

Lactic acid unchained: enabling the LA platform with lactic acid production with high productivity and titer

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Lactic acid has potential as platform chemical

The LA platform

Organic waste → Lactic acid → Bioplastic (PLA), Biosolvents (e.g. ethyl lactate), Microbial protein

- The LA (lactic acid) platform is an attractive biorefinery scheme to valorize waste streams.
- Current know-how on LA production comes from pure-culture fermentations, which are economically unviable for waste [1].
- We need to optimize LA production in open culture processes

Thermophilic open culture fermentation

Substrate

- Cheese whey permeate (≈ 60 g/L lactose)
- Yeast extract (9 g/L)

Inoculum: cheese whey

Tested conditions

- pH: 5.0, 5.5, 6.0, 6.5
- Temperature: 45°C, 50°C, 55°C
- HRT: 1.5 to 10 h

Reactor system

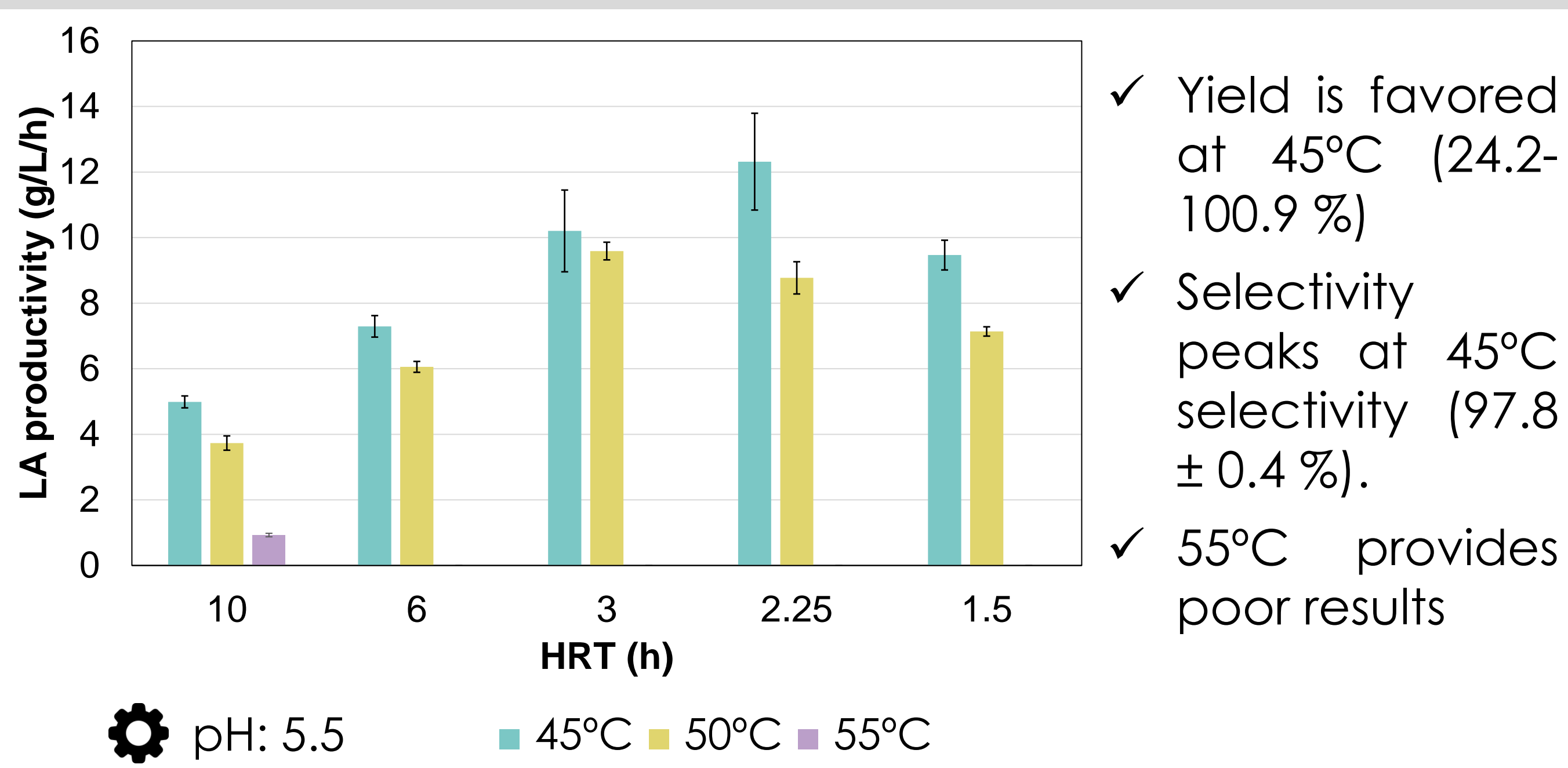
CSTR

Monitored parameters

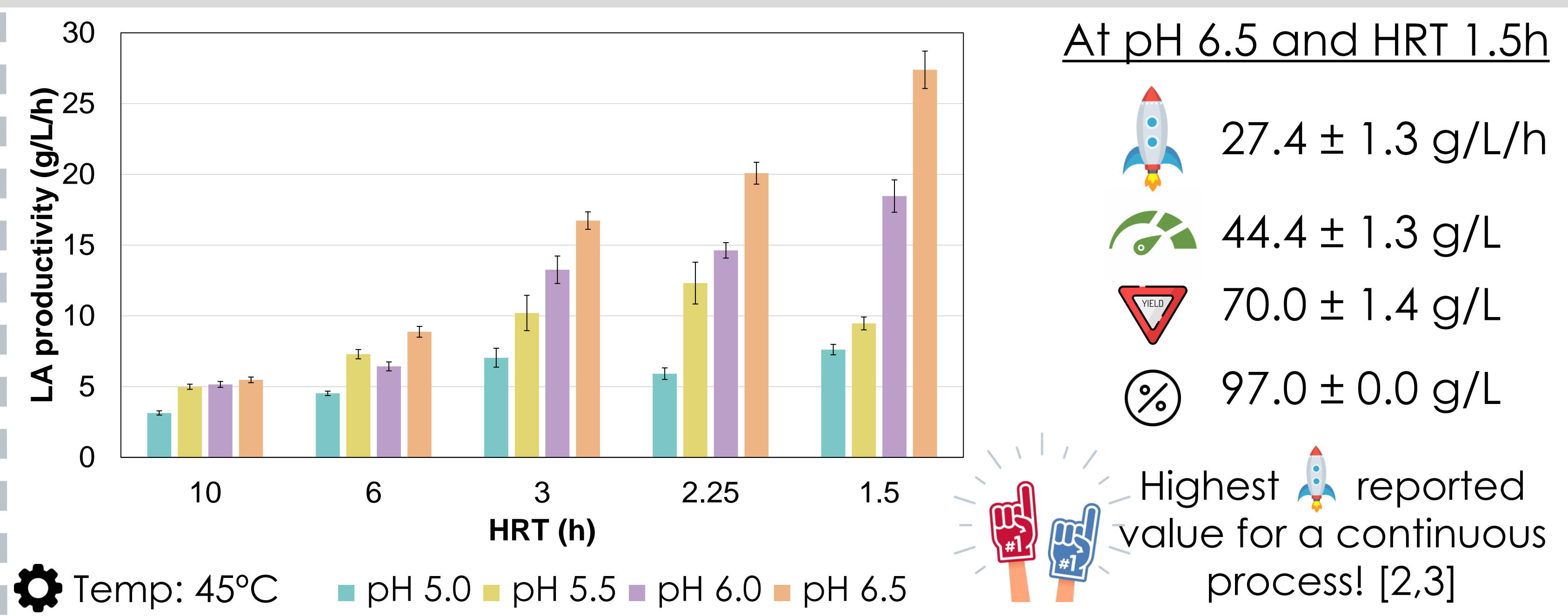
- Productivity (g/L/h)
- Concentration (g/L)
- Selectivity (mass %)
- Yield (mass %)

