



Curtin University



PCCC-8

Novel structured packing for vapor-liquid contacting

Biao Sun



A global university

Western Australia | Dubai | Malaysia | Mauritius | Singapore

Introduction – Curtin University, Perth, Australia

Curtin University

- Founded in 1966
- Main campus in Perth, Western Australia
- ~60,000 students from 130+ countries
- Strong in Science & Engineering, Business, Health, Humanities, and Medical Sciences
- Research strengths: Energy, Sustainability, Space, Health, Digital Innovation
- Partnerships: BHP, Woodside, CSIRO, NASA



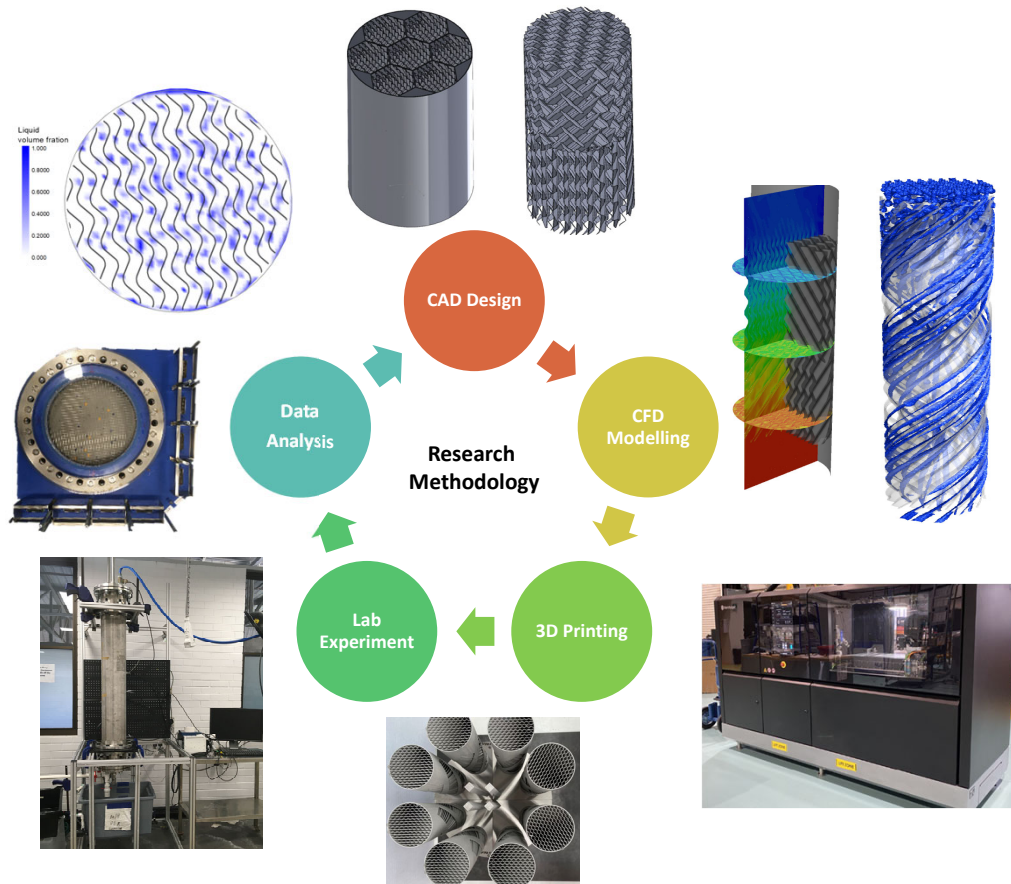
Introduction – SpiroPak PTY Ltd



SpiroPak PTY Ltd (<https://www.spiropak.com.au/>)

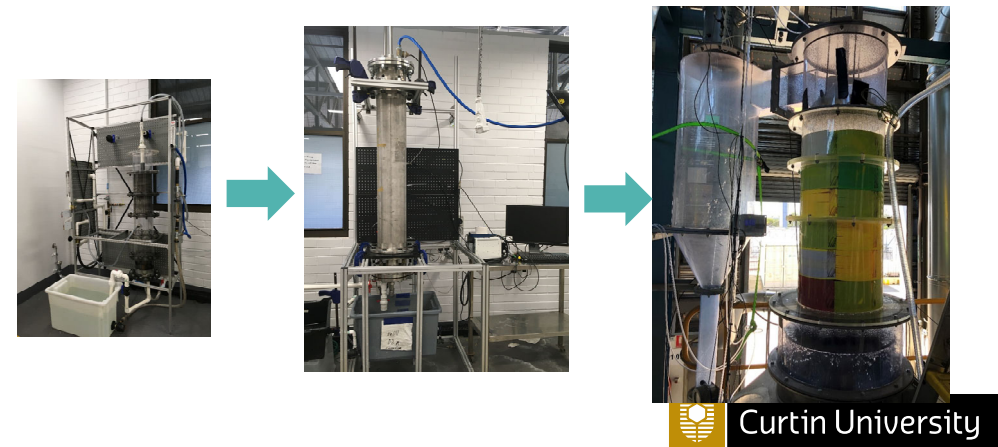
- Australian company, started in 2024, specializing in **structured packing**
- Advanced **separation and mass transfer solutions**
- Applications across oil & gas, petrochemical, and **chemical industries (e.g., DAC, PCCC)**
- Known for **innovation, efficiency, and quality manufacturing**

Research and Development

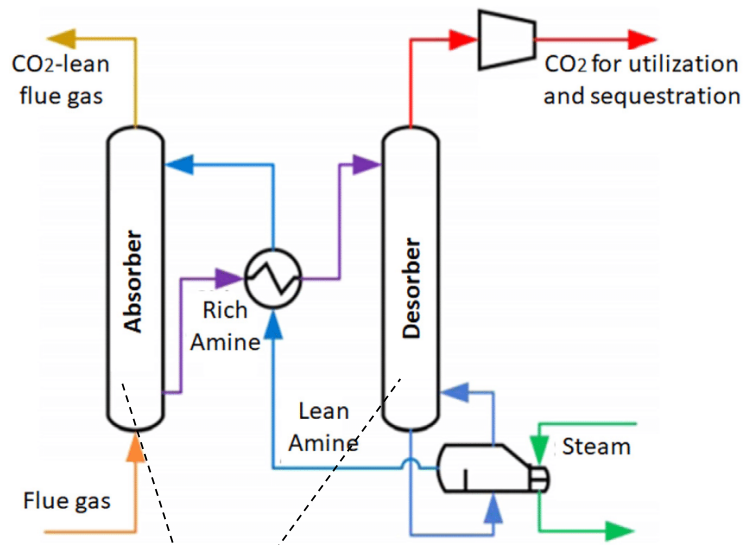


What has been done?

