



## Polyhydroxyalkanoates(PHA) production from crude glycerol

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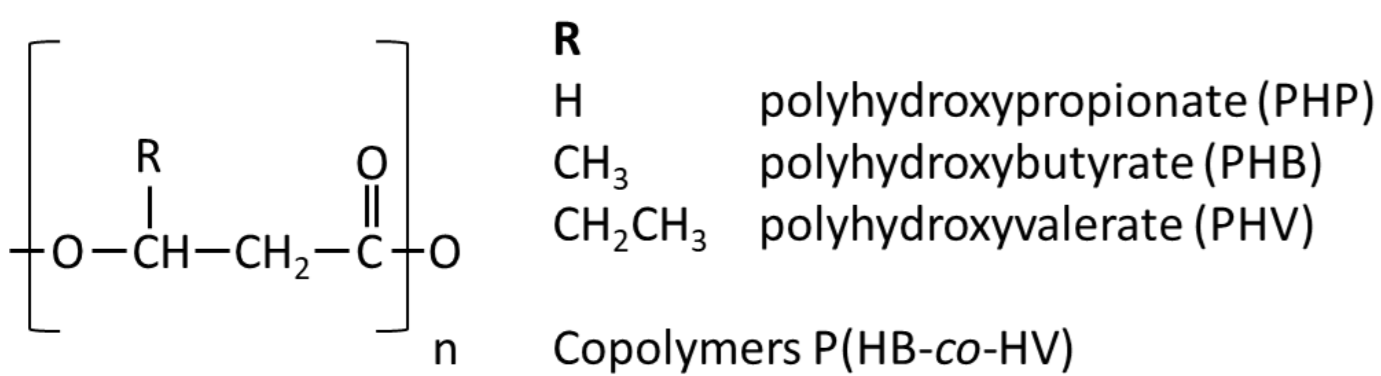
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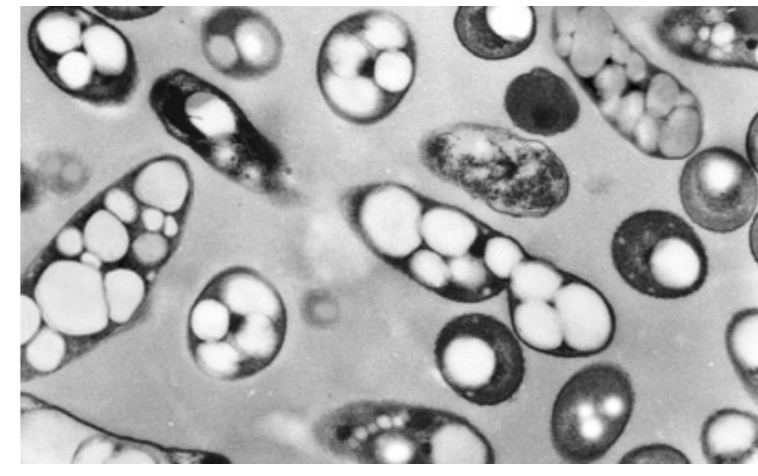


## Polyhydroxyalkanoates (PHA)

PHA are a family of bacterial polyesters. The most common polymers are PHB and PHV.



PHA are produced in microbial cells as a storage polymers in situations of unbalanced growth.



PHA inside of microbial cells (source: www.bio-on.it)

PHA are biodegradable bioplastics with similar properties to PE and PP.



Biodegradable PHA bottles (source: www.biobasedpress.eu)

PHA can be produced from **renewable resources** and organic wastes.

