FKITMCMXIX

SUSTAINABLE PRODUCTION OF POLYHYDROXYALKANOATES FROM VOLATILE FATTY ACIDS

21 Ružičkini dani
DANAS ZNANOST – SUTRA INDUSTRIJA
9. – 11. rujna 2026. • Vukovar • Hrvatska

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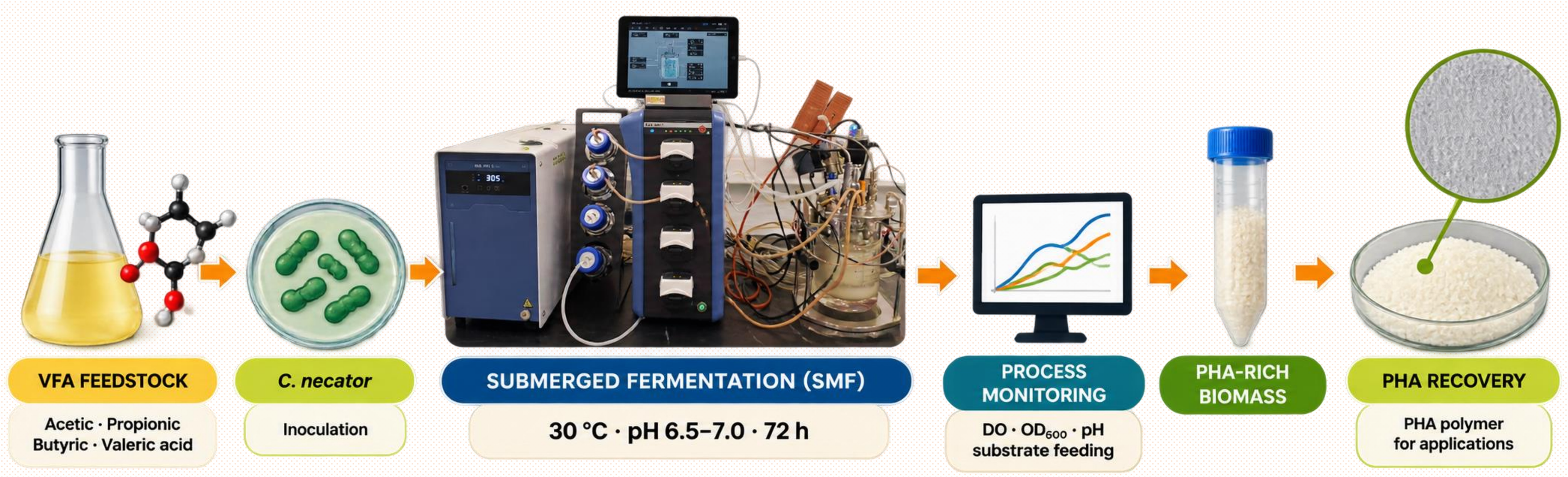
INTRODUCTION

The increasing accumulation of petroleum-based plastic waste and its persistence in the environment have intensified the search for sustainable and biodegradable alternatives. Polyhydroxyalkanoates (PHAs) are microbial biopolyesters with properties comparable to conventional plastics, while offering biodegradability and production from renewable carbon sources. Among potential substrates, volatile fatty acids (VFAs) are particularly attractive due to their high bioavailability and potential recovery from organic waste streams, supporting circular resource utilization. This study investigates the potential of acetic, propionic, butyric, and valeric acids as carbon substrates for PHA production by *Cupriavidus necator* under submerged fermentation conditions.