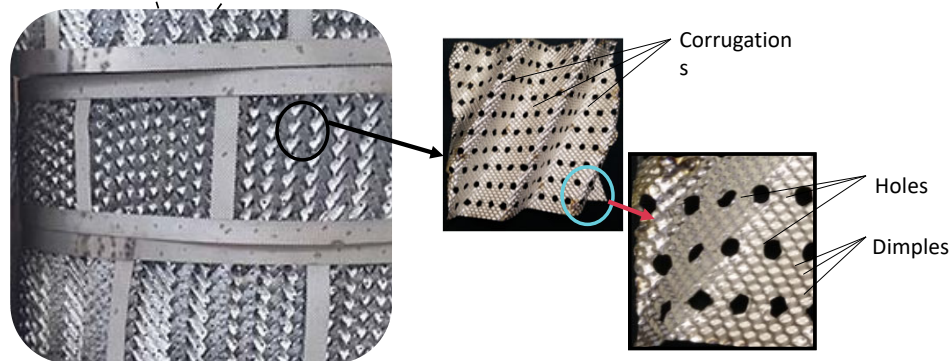
- Patented technology
 - US: 11602726
 - India: 469090
 - Japan: 7499230
- SpiroPak company
<https://www.spiropak.com.au/>
- Technology readiness level 5~6



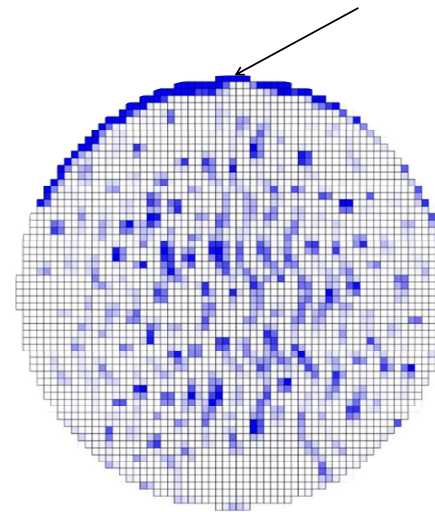
Conventional structured packing



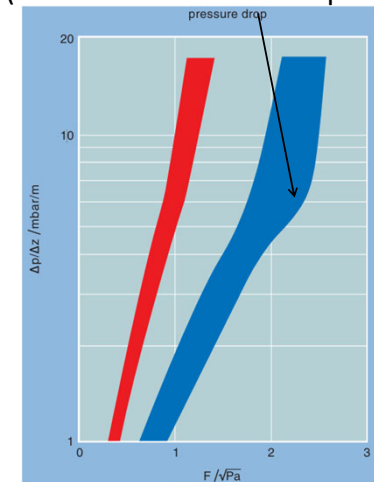
Pressure drop	Pressure ~100 Pa/m
Flooding	Design margin ~70% of flooding velocity
Liquid-maldistribution	Channelling effect
Fouling/forming	Pressure drop increase, and effective area reduced.



Maldistribution
(Wire-mesh measurement)

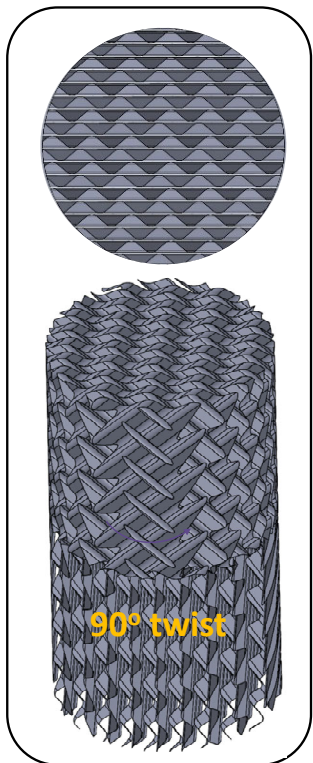


Sensitive pressure drop and flooding
(Ref. SULZER Structured packing)

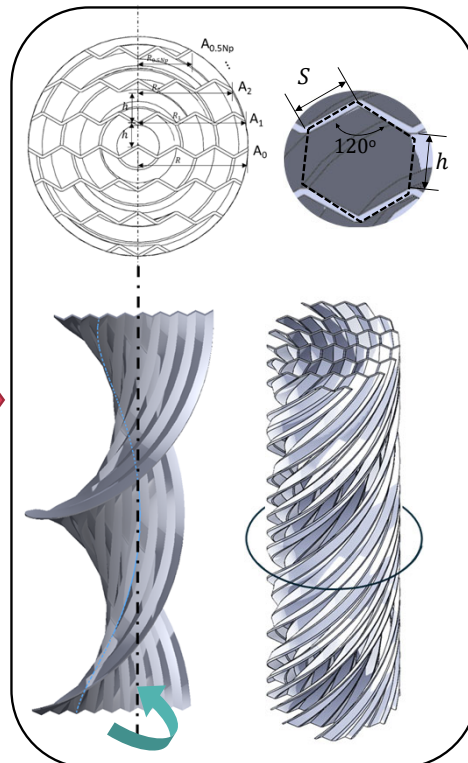


What SpiroPak is?

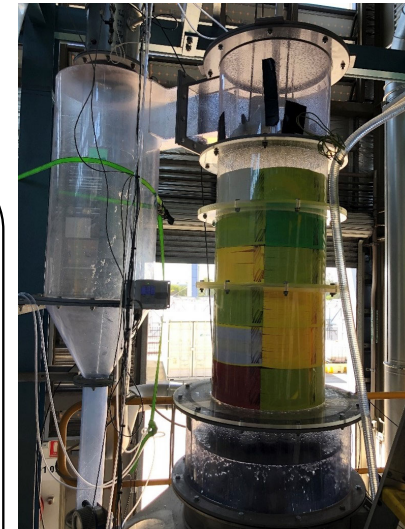
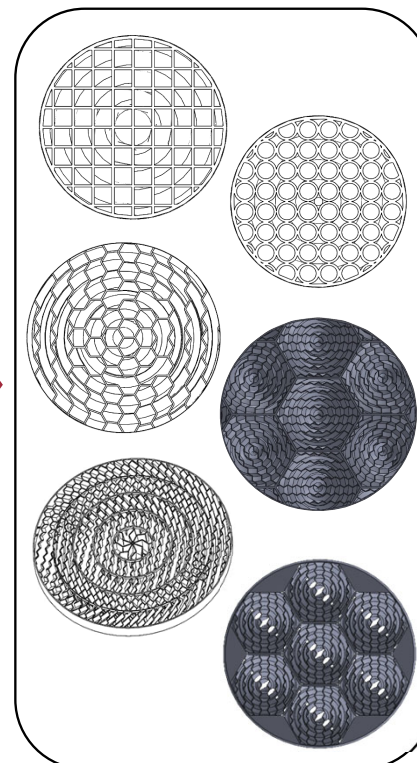
Conventional packing



