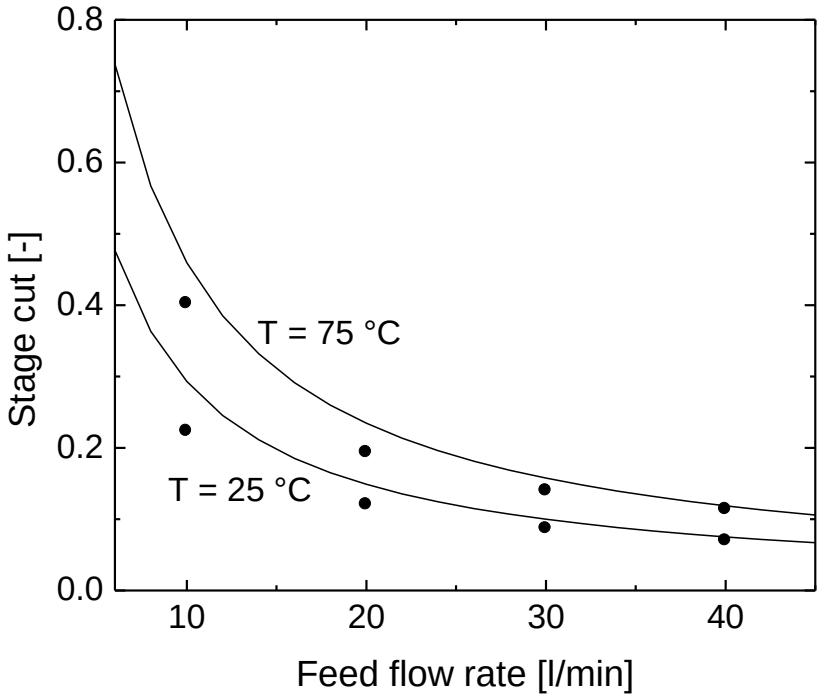


p_{Perm} = 1 bar, T = 50°C,

feed compostition: 75 Vol% Ar, 25 Vol% CO_2

Model validation

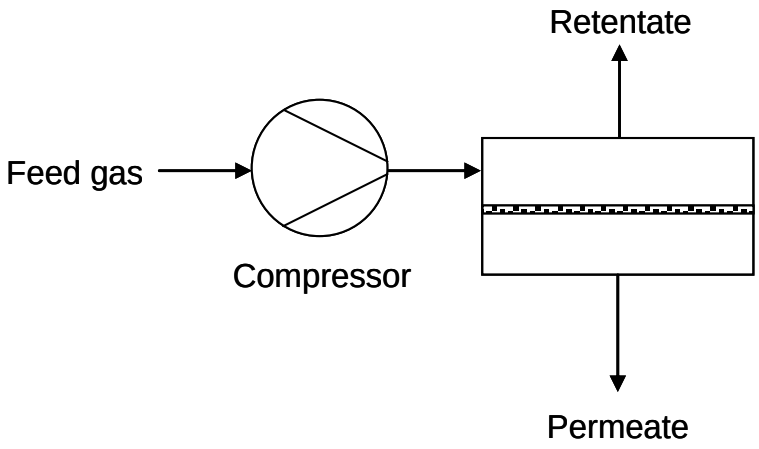


