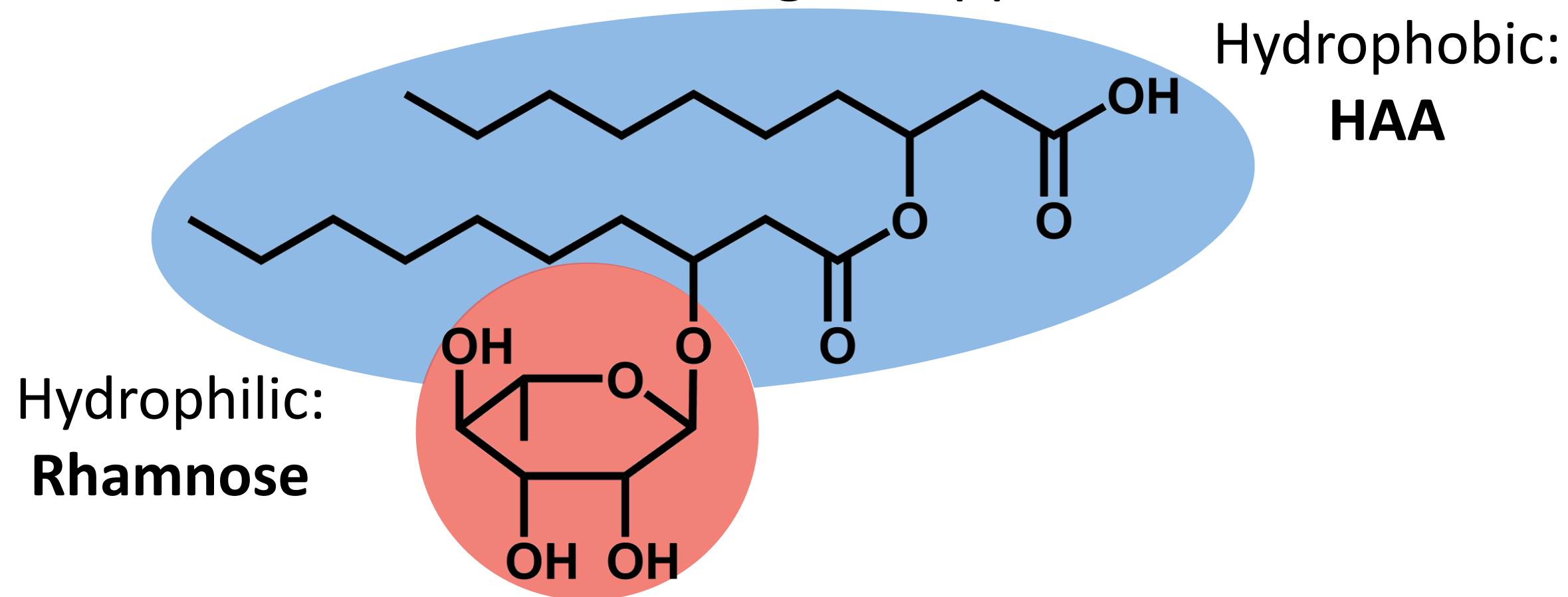




## I Background

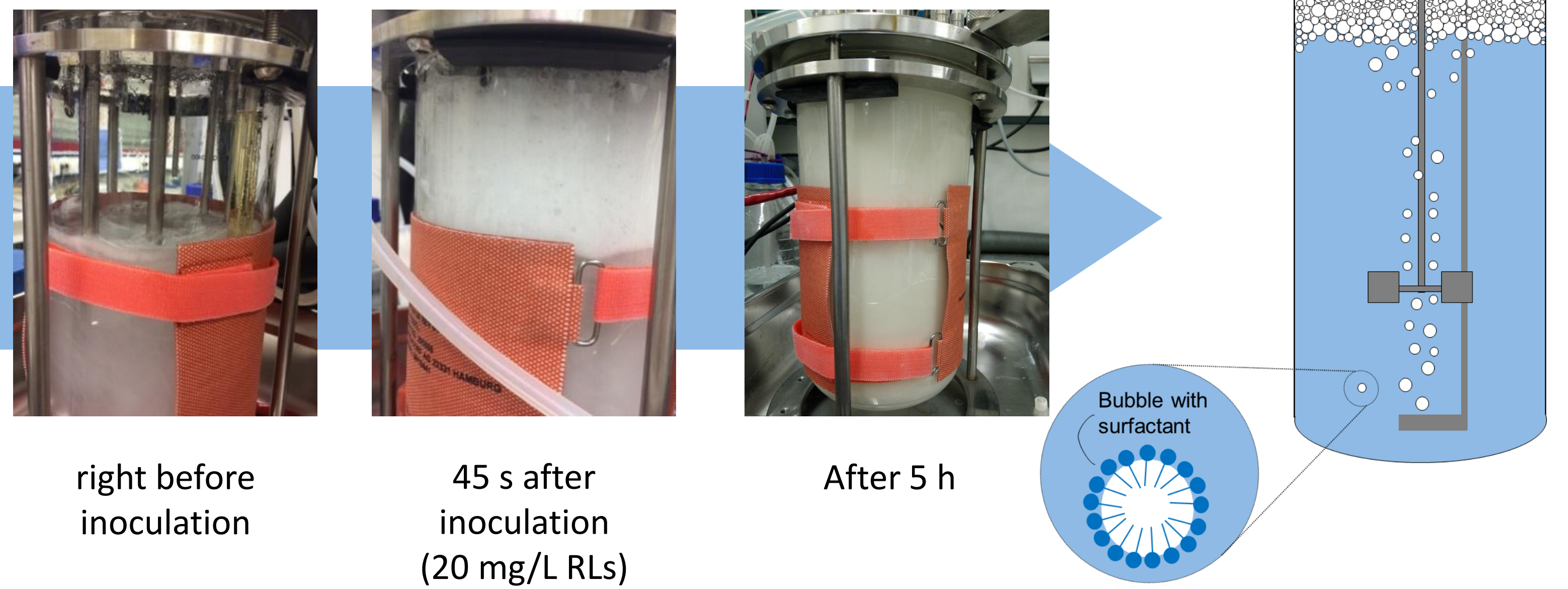
Surfactants as bulk chemicals are still mainly derived from crude oil thus contributing to global pollution. To sustainably produce these commodity chemicals, microbial production is key. Rhamnolipids are biosurfactants with high potential for a variety of industrial and biotechnological applications.



## II The challenge

In biosurfactant production with aerated bioreactors, excessive foaming occurs.