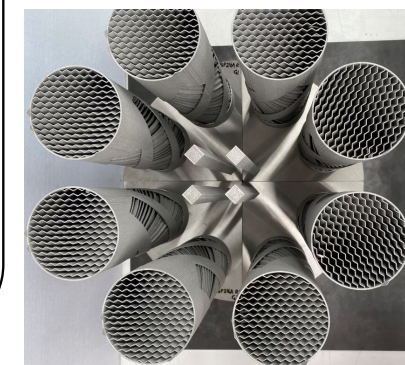
SpiroPak design



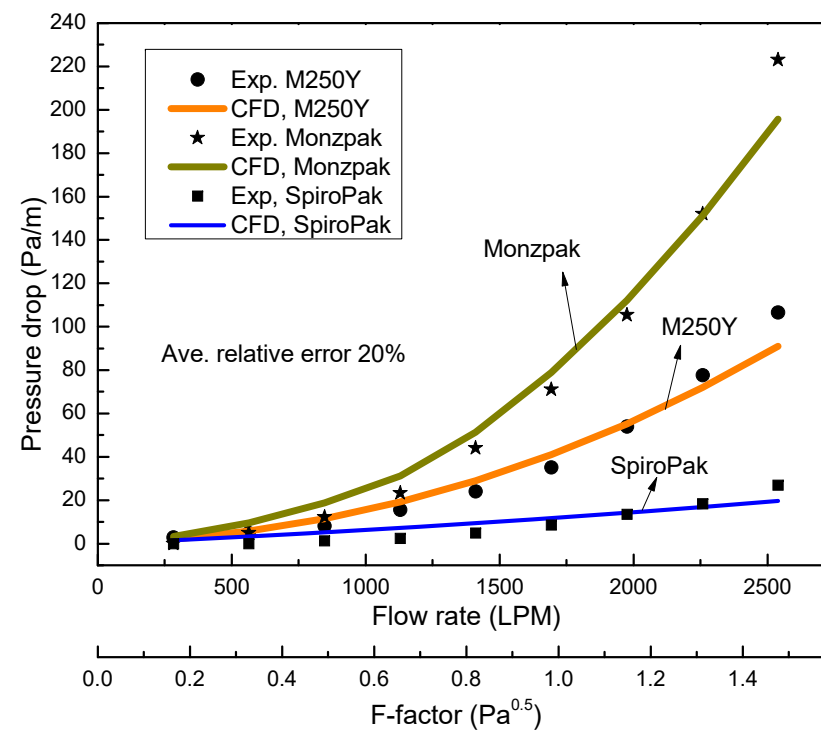
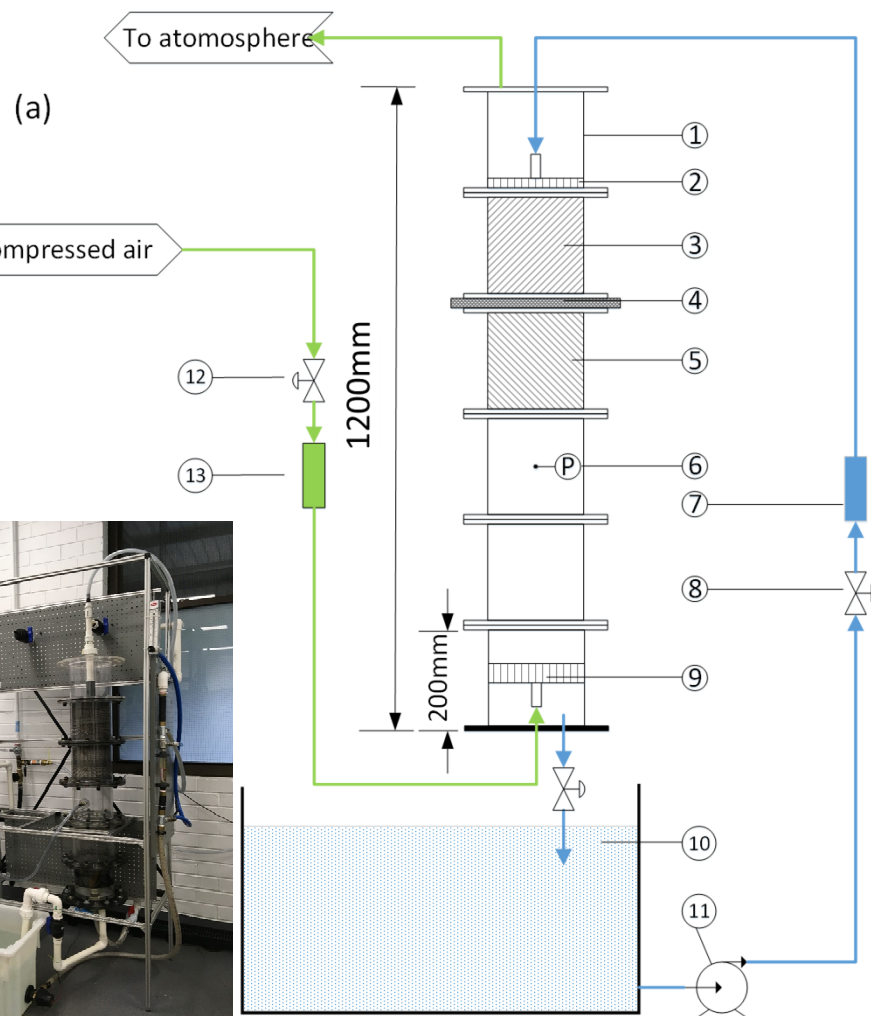
Scale up



