Aquaporin og DTU Miljø

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Combined forward osmosis and membrane distillation

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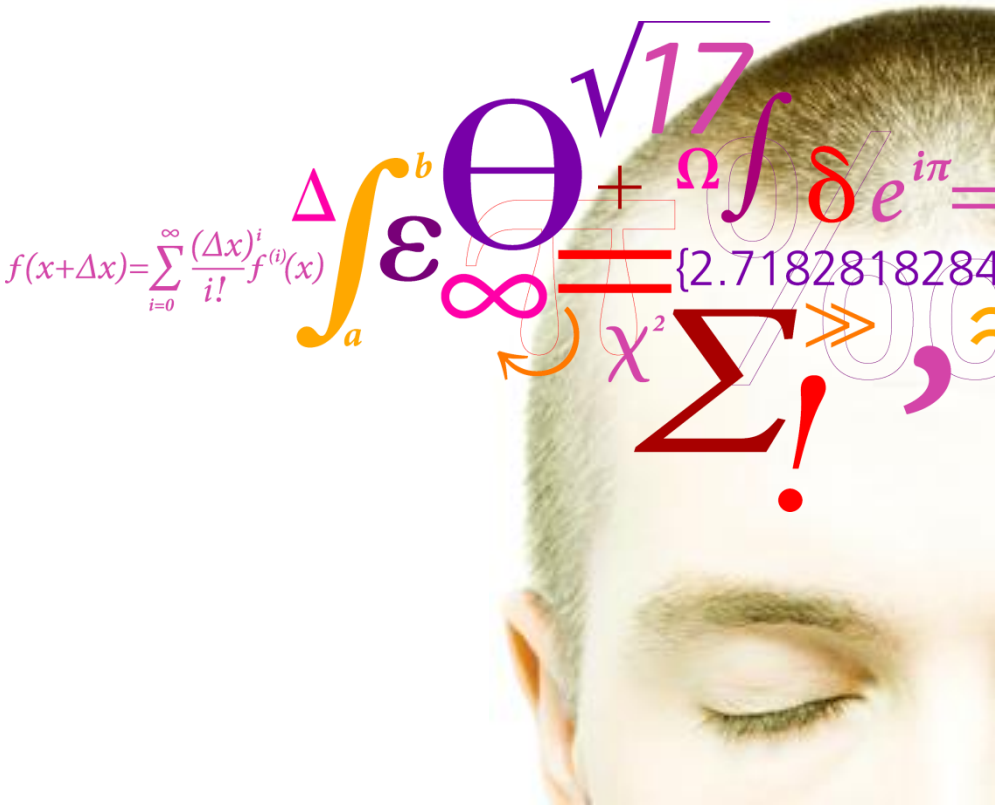
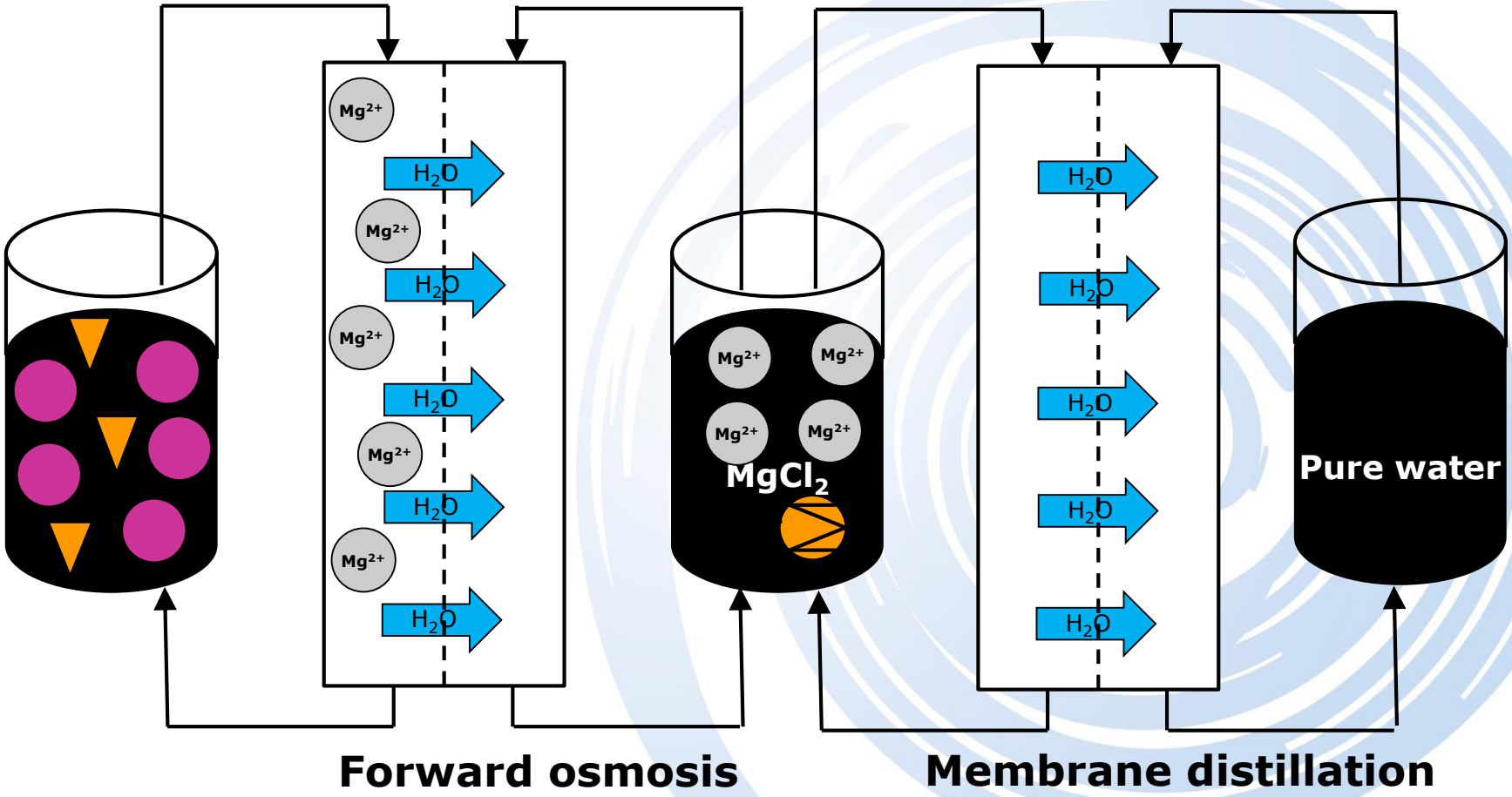