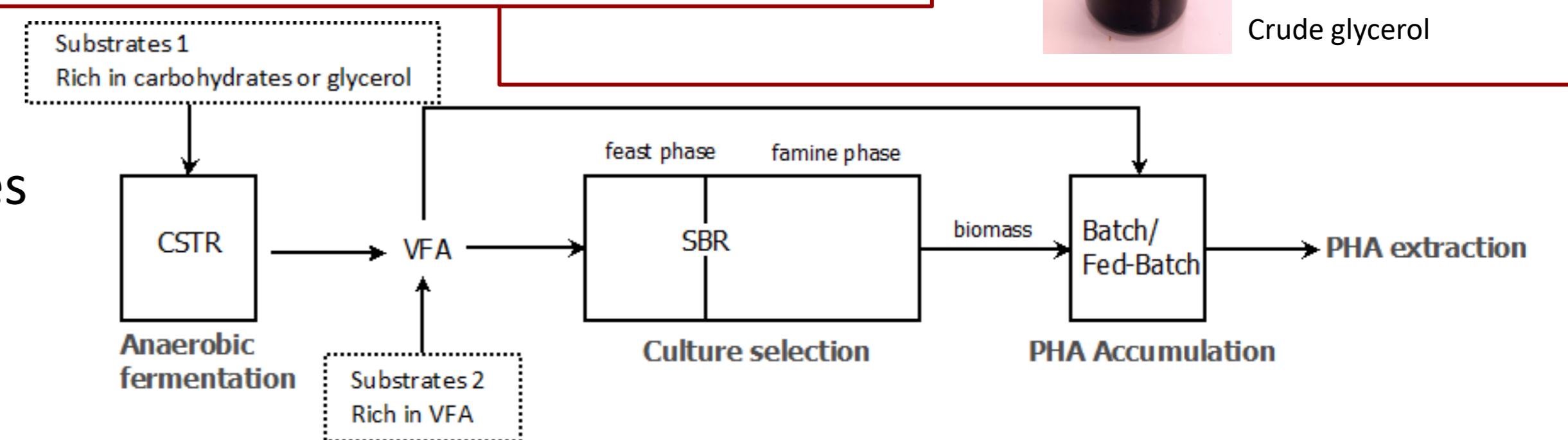
The project aimed at the conversion of **crude glycerol**, a by-product of the bio-diesel industry.



Crude glycerol

PHA production in **Mixed Microbial Cultures** has three main steps:

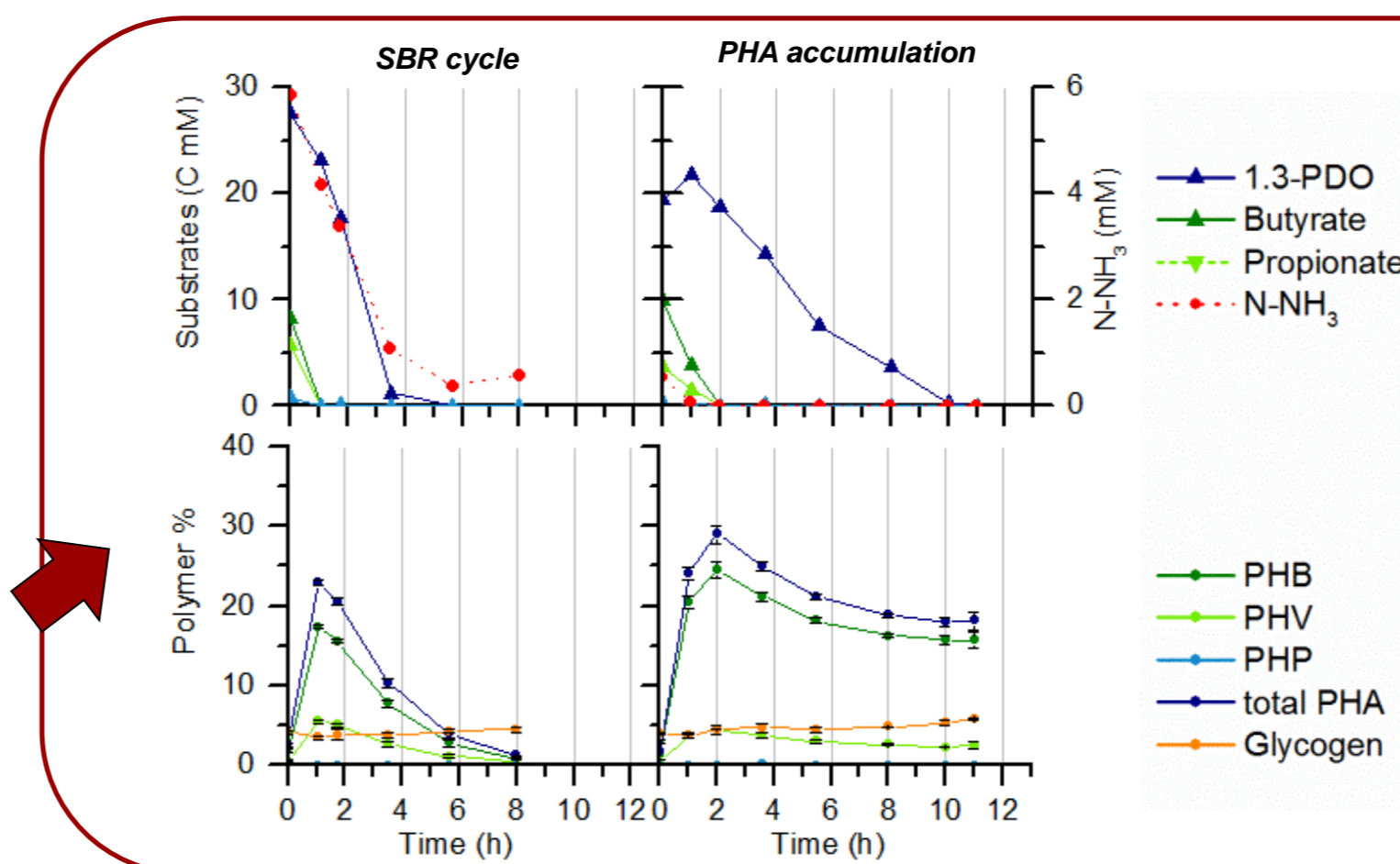
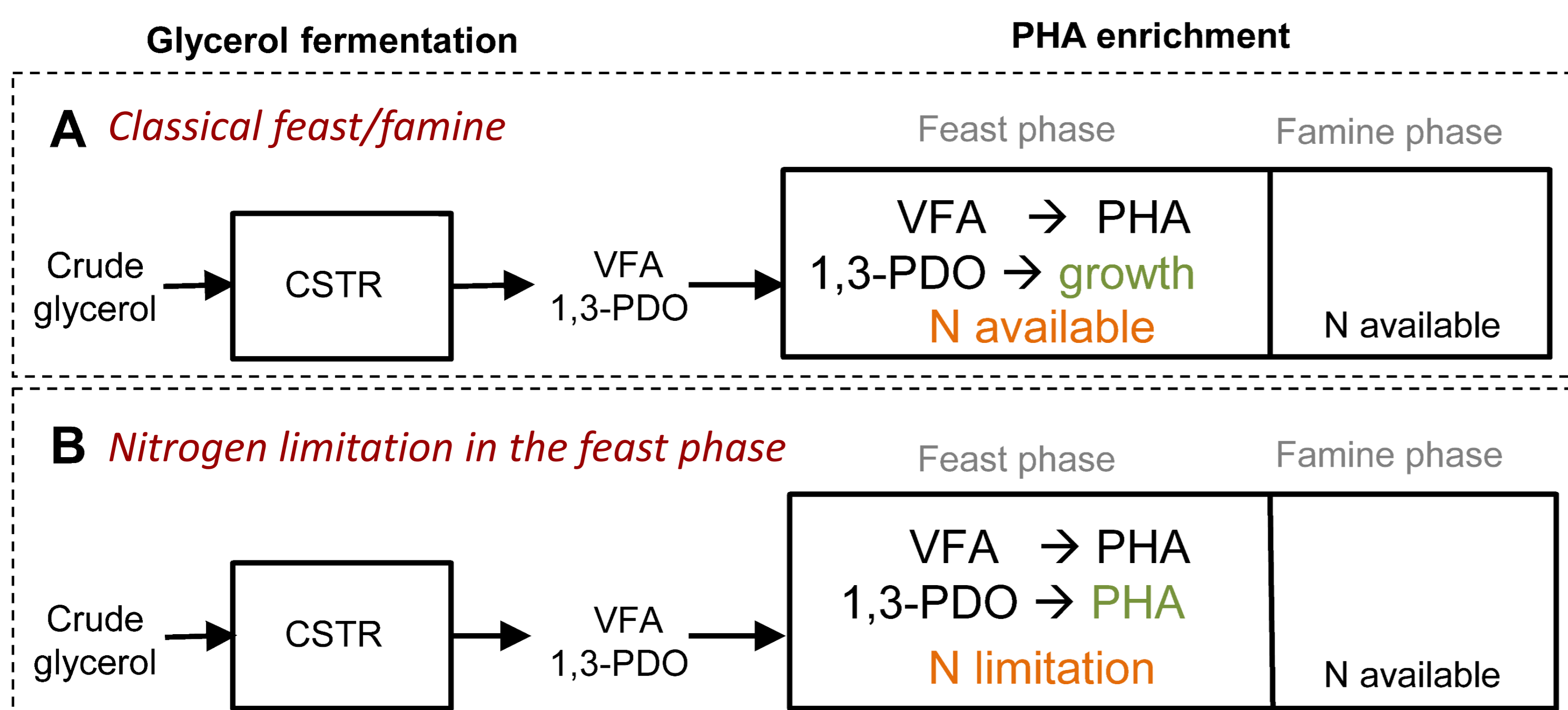
- 1) **Fermentation** of the substrate to volatile fatty acids (VFA), which are optimal substrates
- 2) **Enrichment** of a culture under unbalanced conditions (feast-famine cycles)
- 3) **PHA accumulation** under nutrient limiting conditions



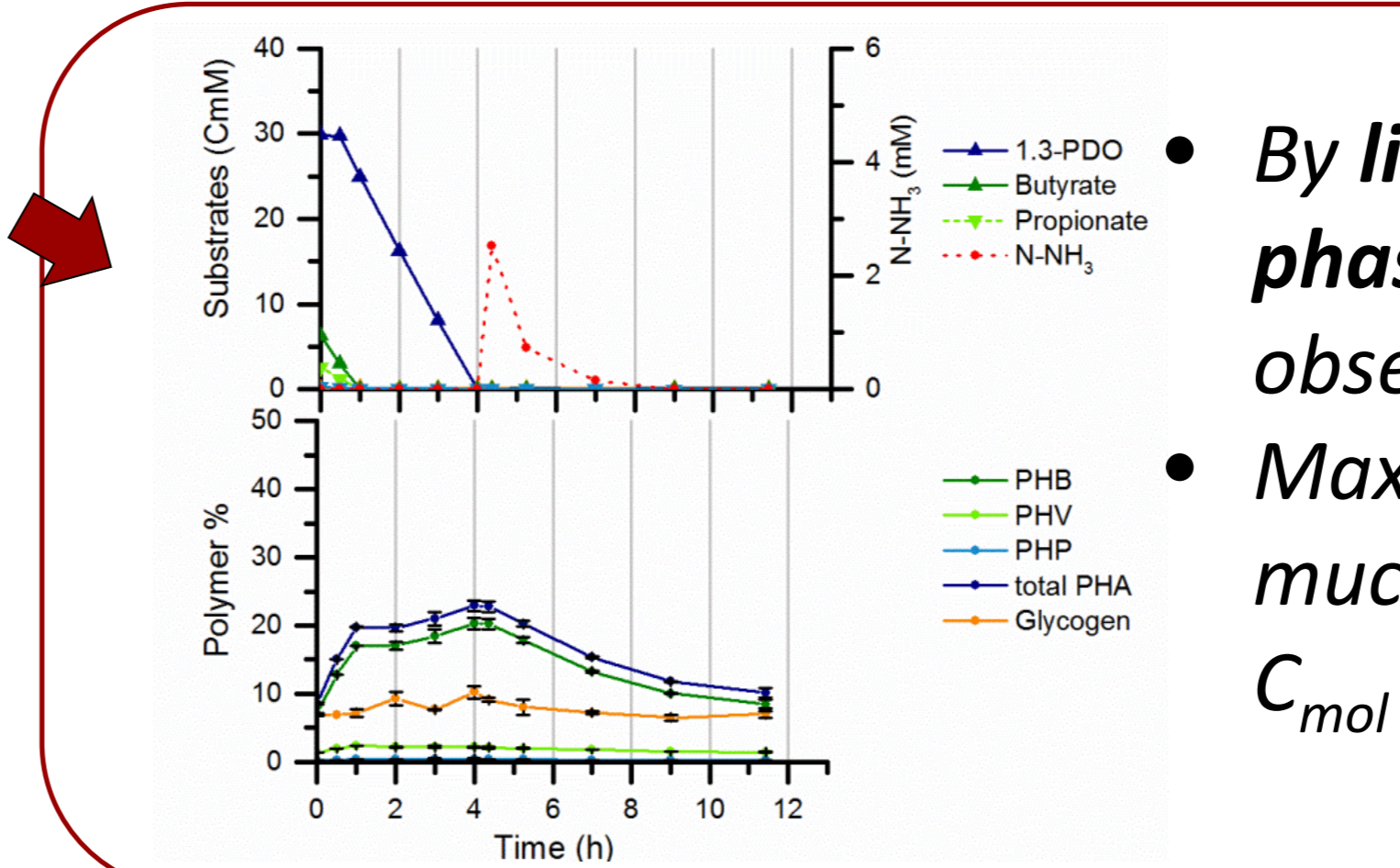
## Strategies for PHA production from fermented crude glycerol