*SpiroPak
Products*



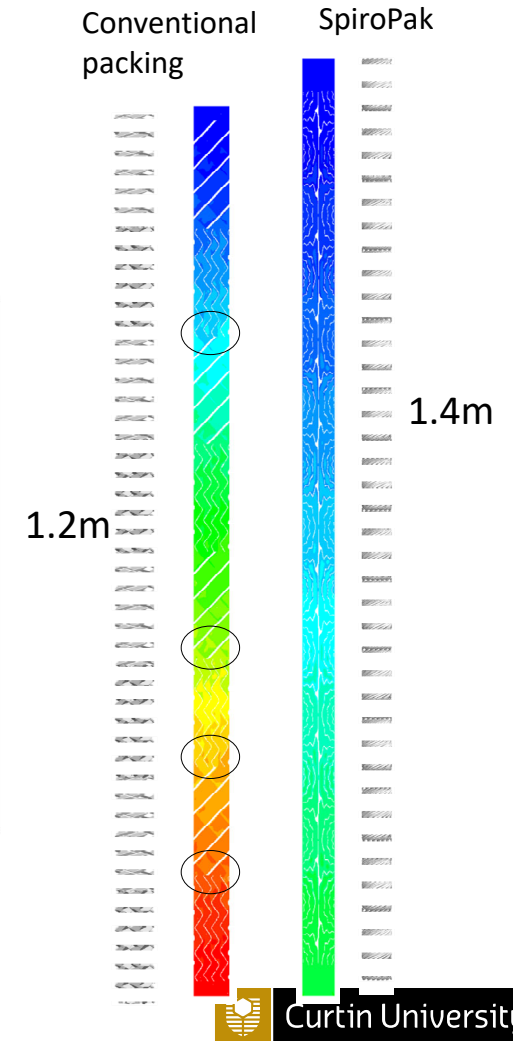
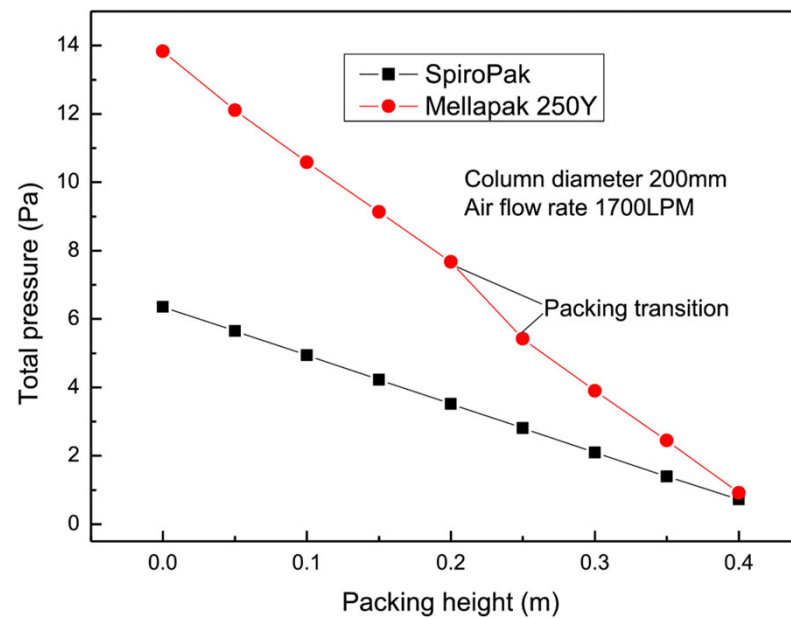
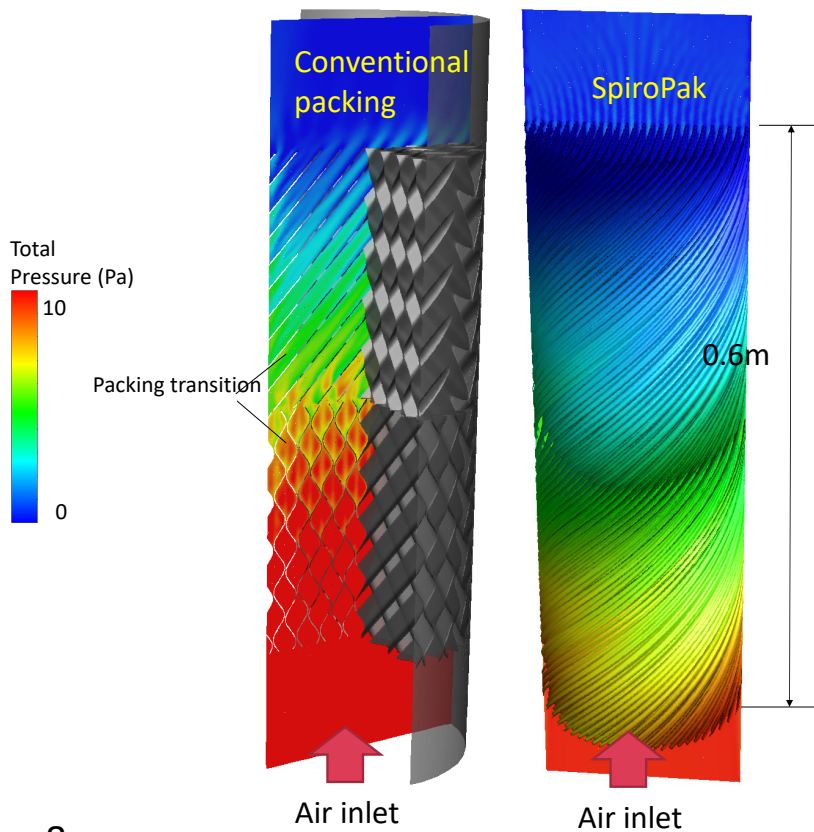
Packing performance – Pressure drop