Hybrid process: Forward osmosis-Membrane Distillation



Forward Osmosis

Forward osmosis

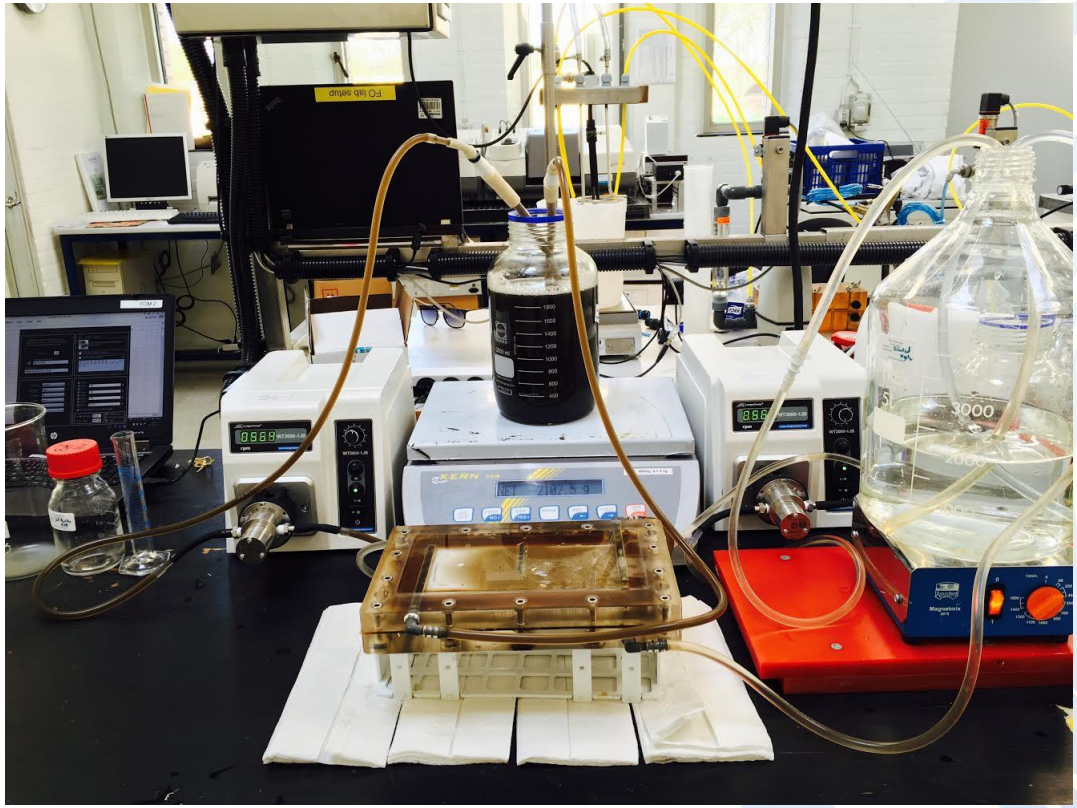
- ☺ No need of high hydraulic pressure
- ☺ Reduced fouling & simple cleaning

Membrane distillation

- ☺ Low energy consumption (utilized excess of heat)
- ☺ Water production & draw solution regeneration