Recombinant *Pseudomonas putida* KT2440 producing rhamnolipids

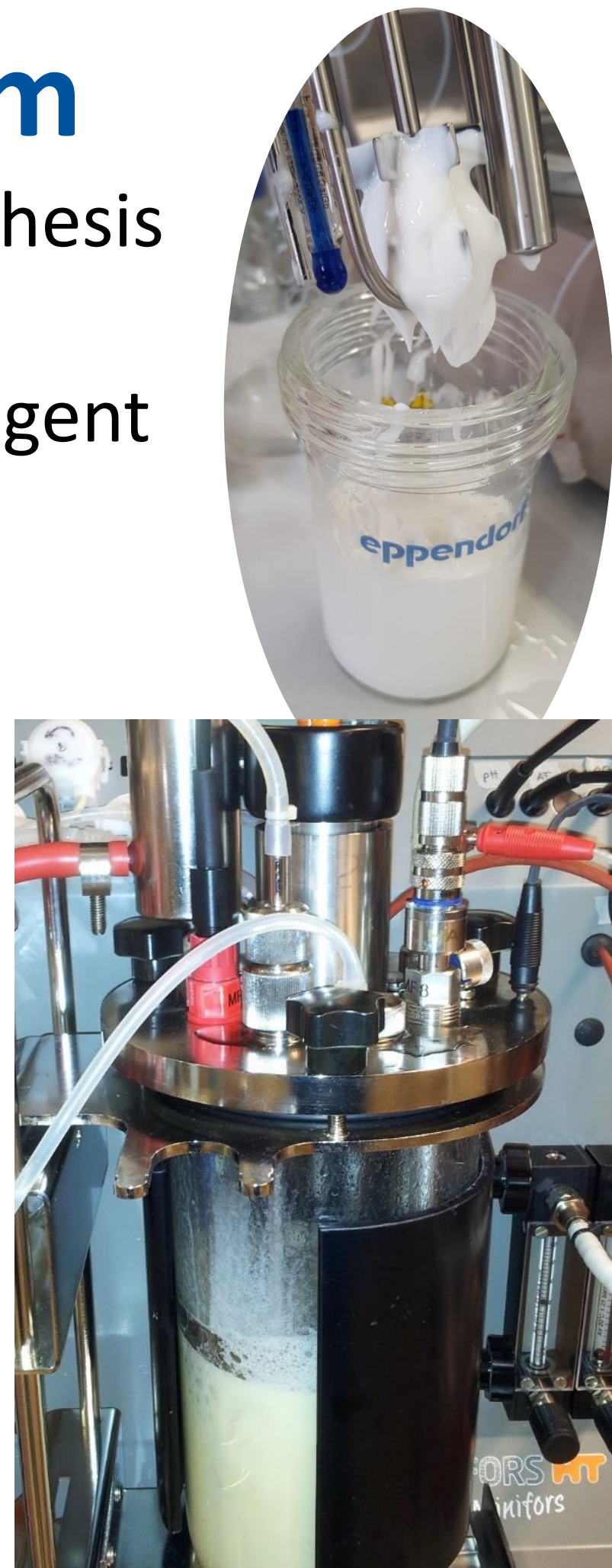
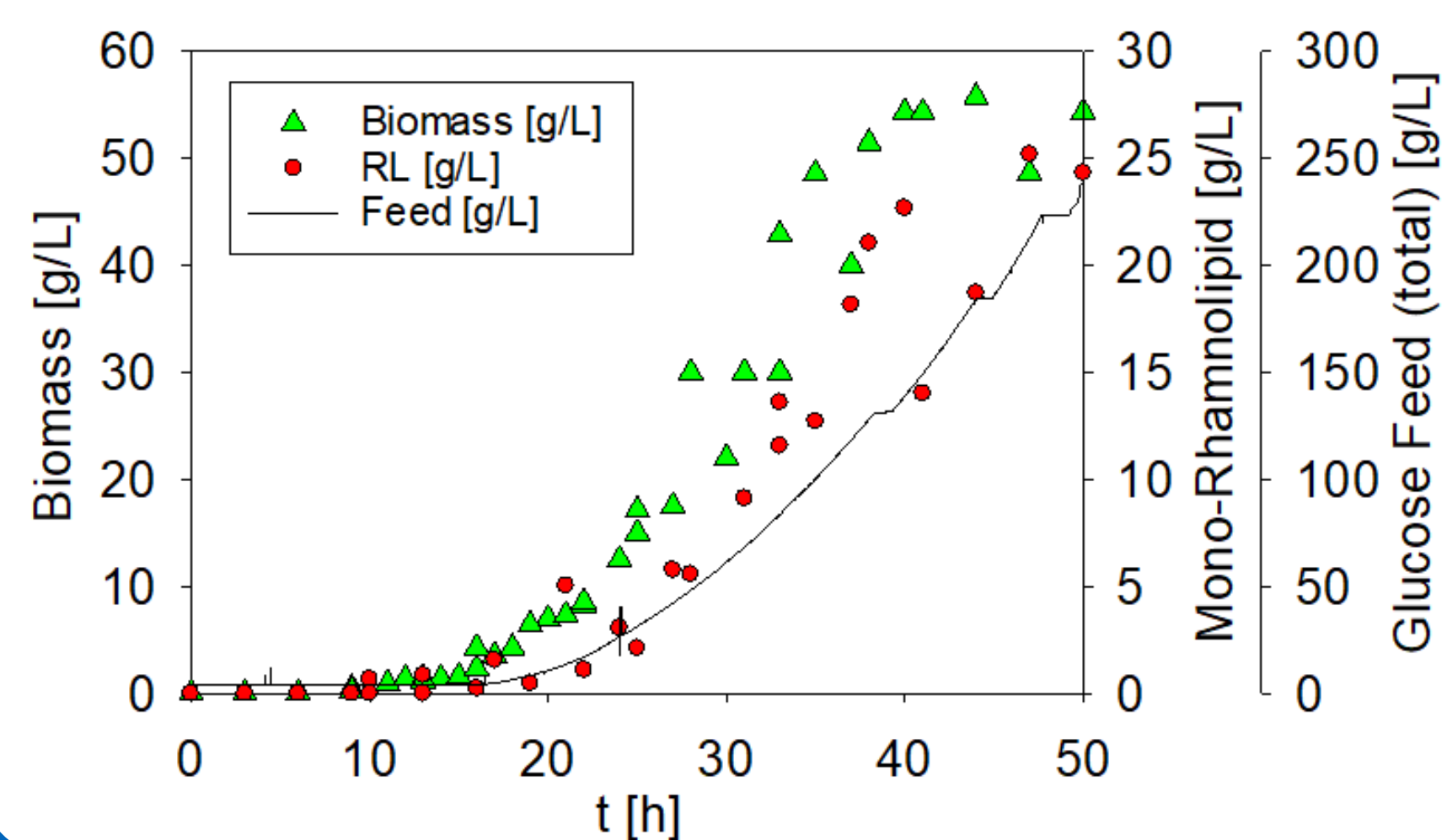