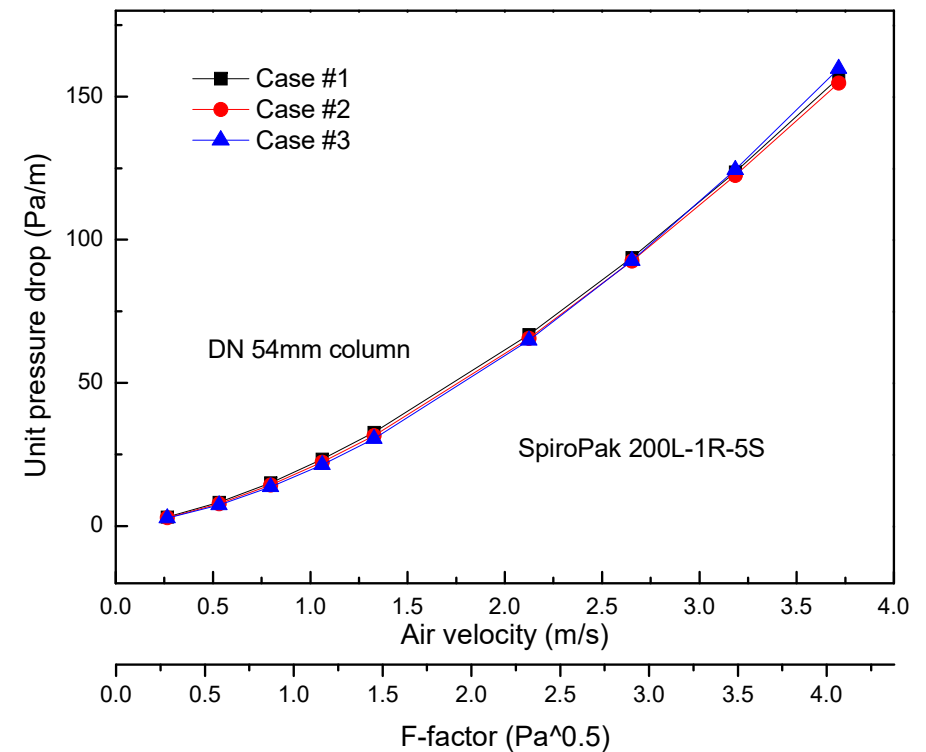
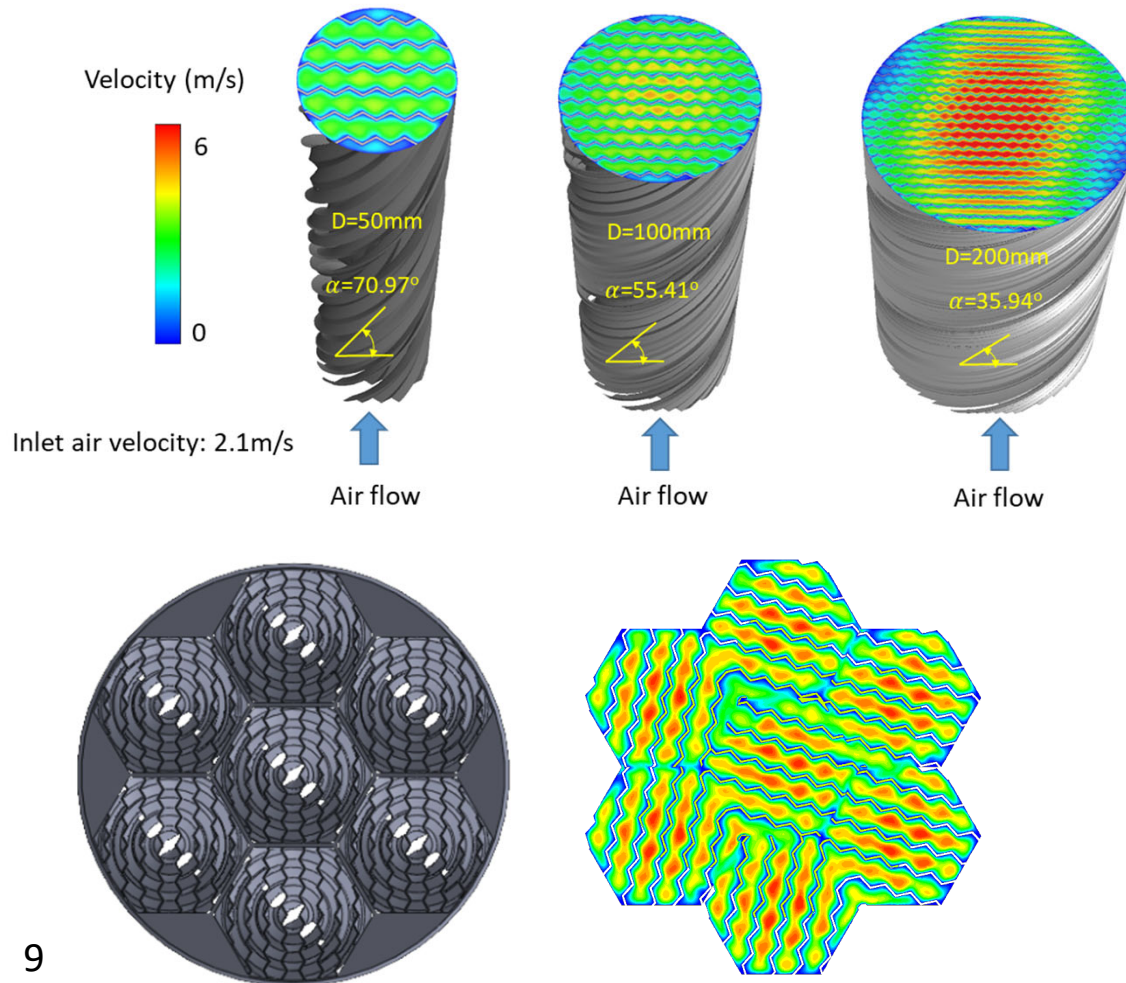
<https://doi.org/10.1016/j.cep.2021.108533>

Sun, Biao, et al. "Hydrodynamics of a novel 3D printed structured packing–SpiroPak." *Chemical Engineering and Processing-Process Intensification* 167 (2021): 108533.