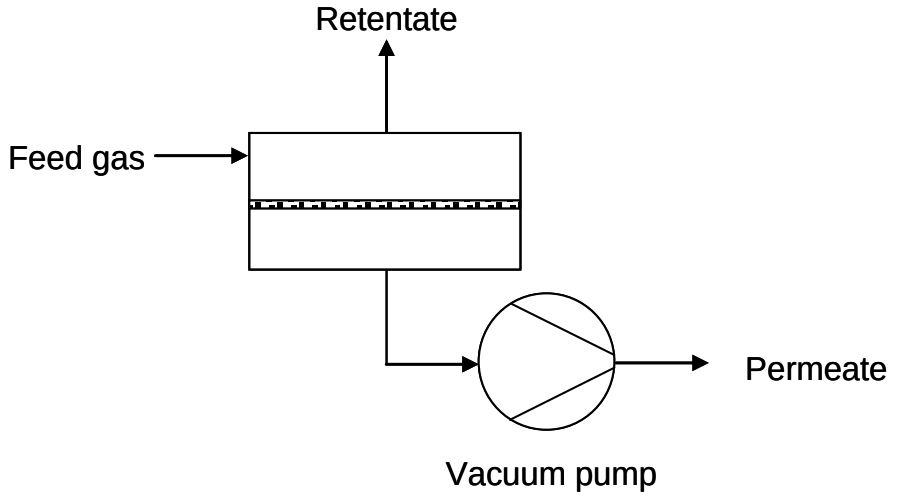


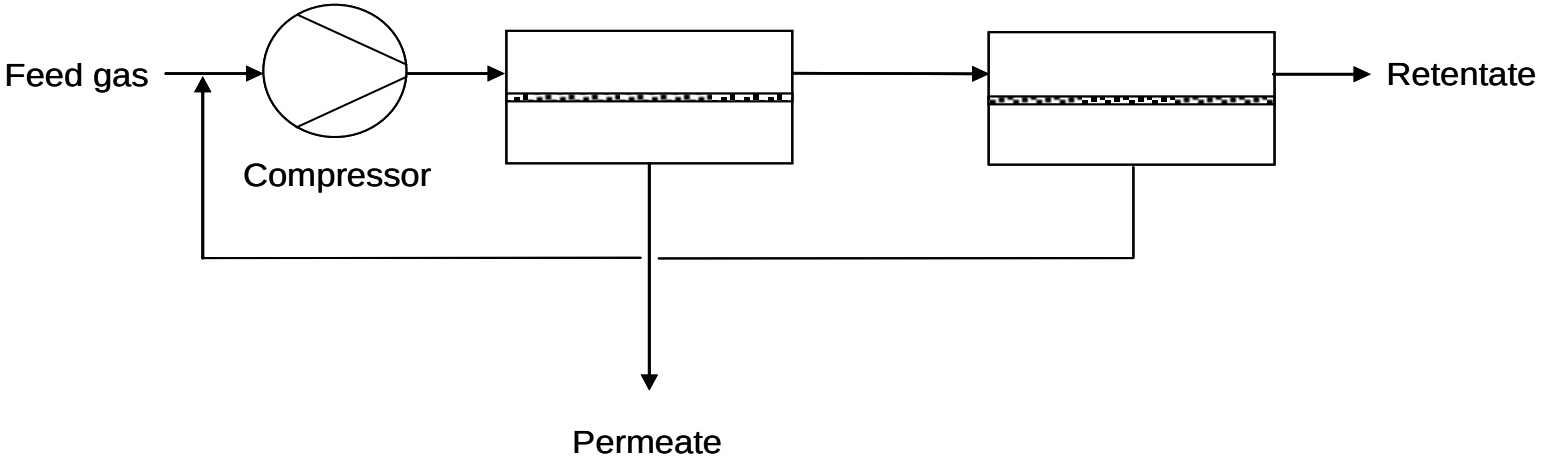
p_{Ret} = 3 bar, p_{Perm} = 1 bar,

feed compostition: 75 Vol% Ar, 25 Vol% CO_2

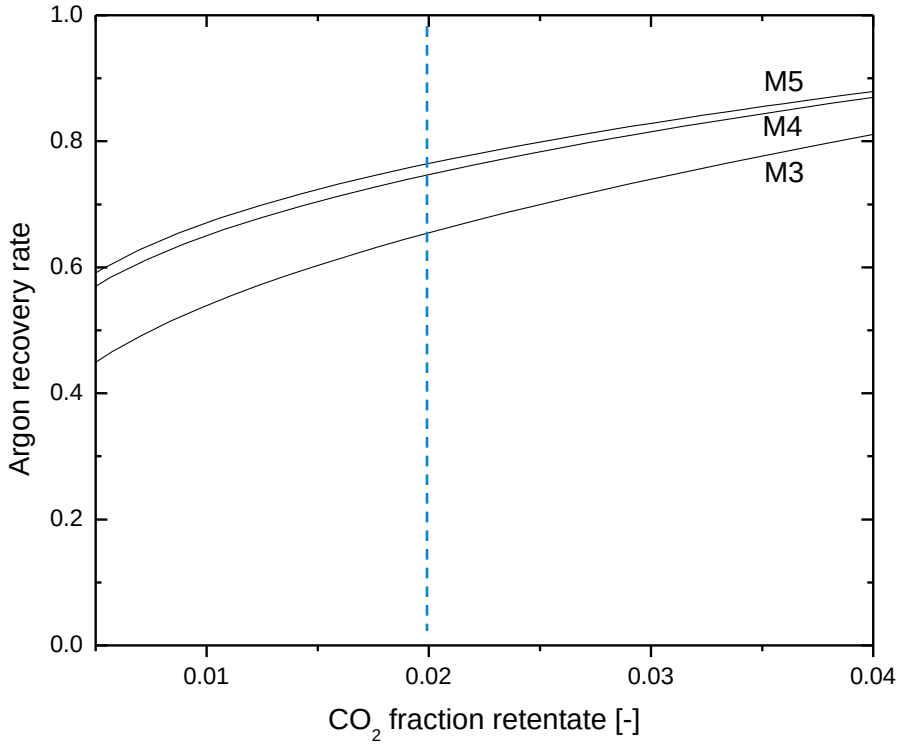