## Solutions

## III Fed-batch with antifoam

- Recombinant *P. putida* KT2440 for RL synthesis
- Foam centrifuges in the headspace
- Foam controller addition of antifoaming agent
- Two feeding phases
  - 100 g/L Glc,  $\mu = 0.2$
  - 400 g/L Glc,  $\mu = 0.05$

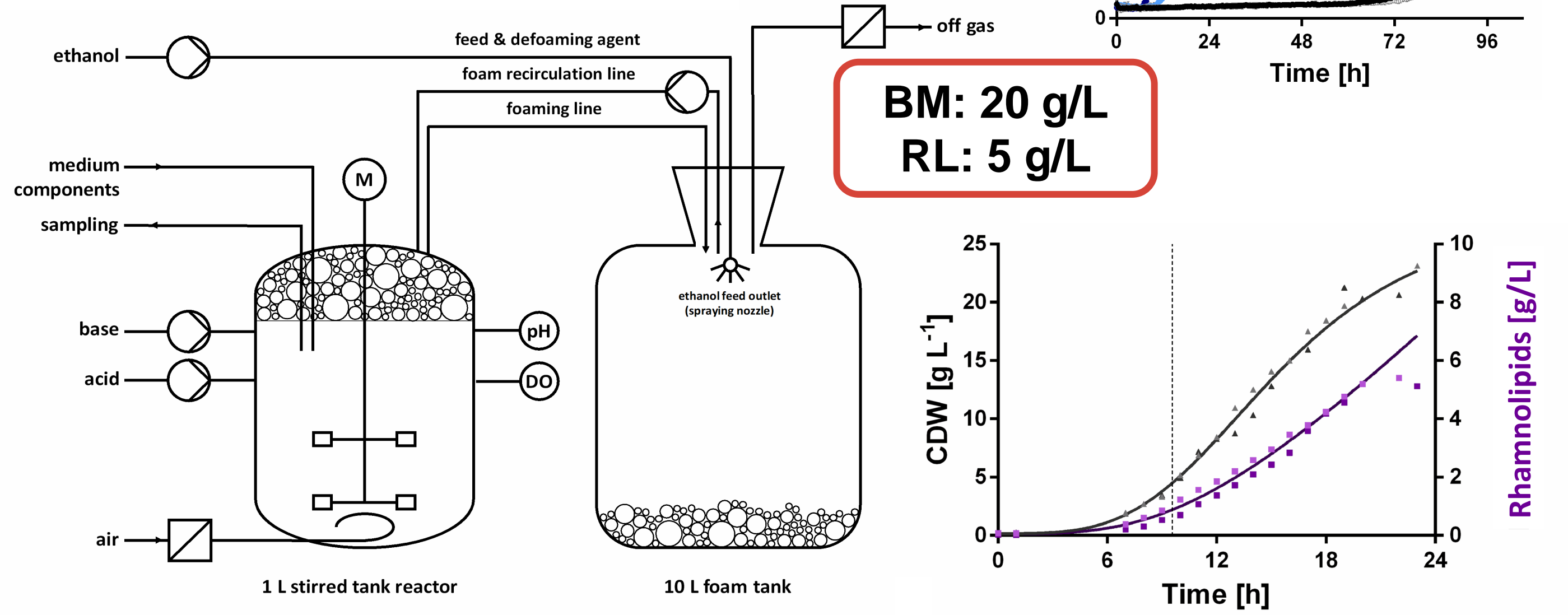
**BM: 50 g/L**  
**RL: 25 g/L**



## IV Substrate to destabilize the foam

- *P. putida* was engineered to grow on ethanol
- ALE for growth on EtOH
- EtOH sprayed in foam collection bottle as carbon source and defoamer