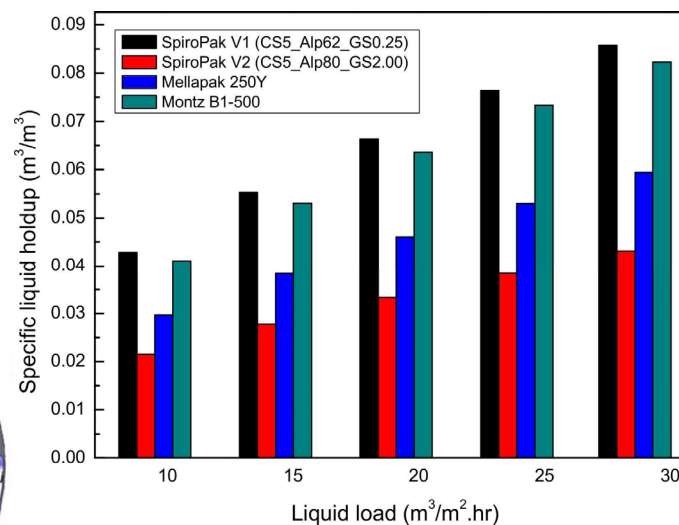
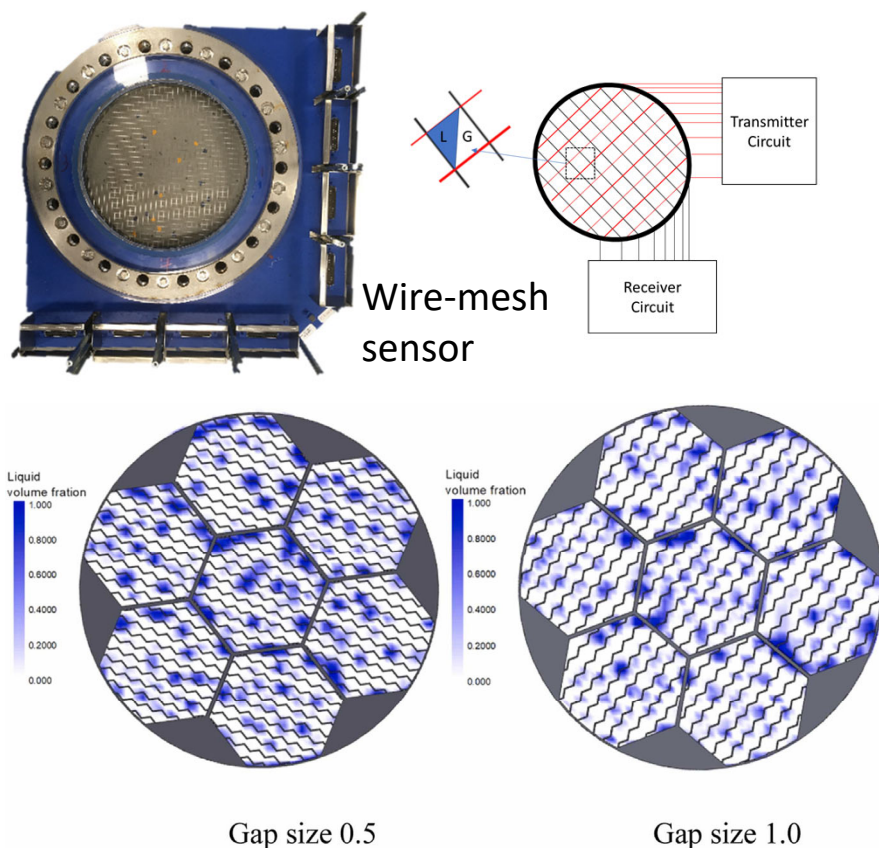
Packing performance – Pressure drop



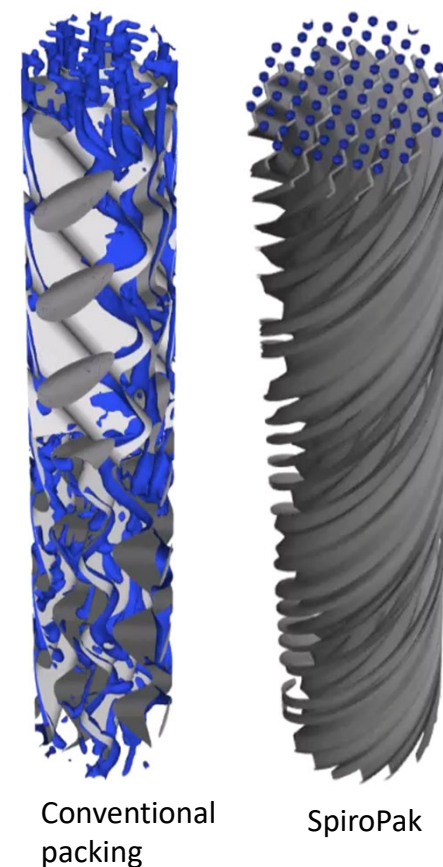
Packing performance – Pressure drop



Packing performance – Liquid distribution and holdup



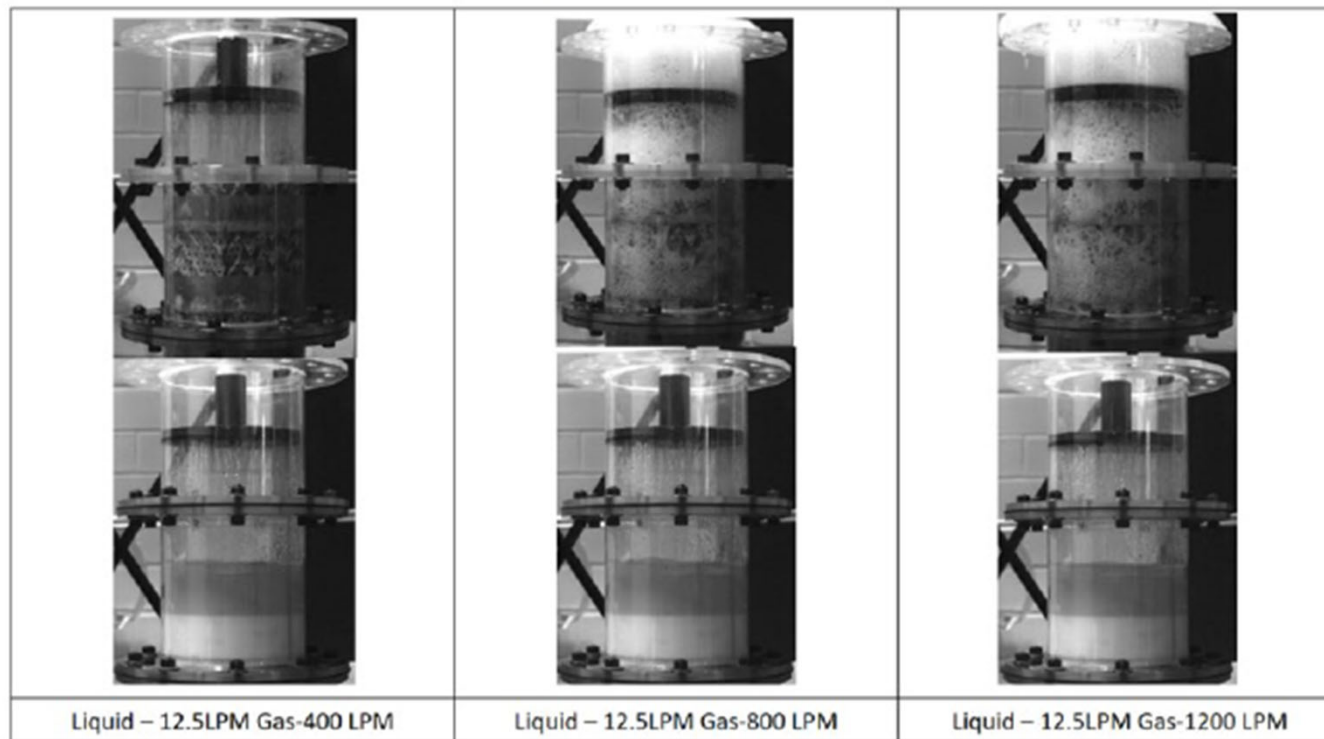
CFD study



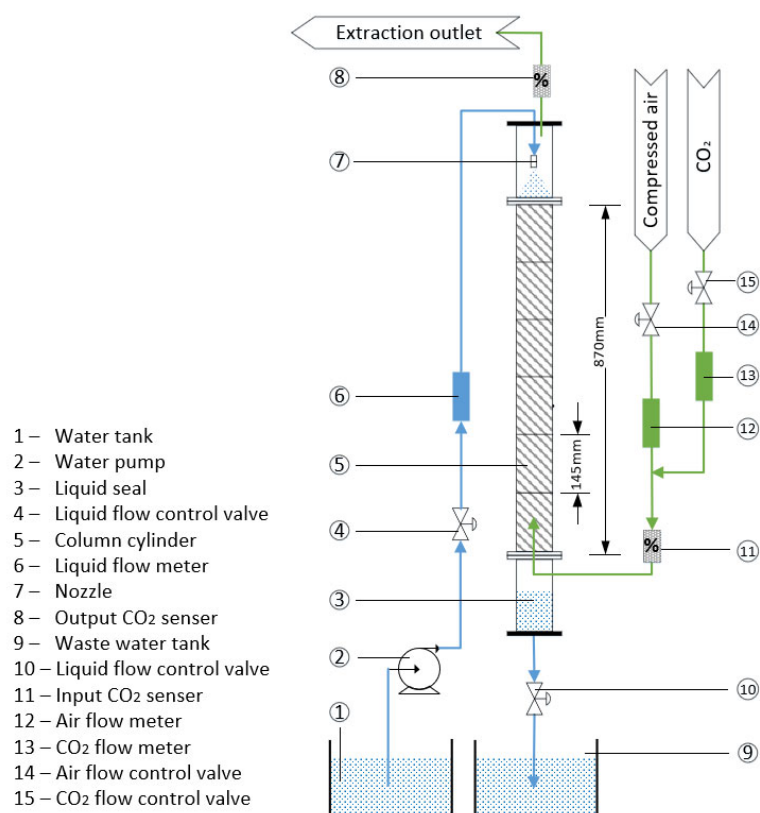
Packing performance – Foaming and Fouling

Conventional
packing

SpiroPak



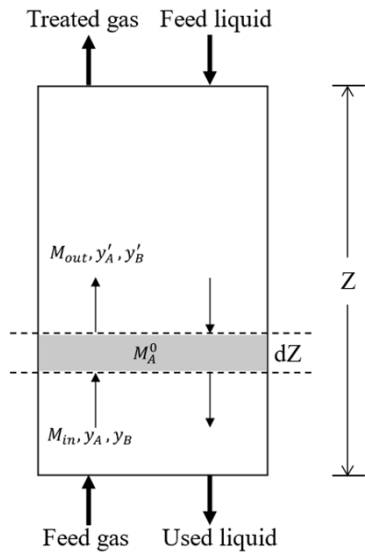
Packing performance – Mass transfer



Operating Temperature (°C)	20
Operating pressure (kPa)	101.3
Gas Density (kg/m ³)	1.26
Gas Flowrate (LPM)	100 ~ 700 (or 6 ~ 42 Nm ³ /hr)
F-factor (Pa ^{0.5})	0.28 ~ 1.97
Solvent Flowrate (LPM)	1.3 ~ 2.8
Liquid Load (m ³ /m ² ·h)	11.73 ~ 25.27
NaOH Concentration (mol/L)	0.1 ~ 0.3
CO ₂ Volume Fraction (%)	3-9

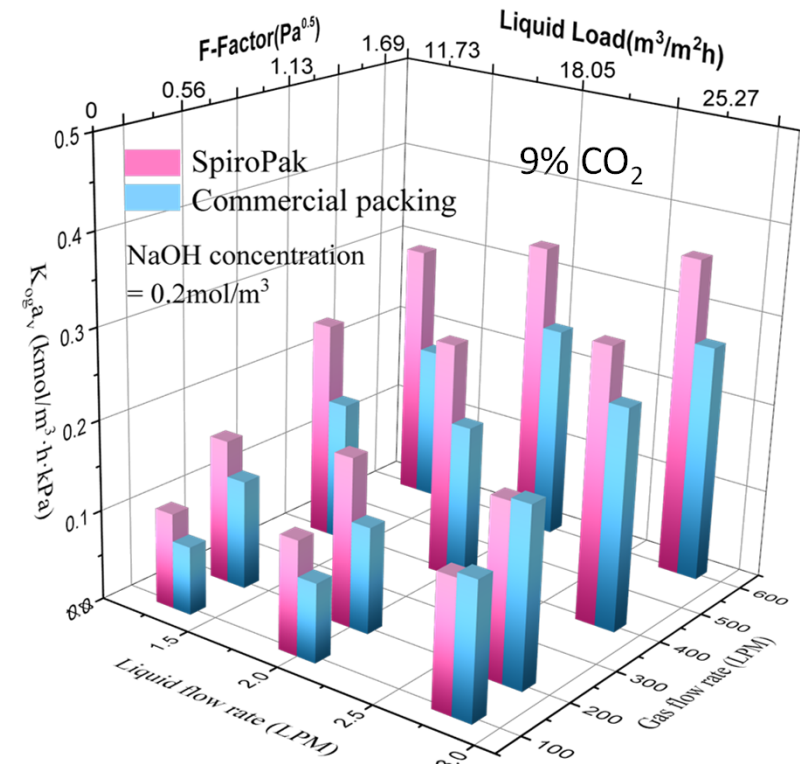
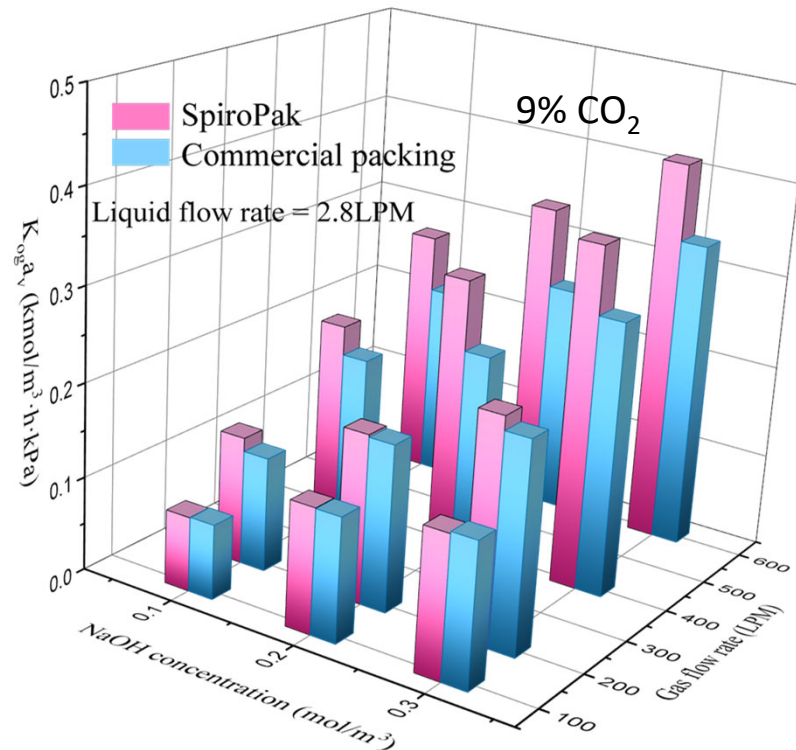
Packing performance – Mass transfer