Conceptual process design

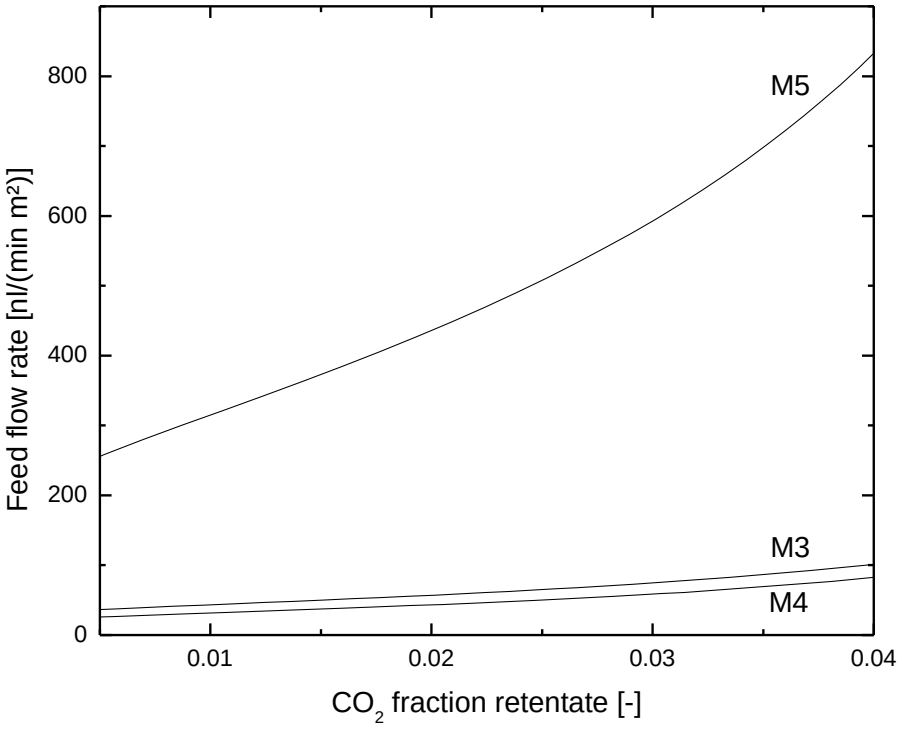


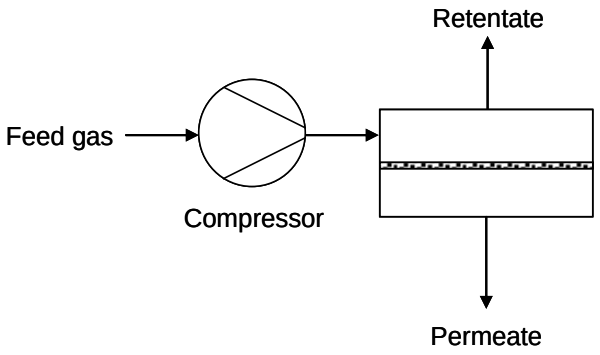




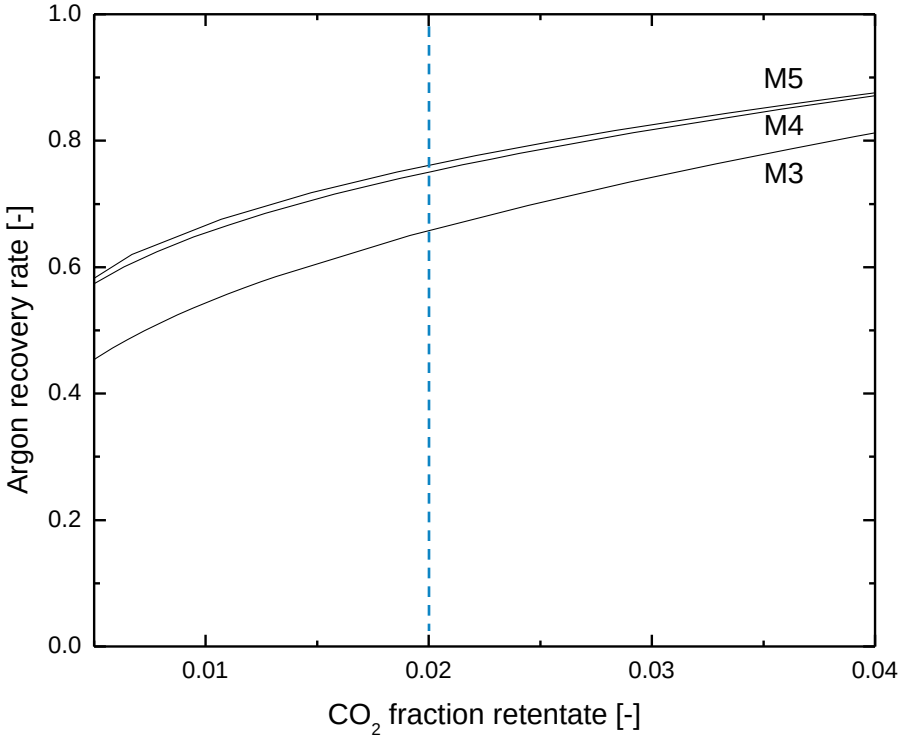
Process simulation