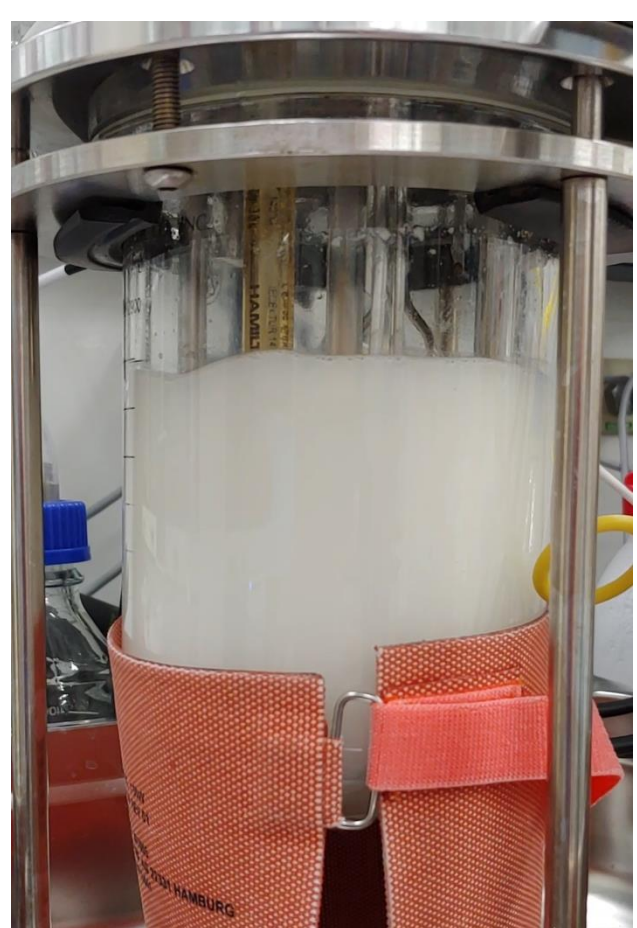
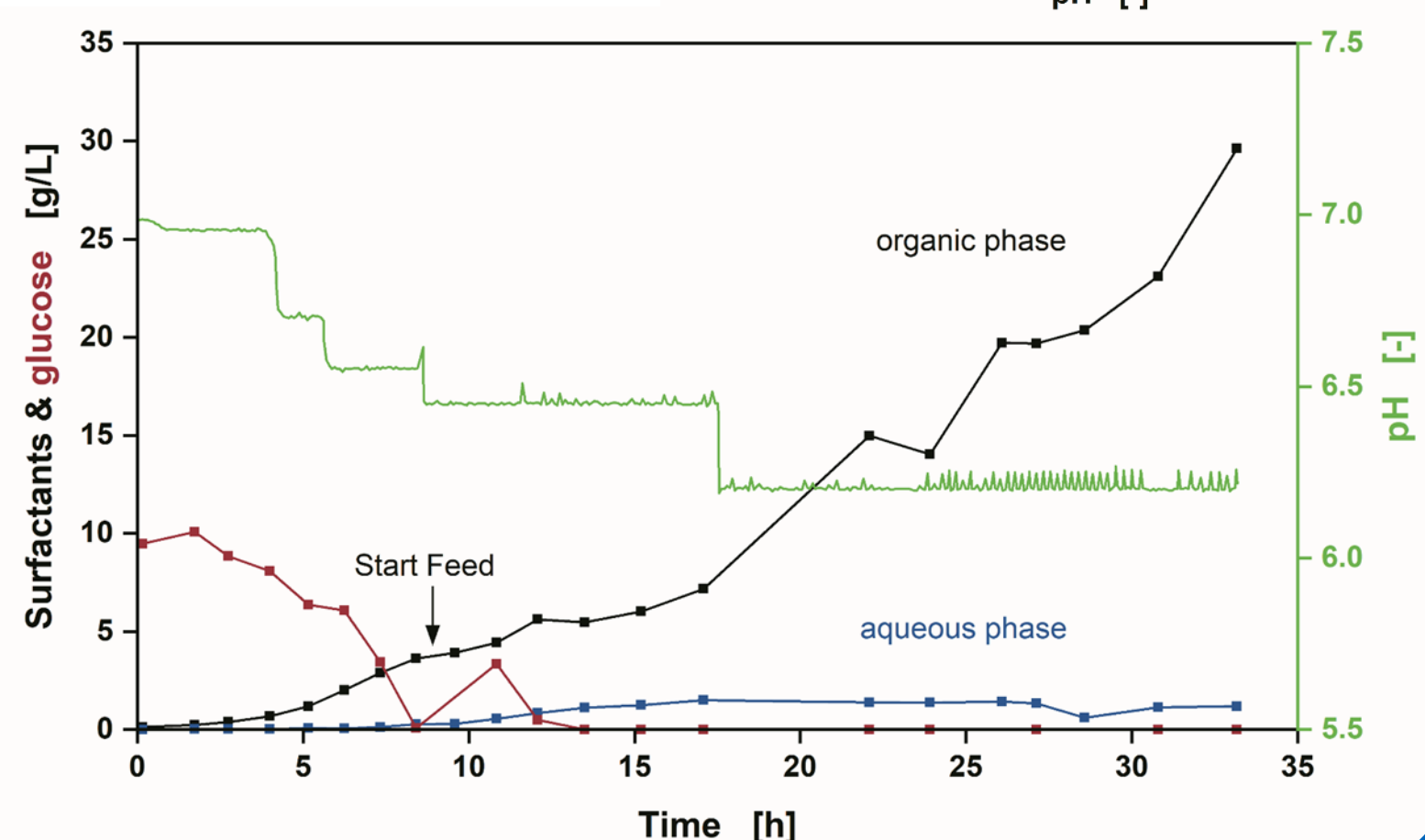