SpiroPak mass transfer increased by >20%.

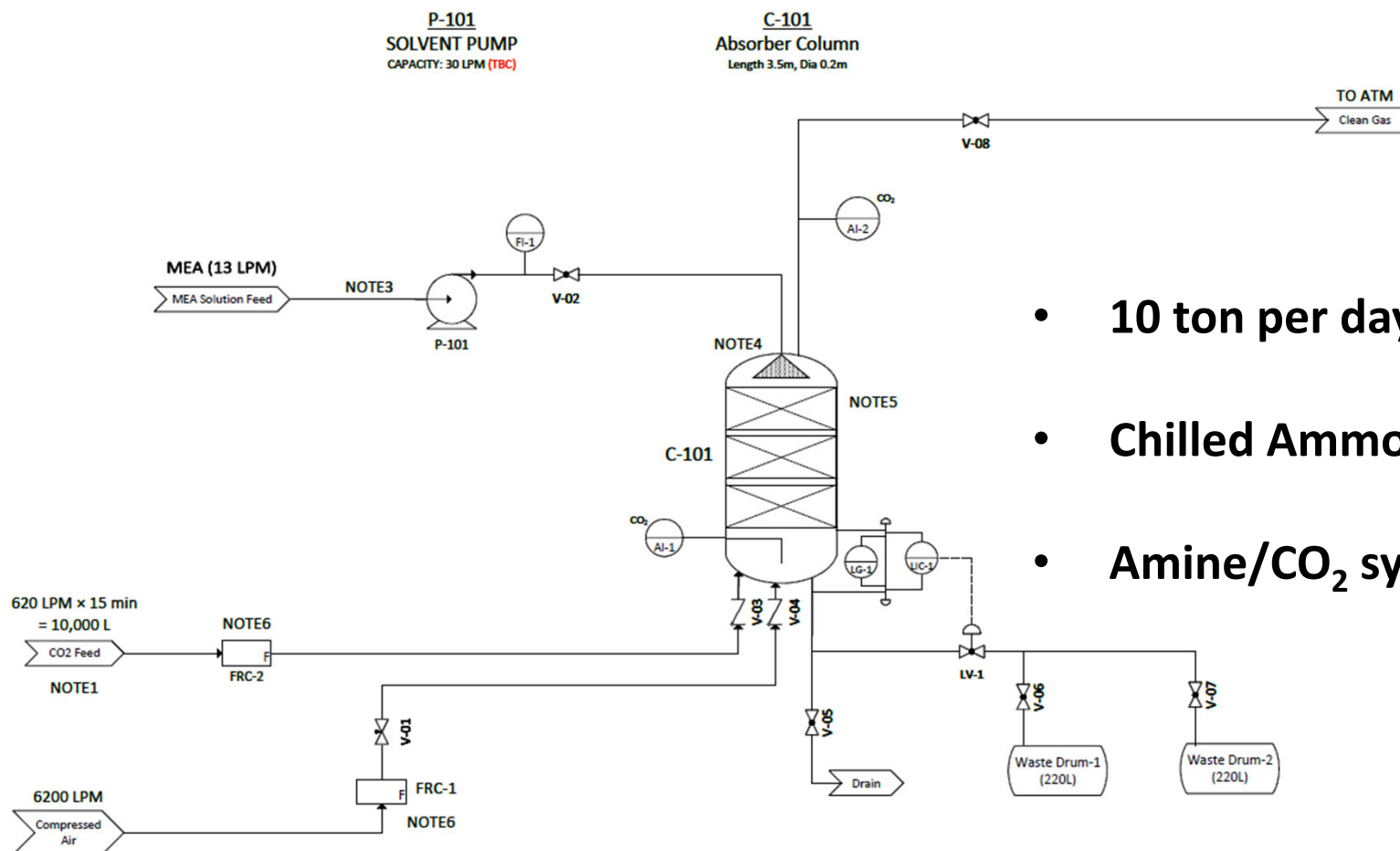


Overall mass transfer coefficient

$$K_{og}a_v = \frac{G_I}{P(y_A - y_A^*)} \cdot \frac{dY_A}{dZ}$$



Packing performance – Mass transfer (Further test)



- 10 ton per day trial
- Chilled Ammonia Process (CAP)
- Amine/CO₂ system

SpiroPak PTD Ltd



Jasper Bouwmeester, MSc MBA

Principal Mechanical Engineer & Interim CEO

Jasper has extensive experience in both processing and 3D printing industries.



Prof. Dr. Tejas Bhatelia

Chief Technology Officer

Tejas has a very strong academic record and is one of the original inventors of SpiroPak.



Dr. Tom Hammond

Chief Operating Officer

Tom has been involved with SpiroPak since its start and has a strong record in commercialising technologies.



Dr. Biao Sun

Scientist

Biao is one of the original inventors of SpiroPak and has published multiple papers on the fundamentals of the 3D shape.



Eveline de Jong, MSc

Engineer

Eveline provides us with the tools and know-how to simulate SpiroPak in a variety of industries and cases.



Dr. Qiaoran (Tiffany) Liu

Scientist

Tiffany is our experimental scientist.



Curtin University

 SpiroPak