METHODOLOGY

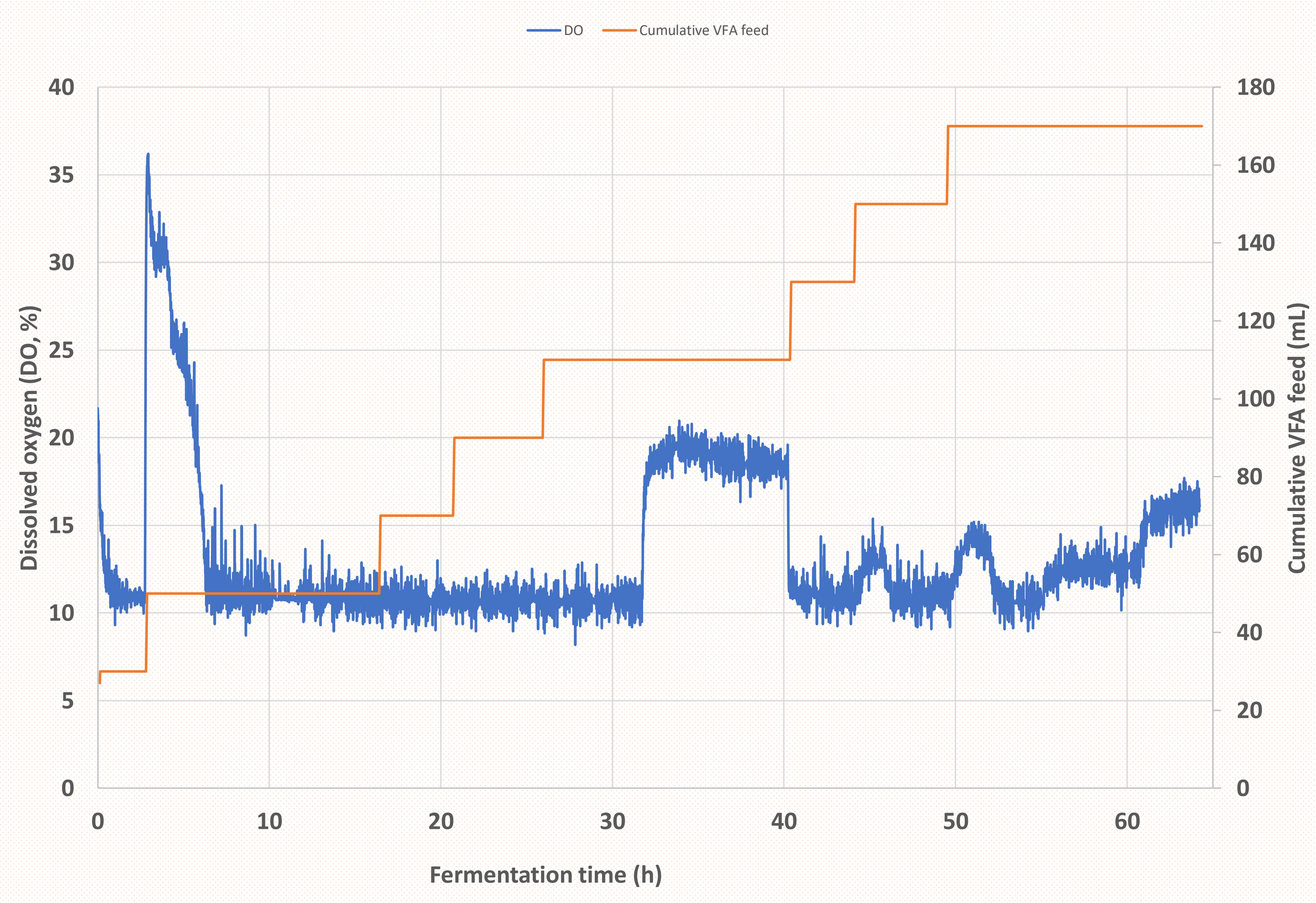


INITIAL FERMENTATION CONDITIONS

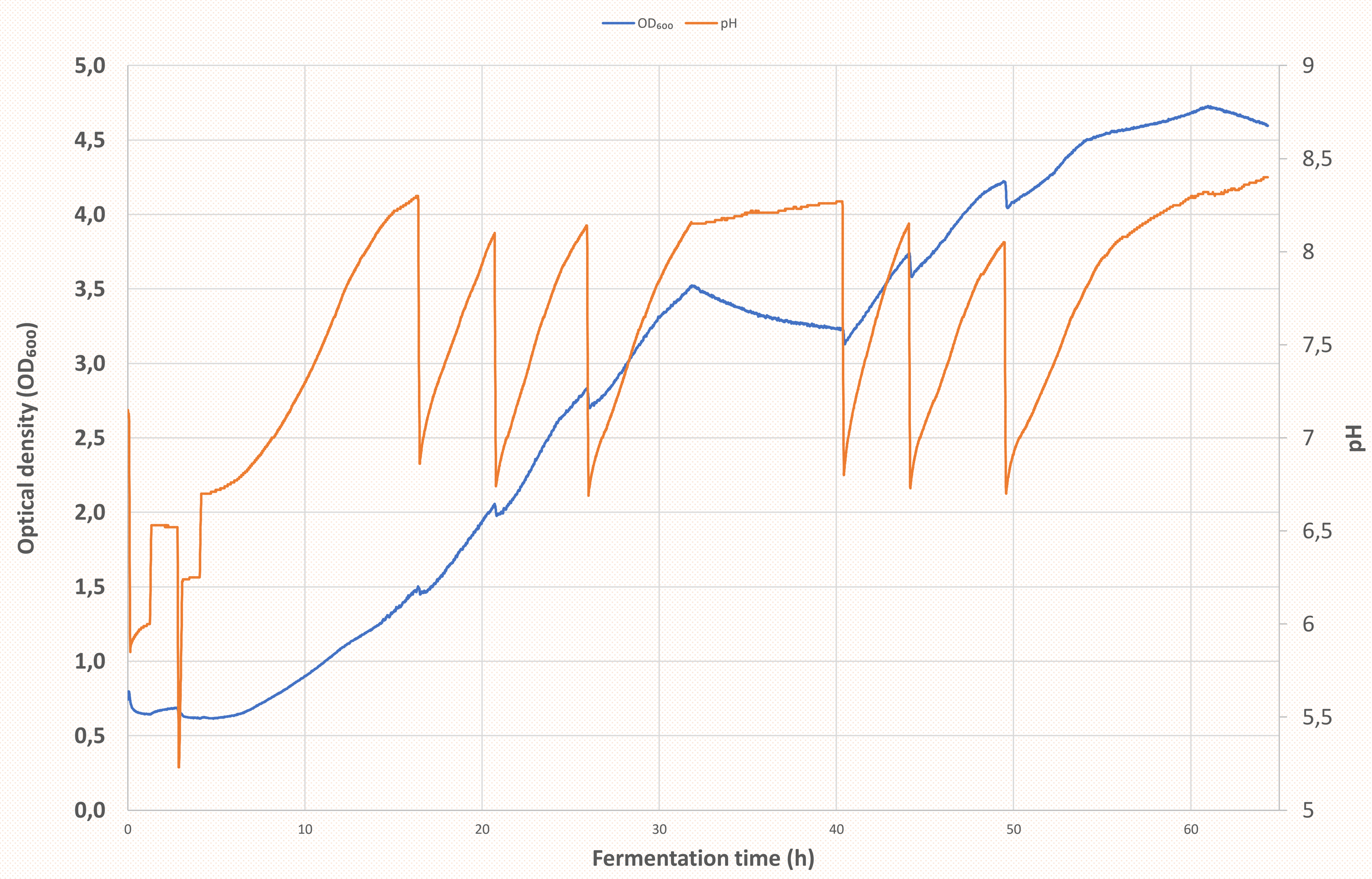
Microorganism	Carbon source	Temperature	pH	Fermentation time
Cupriavidus necator	Acetic, propionic, butyric and valeric acids	30 °C	6.5–7.0	72 h

RESULTS

Dissolved Oxygen and VFA Feeding Profile



Optical Density and pH Profile



PHA EXTRACTION AND GC–MS ANALYSIS

64.70 %	Chloroform-extracted fraction *(mean, n = 2)*
62.76 ± 2.91 %	PHA content by GC–MS *(n = 2)*
74.50 ± 9.19 %	GC–MS purity *(n = 2)*

- M3HB and M3HV detected by GC–MS analysis.
- M3HH not detected.

CONCLUSION

Cupriavidus necator successfully utilized volatile fatty acids as carbon sources under submerged fermentation conditions. Progressive biomass growth was observed throughout fermentation. PHA recovery resulted in a chloroform-extracted fraction of 64.70%, while GC–MS analysis determined a PHA content of 62.76 ± 2.91% and purity of 74.50 ± 9.19%, with M3HB and M3HV detected. These results demonstrate the potential of VFAs as alternative carbon sources for PHA production.

NEXT STEPS

❖ Optimization of fermentation conditions to improve PHA yield and purity.
❖ Further physicochemical and structural characterization of the recovered polymer.
❖ Evaluation of VFA composition and feeding strategies to enhance PHA production.
❖ Process optimization and scale-up for efficient PHA production from VFAs.

ACKNOWLEDGMENT

Financira Europska unija
NextGenerationEU

This research was conducted within the project BioSmart (112101) financed by the European Union's- NextGenerationEU fund from the source 581 – The recovery and resilience mechanism, in the frame of Programme financing of public higher education institutions and public scientific institutes.