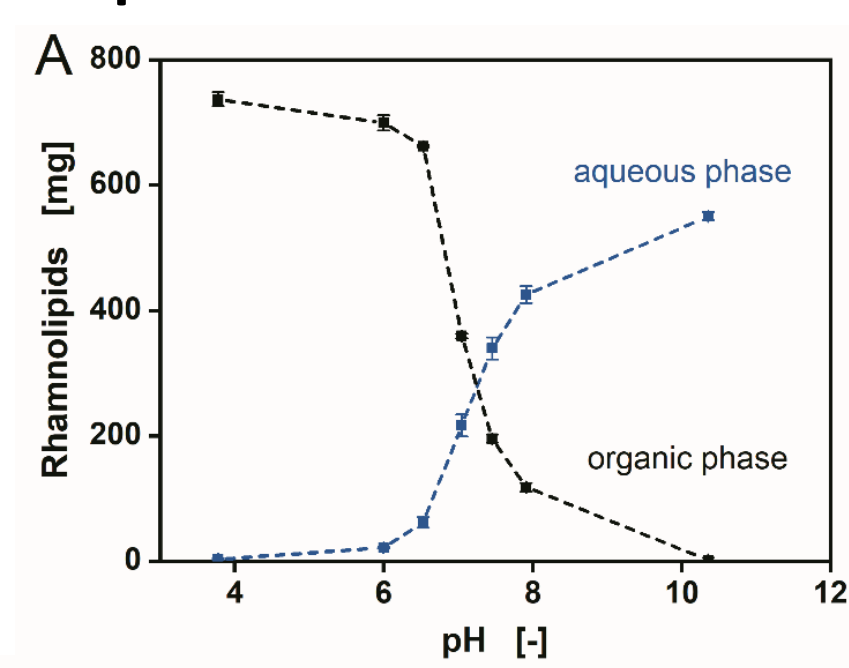
**BM: 20 g/L**  
**RL: 5 g/L**