Acknowledgement: ***Kuiling Li***

Forward Osmosis

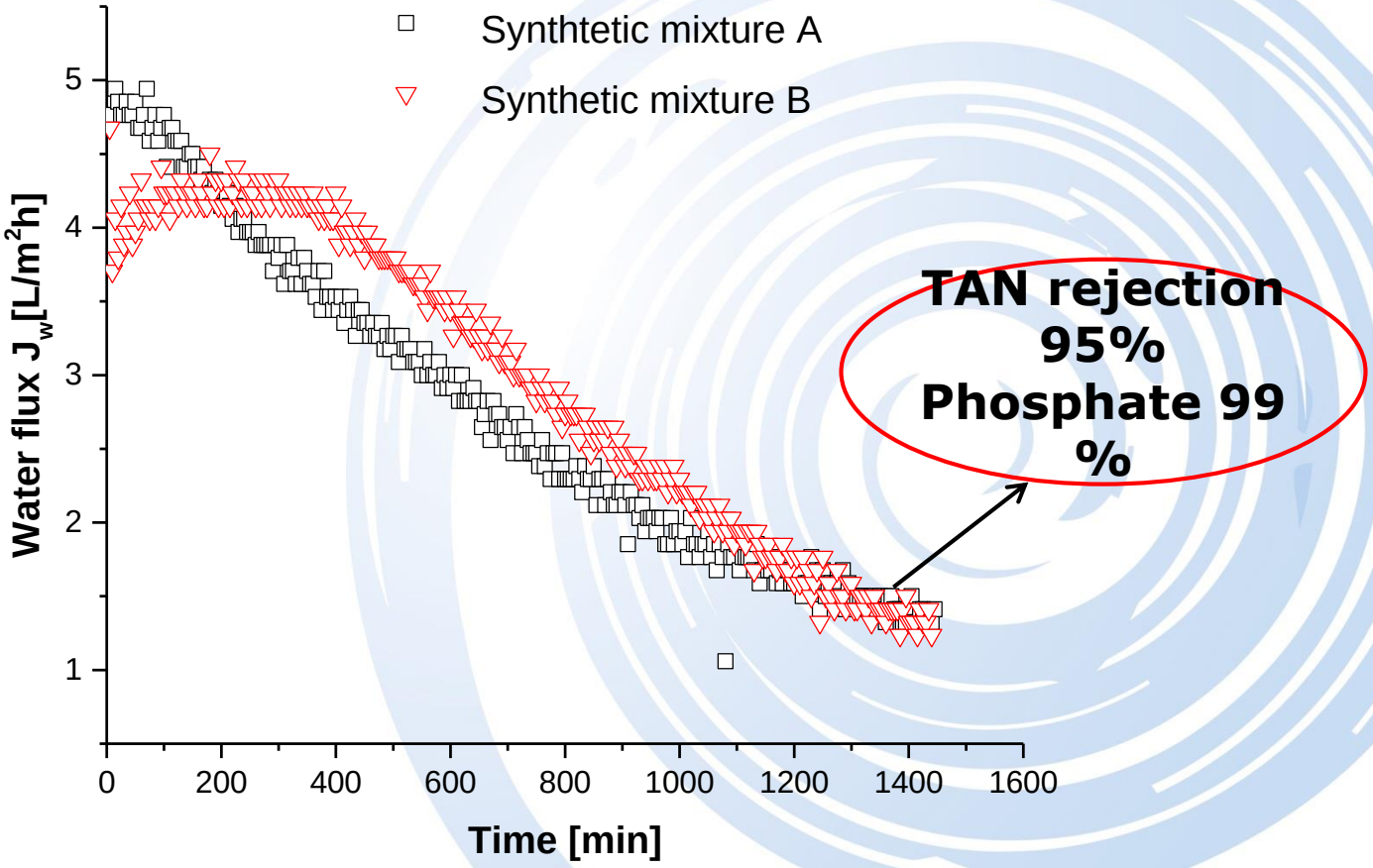


Operating conditions

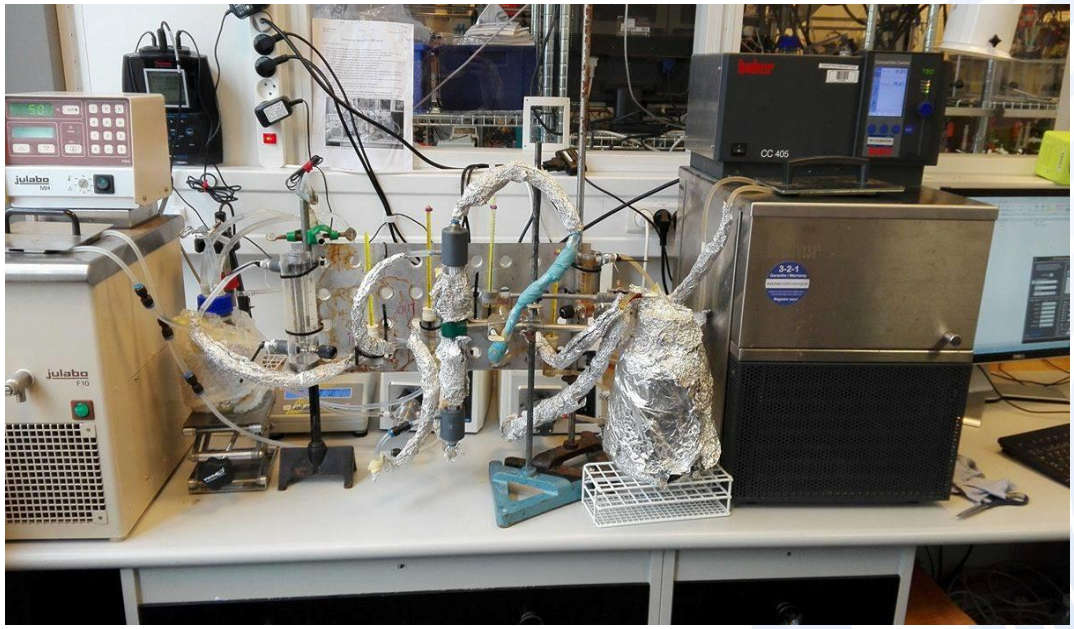
- **Feed**: Synthetic mixture 2L
- **Draw solution:** $MgCl_2$ 0.66 M 2L
- **Membrane**: Aquaporin Inside™
- **Temperature**: 24 °C
- **Experiments time**: 24 h
- **Velocity:** 8.3 cm/s

Acknowledgement: ***Rajath Sathyadev Rajmohan***

Forward Osmosis: Results



Membrane distillation

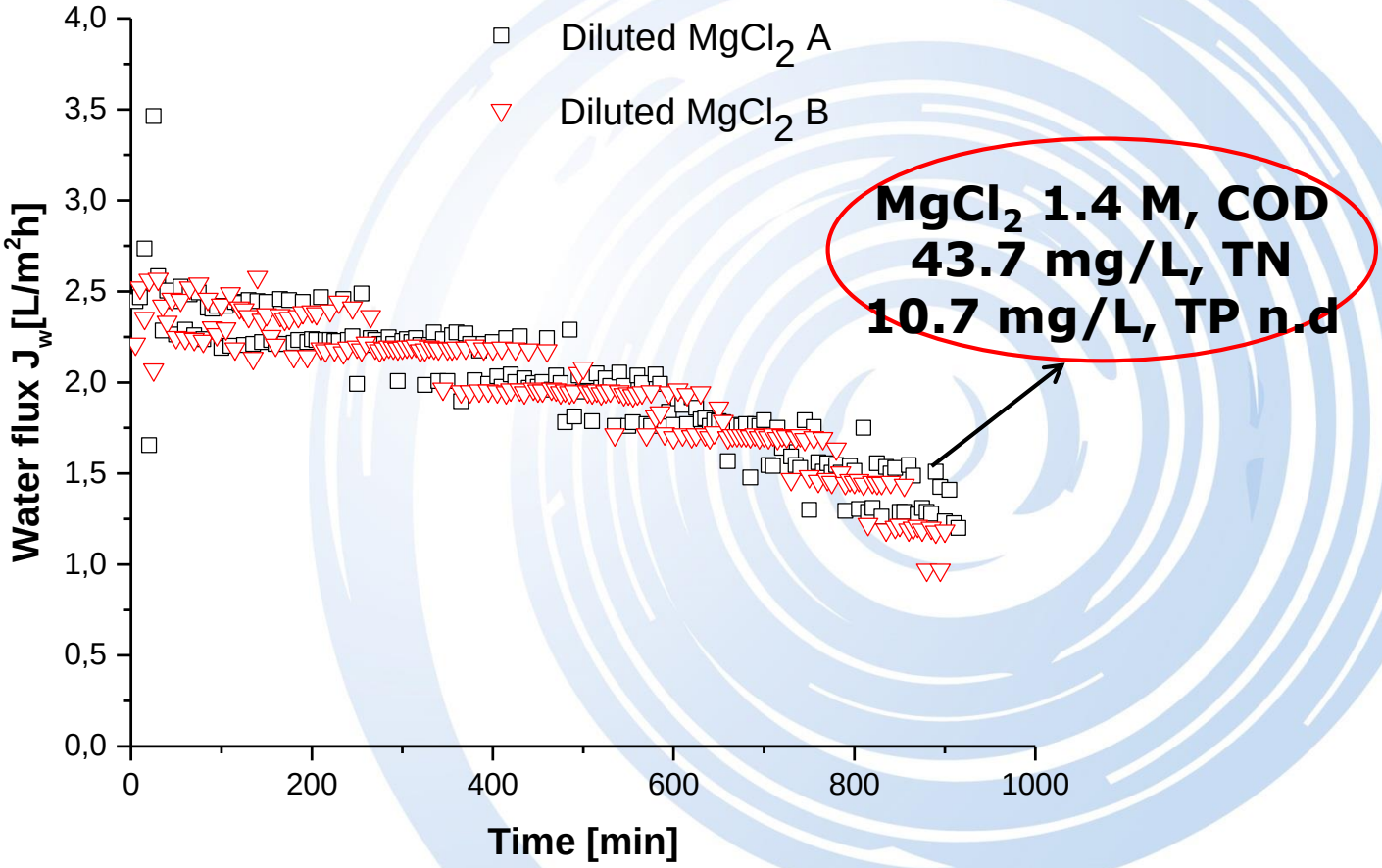


Operating conditions

- **Feed**: Diluted $MgCl_2$ (0.43M) coming from FO experiments with synthetic mixture
- **Distillate:** DI water
- **Membrane**: PTFE hollow fibers
- **Temperature Feed$_{inlet}$**: 55 °C
- **Temperature Distillate$_{inlet}$**: 22 °C
- **Velocity Feed:** 0.6 m/s
- **Velocity Distillate:** 0.03 m/s
- **Experiments time**: 15 h

Acknowledgement: ***Agnieszka Niedzielska***

Membrane distillation: Results



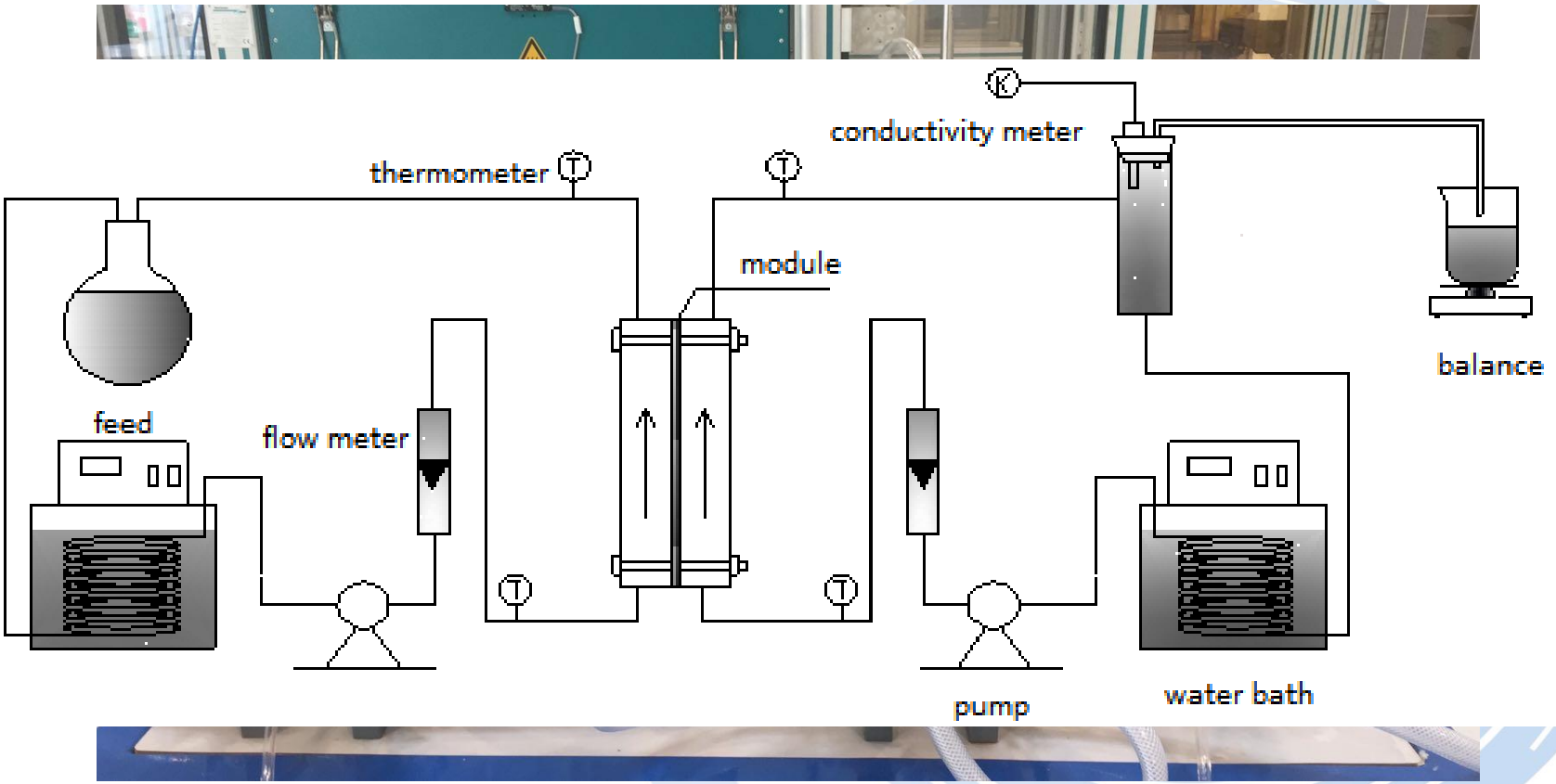
MEM-FO: progress

		Mid-April Mid-May	Mid-May Mid-Juni	Mid-Juni Mid-Juli	Mid-Juli Mid- August	Mid-August Mid-September
Combing FO-MD	Construction of MD setup	x				
	Optimization of operating conditions		x	x	x	
	Conducting experiments		x	x	x	
Data evaluation	Assessing membrane performance				x	x
	Assessing economic feasibility				x	x
	Designing pilot plant					x
Milestones				M1		M2

Milestone 1: Water treatment setup built, operational and optimized.

Milestone 2: Data analysis, cost evaluation, design pilot plant.

MEM-FO: progress



Membrane distillation setup