### Strategy 1 - Conversion of VFA and 1,3-PDO to PHA – Nitrogen limitation during the feast phase

Can 1,3-propanediol (1,3-PDO) be converted to PHA?



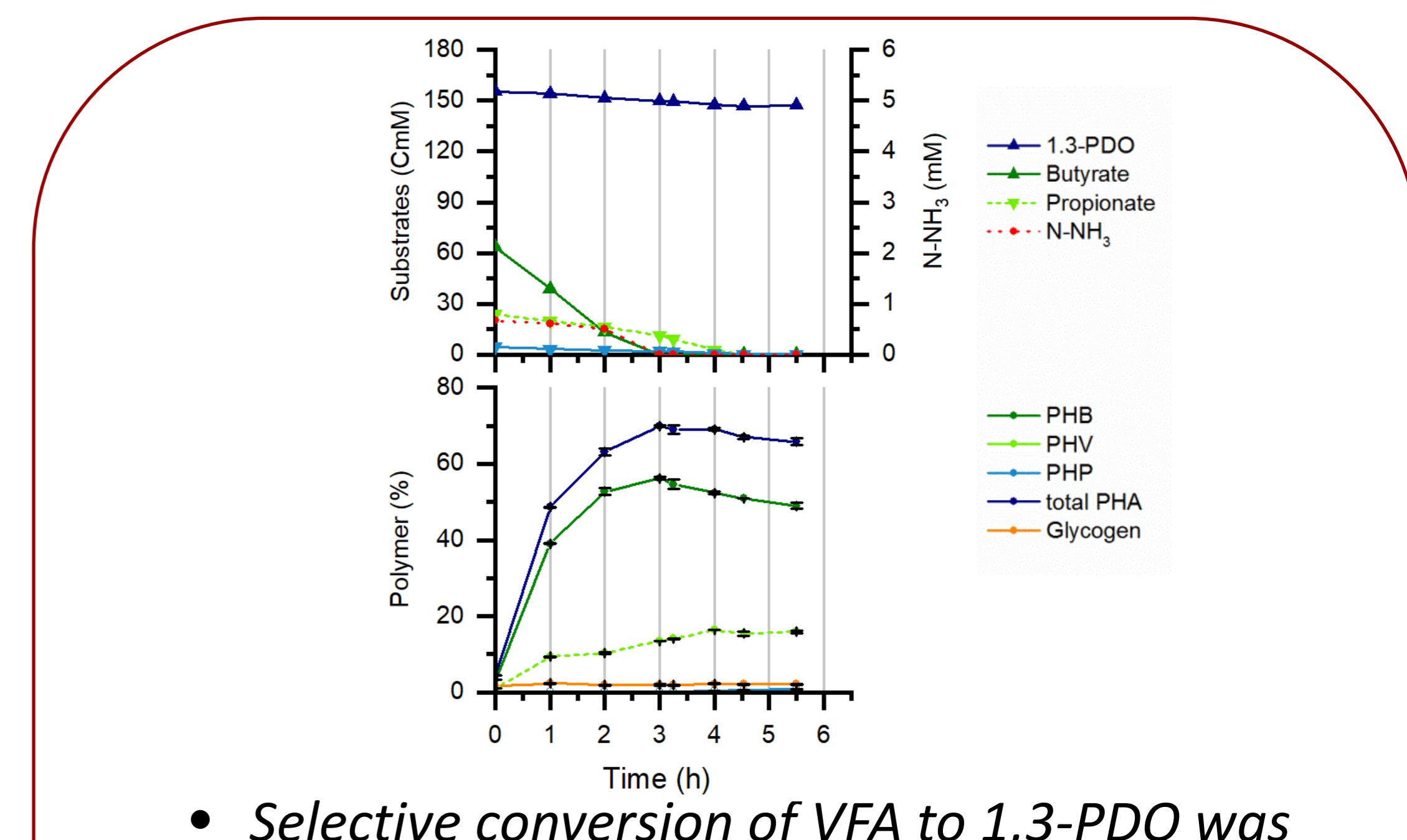
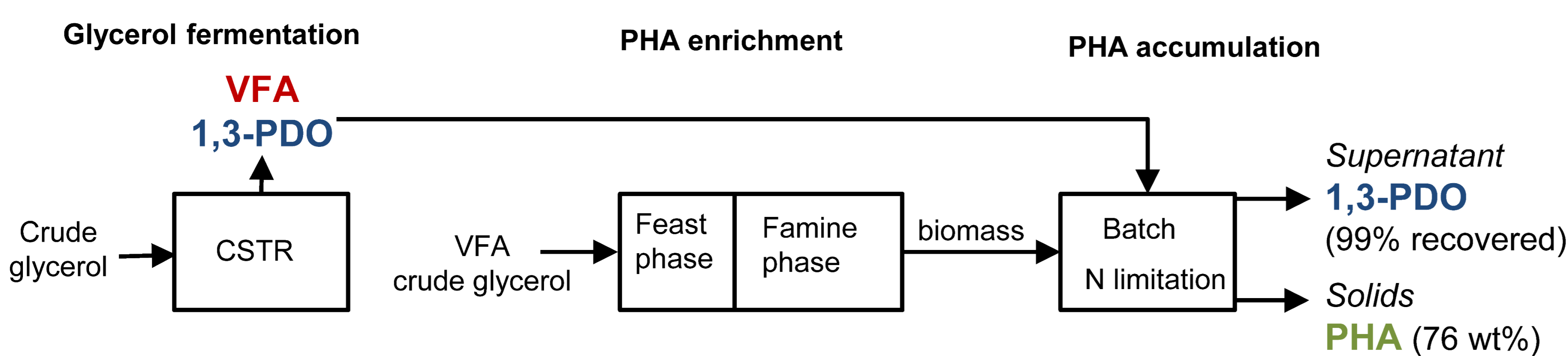
- Classical feast/famine enrichments are performed with nitrogen during the whole enrichment phase.
- This strategy did not lead to PHA production from 1,3-PDO during the accumulation phase.



- By limiting the nitrogen during the feast phase, PHA production from 1,3-PDO was observed.
- Maximum PHA yields from 1,3-PDO were much lower than from VFA (0.21 vs 0.74 C<sub>mol</sub> PHA/C<sub>mol</sub> Substrate, respectively).

### Strategy 2 – Conversion of VFA to PHA with 1,3-PDO recovery

Can we avoid 1,3-PDO consumption by manipulating enrichment conditions?



- Selective conversion of VFA to 1,3-PDO was attained by not supplying 1,3-PDO during the enrichment phase.
- PHA yield was 0.99 C<sub>mol</sub> PHA/C<sub>mol</sub> Substrate.
- The strategy converted a fermentation by-product into PHA, a high value product.
- Potential to be applied to other biological fermentations.

## Acknowledgements

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