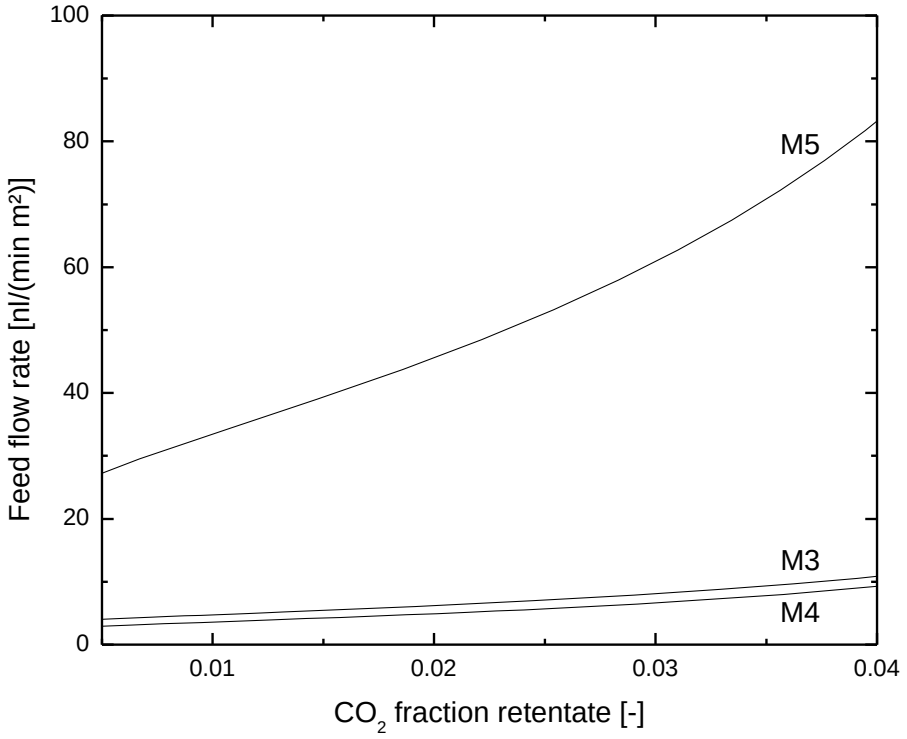


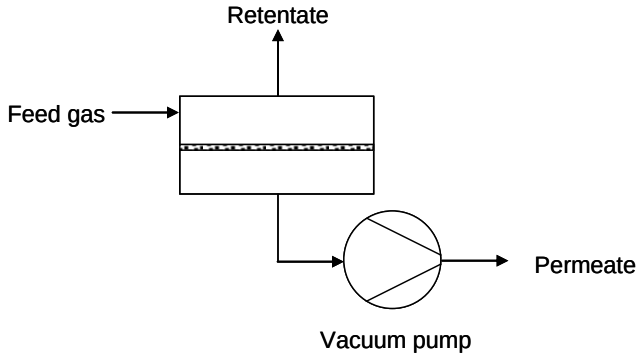




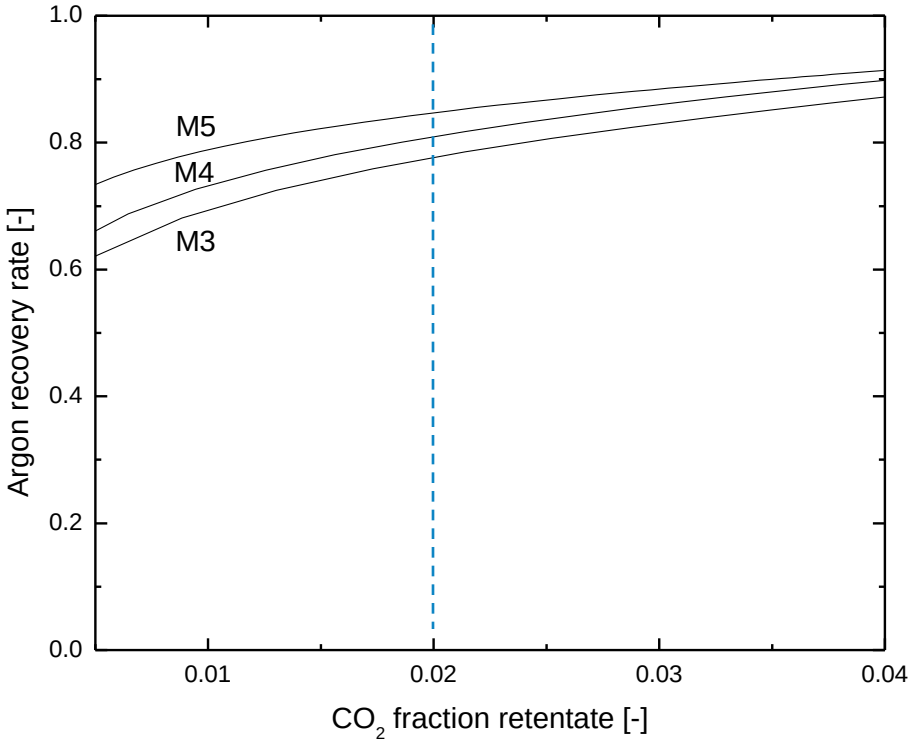
Process simulation

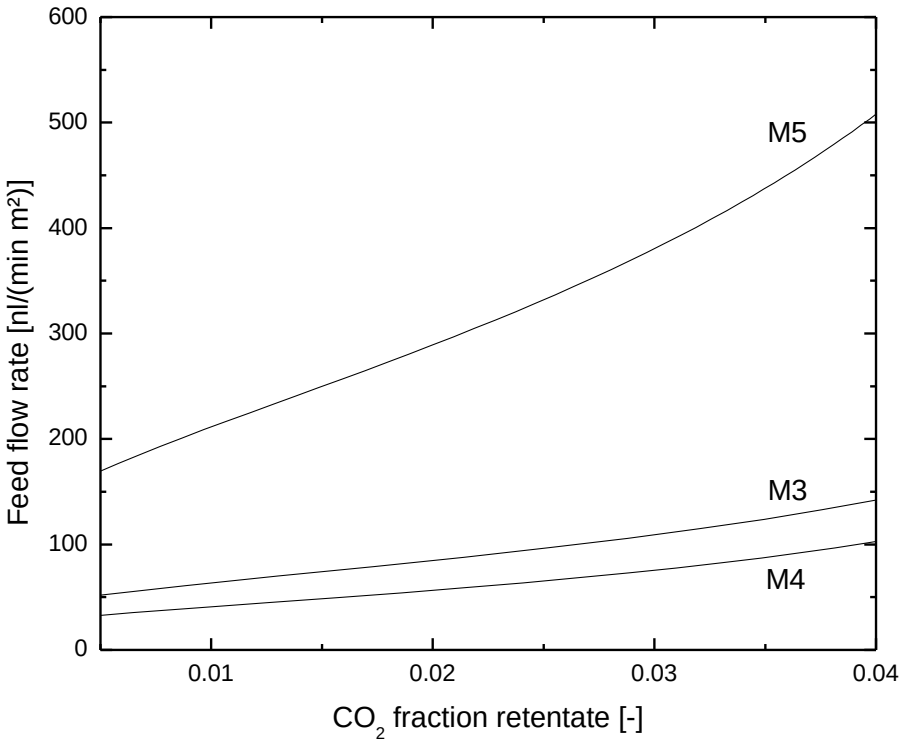