MEM-FO: experimental plan

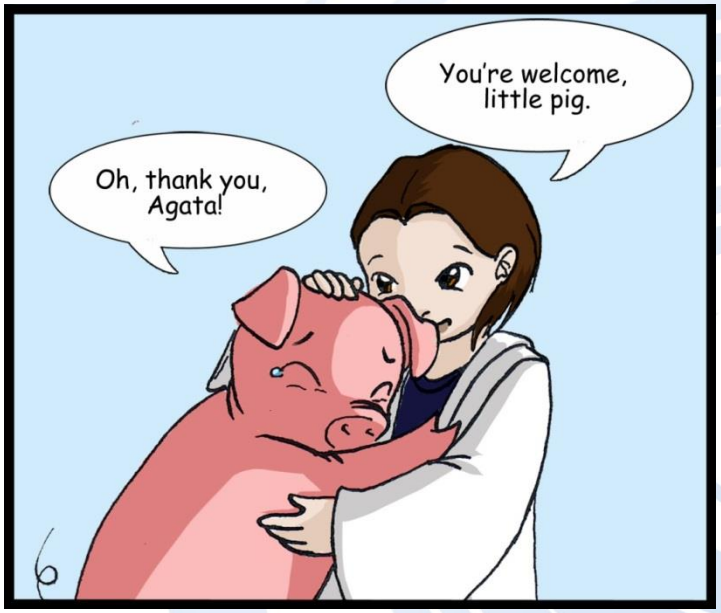
Starting parameters

- Temperatures: Feed = 40 ° C / distillate = 20 ° C
- Module: 1.7x5.5 MiniModule (3M); X-50 PP fibers; active area 0.5 m^2
  & new developed electospun polyphenylsulfon nanofiber membrane by DTU Energy
- Feed: $MgCl_2$ solution

Parameters to investigate

- Flux at 20 ° C difference
  1M $MgCl_2$
  1.5M $MgCl_2$
- Flow speed:
  - How slow can we go ? (V_{feed} <1.6 L/min-2.5 L/min>, $V_{distillate}$ ~ 2.5 L/min
  - What is the optimal speed (highest flux) ?
  - Change temperature difference to 10 and 30 ° C

Thank you for your kind attention



Acknowledgement

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