Testing operational conditions for optimal LA production

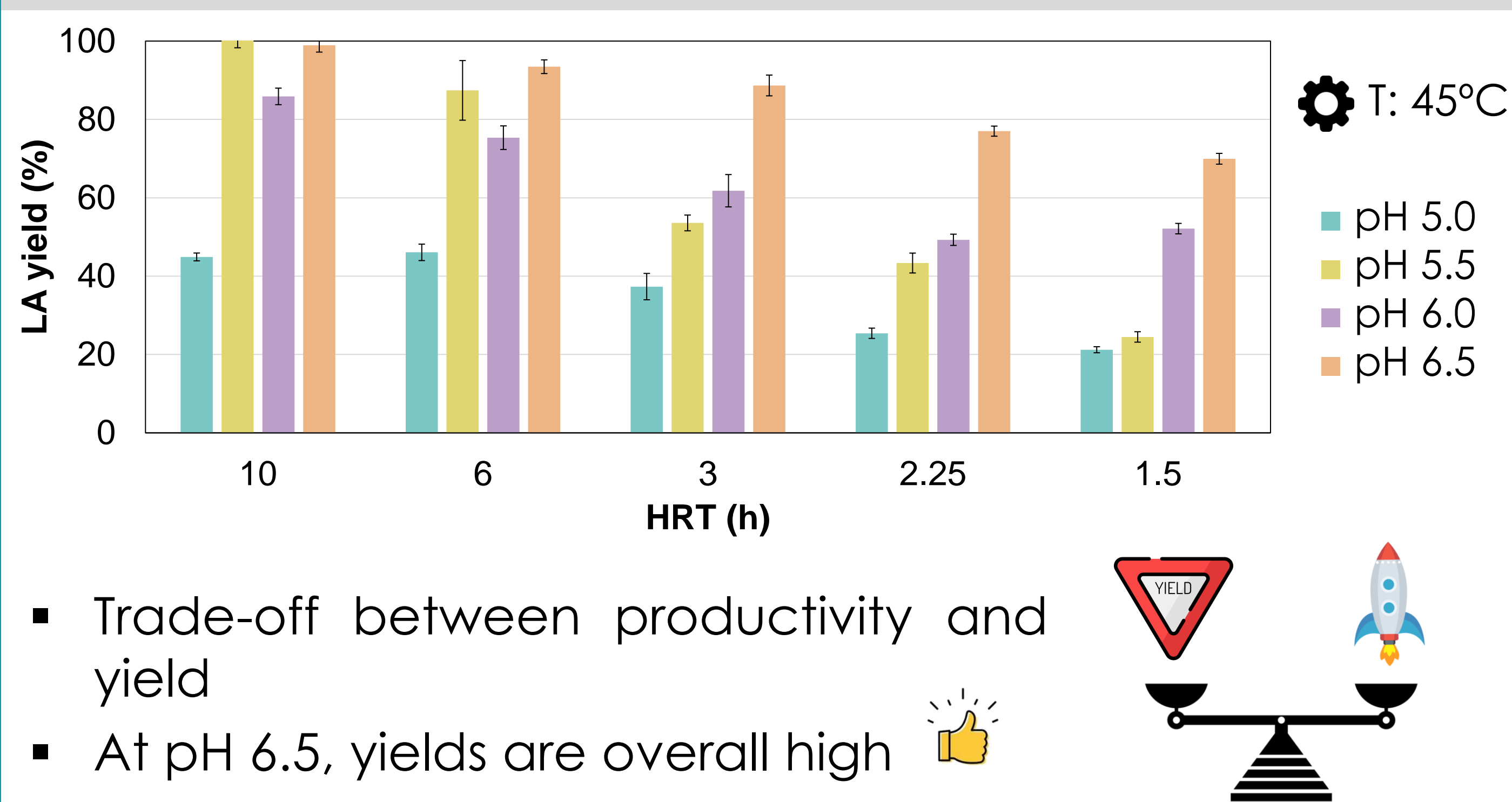
1. Mild thermophilic (45°C) temperature is optimal



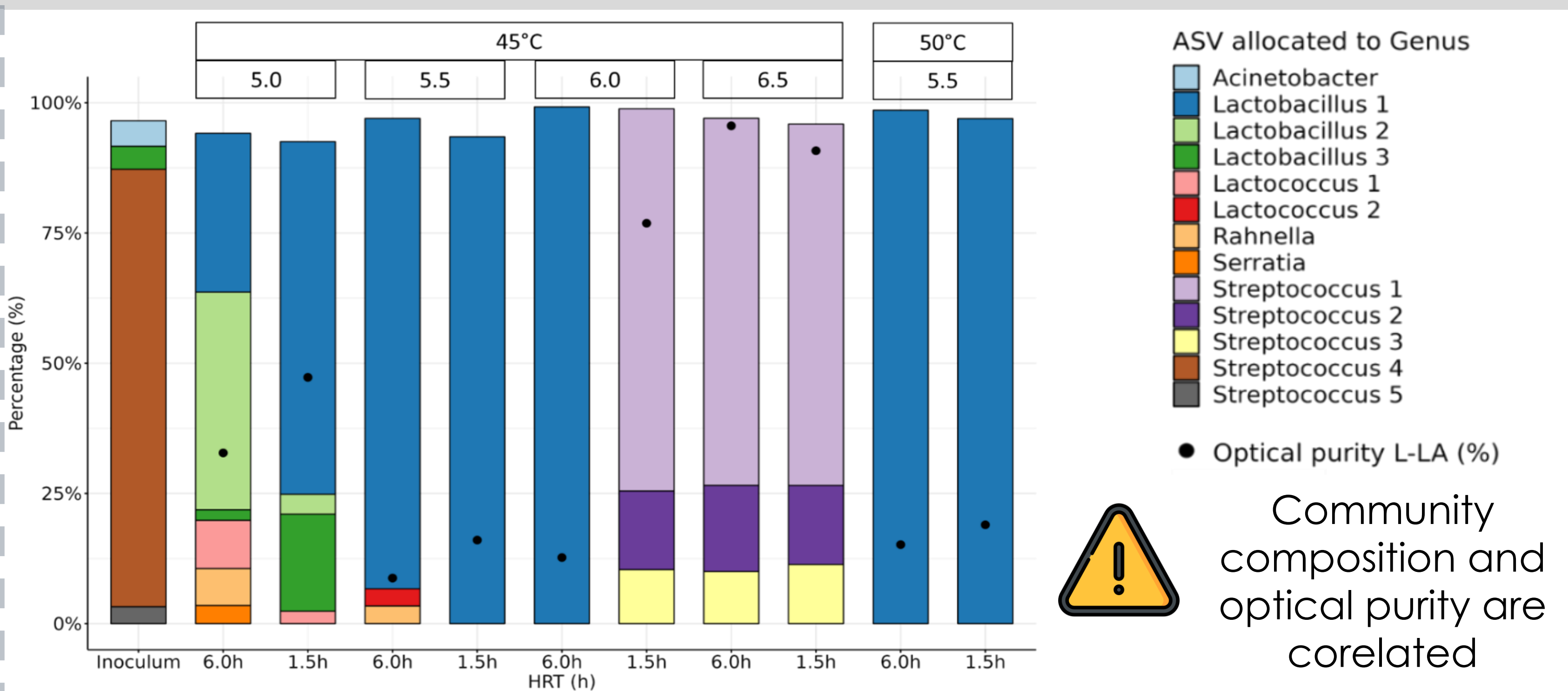
2. Circumneutral pH values boost LA productivity...



3. ...and also ensure better yields



4. Microbial community composition and optical purity also matter



Take home messages

- Lactic acid can be produced in a biorefinery context with open fermentations using the right reactor parameters
- Two production scenarios can be visualized:

As productive as possible



Full conversion required



References

- Haris et al. (2024). Biofpr, 19(2).
- Sakarika et al (2022). Chem. Eng. J., 433.
- Göksungur et al (1997). Chem. Technol. Biotechnol. 69(4)