## V In situ extraction

- Partition coefficient depends on pH
- 20% [v/v] ethyl decanoate
- Stepwise pH reduction when foaming occurs

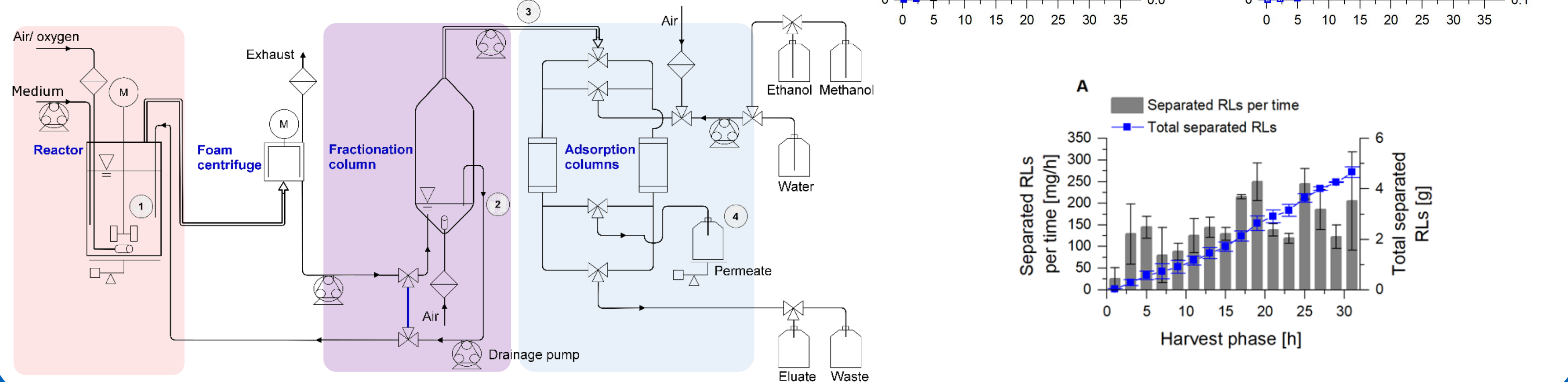
**RL: 8 g/L**



## VI Foam fractionation

- **Foam fractionation** operation uncoupled from **fermenter** operation (separate air intake)
- Automated integrated **foam adsorption**
- RL harvest: 5 g, 80% pure

**BM: 10 g/L**  
**RL: 4 g/L**



### References

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Industrial partners:



Funders:

