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Optimising butyrate and lactate yields fermenting xylose in a mixed culture system

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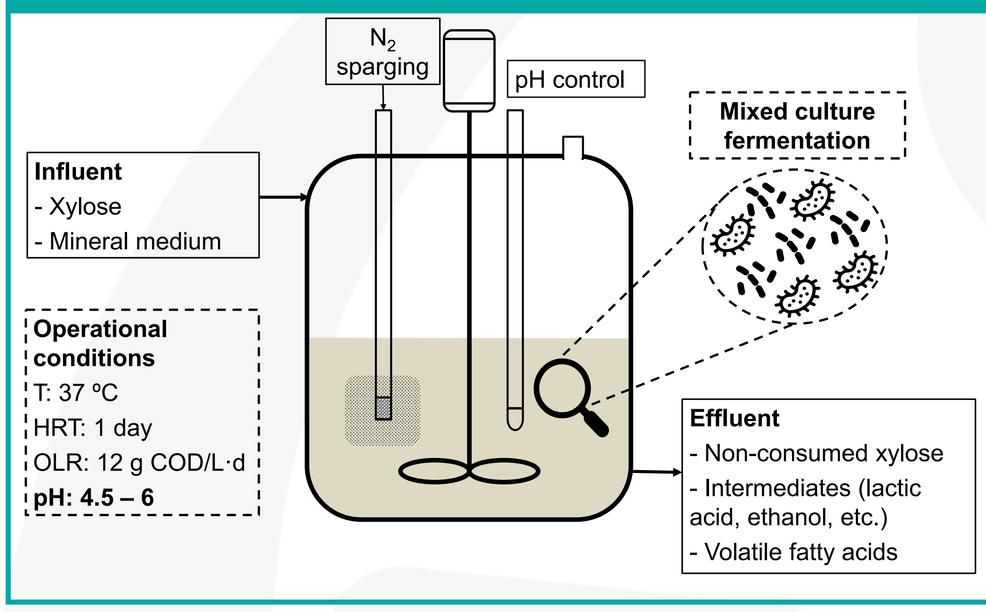
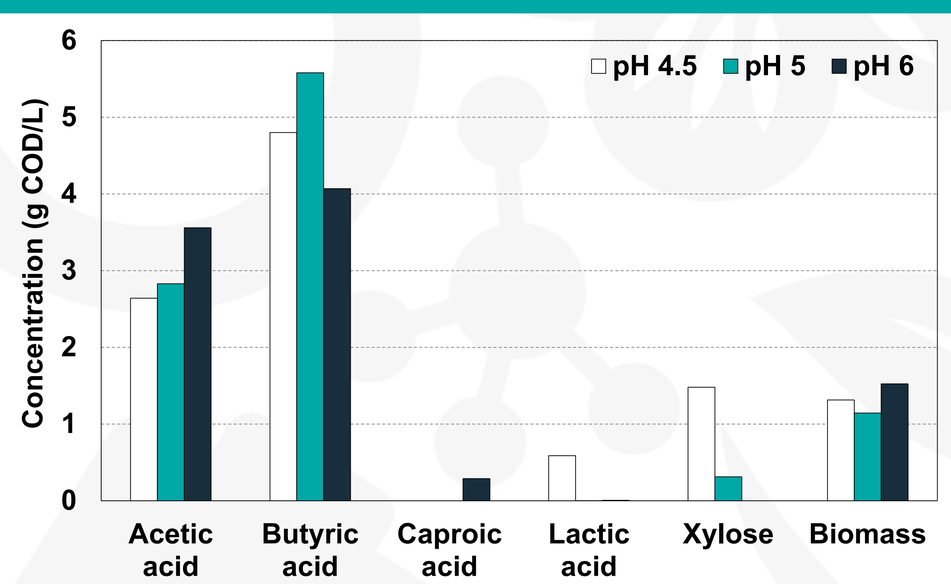
INTRODUCTION

Medium chain fatty acids (MCFA), produced from volatile fatty acids (VFA) and an electron donor, such as lactate, are promising alternatives for carbon recovery (Spirito et al., 2014). To obtain simultaneously a suitable VFA composition and an electron donor for chain elongation, pH stands as one of the most important parameters, since it affects the fermentation bioenergetics and therefore the product spectra (González Cabaleiro et al., 2015; Regueira et al., 2020). When dealing with one of the most abundant source of organic carbon, such as lignocellulosic waste streams, there are still significant gaps in literature. This study analyses the pH effect in xylose mixed-culture fermentation targeting lactic and butyric acid as MCFA precursors.