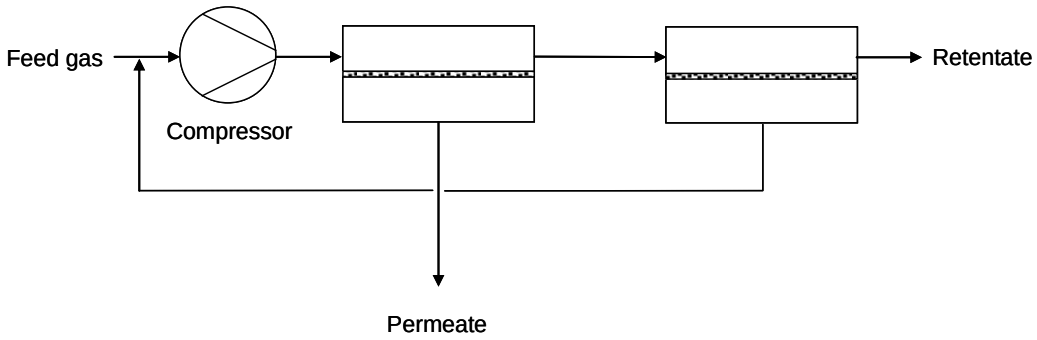




Process simulation







Conclusions

- Inert gas recovery by polymeric membranes for TyGRe process
- Different procedures for inert gas purification were investigated
- Process design and optimisation were executed
- Pilot plant gas separation unit in progress

Thank you very much for your attention!

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