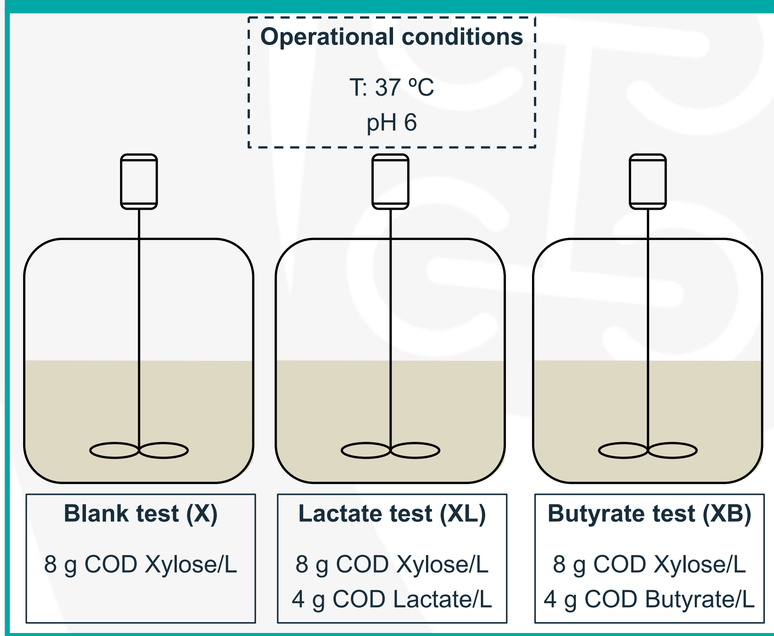
CONTINUOUS REACTOR

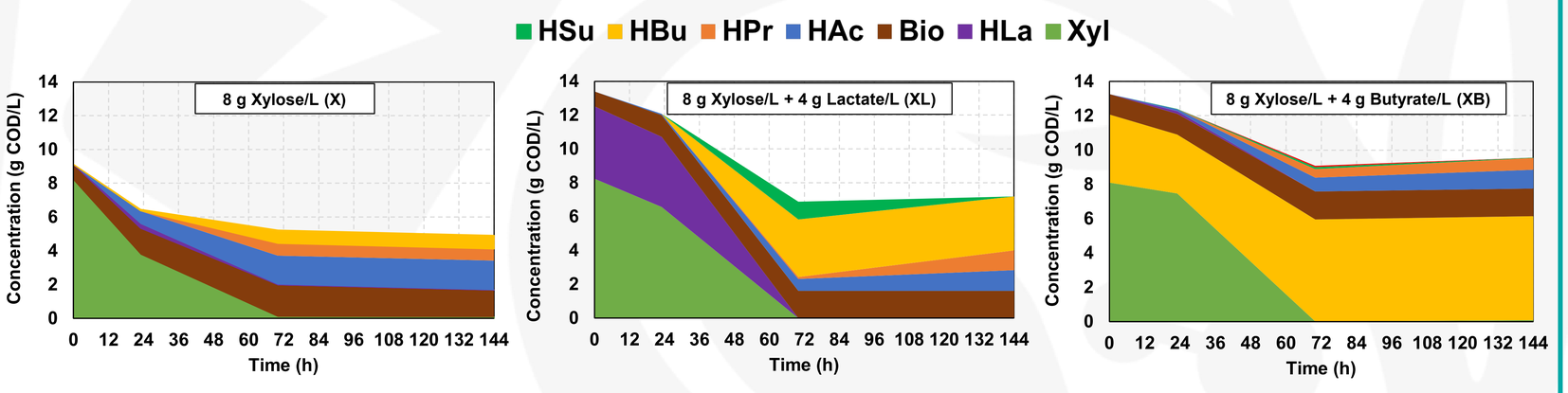




- Uncomplete xylose conversion at pH 4.5.
- Butyric acid concentration is optimised at pH 5.
- Lactic acid appears intermittently during the operation.
- The biomass concentration did not suffer major changes.

BATCH ASSAYS



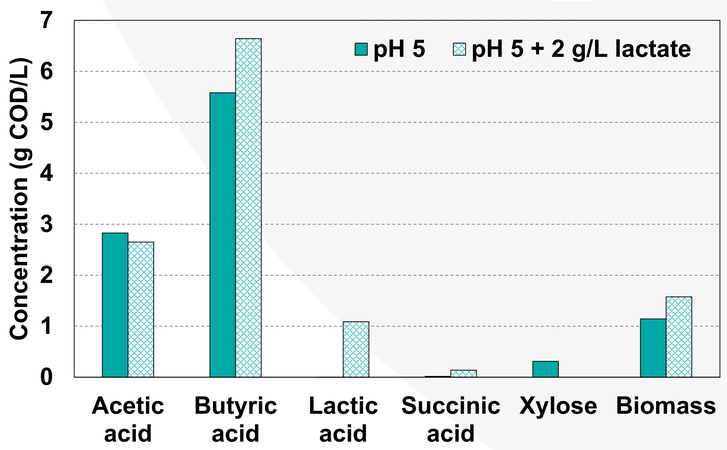


Lactic and butyric acid presence affected negatively to xylose conversion rate

Lactate addition promoted butyric acid production

Butyric acid concentration is not inhibitory in process

LACTATE ADDITION IN CONTINUOUS REACTOR



- 50 % of lactate is consumed.
- Butyric acid concentration raised a 19 %.
- Lactic acid is less energetically efficient than xylose as substrate.

CONCLUSIONS

- Xylose consumption is complete at pH 6.
- Butyric acid yield is maximised at pH 5.
- A steady lactic acid production could not be reached.
- Lactic acid was only produced when butyric acid concentration dropped.
- Co-fermenting xylose and lactate promote butyric acid yield.

ACKNOWLEDGEMENTS

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