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World Journal of Microbiology and Biotechnology  
Volume 27, Issue 10, October 2011, Pages 2455-2459

## Regulating the molar fraction of 4 - hydroxybutyrate in Poly(3-hydroxybutyrate -co- 4 - hydroxybutyrate ) by biological fermentation and enzymatic degradation (Article)

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### Abstract

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The regulation of 4-hydroxybutyrate (4HB) molar fraction in the poly(3-hydroxybutyrate-co-4-hydroxybutyrate) [P(3HB-co-4HB)] of a local isolate *Cupriavidus* sp. USMAA1020 was attempted by employing a feeding strategy through fed-batch fermentation in 100-L fermenter. The growth of *Cupriavidus* sp. USMAA1020 was enhanced by frequently feeding carbon and nitrogen at a ratio of 5 (C/N 5) using a DO-stat with cascade mode at 20% (v/v) dissolved oxygen (DO). The feeding of C/N 5 and the use of the DO-stat mode were able to regulate the 4HB composition from 0-67 mol% by sequential feeding of  $\gamma$ -butyrolactone and supplementing oleic acid. A high 4HB molar fraction of 67 mol% with a PHA concentration of 5.2 g/L was successfully obtained by employing this feeding strategy. Notably, enzymatic degradation carried out enhanced the 4HB composition of the copolymer synthesized. PHB depolymerase enzyme from *Acidovorax* sp. was used to degrade this P(3HB-co-70-mol%4HB) copolymer and the 4HB composition could be increased up to 83 mol%. The degradation process was observed by monitoring the time-dependent change in the weight loss of copolymer films. The percentage of weight loss of solvent-cast film increased proportionally up to 19% within 3 h, whereas salt-leached films showed 90% of weight loss within 3 h of incubation and were completely degraded by 4 h. The molecular weight ( $M_n$ ) of the films treated with enzyme demonstrated a slight decrease. SEM observation exhibited a rough surface morphology of the copolymer degraded with depolymerase enzyme. © 2011 Springer Science+Business Media B.V.

### Author keywords

Depolymerase enzyme Enzymatic degradation Fed-batch fermentation Poly(3-hydroxybutyrate-co-4-hydroxybutyrate)

### Indexed keywords

#### Compendex keywords

4-hydroxybutyrate Butyrolactones Carbon and nitrogen Copolymer films  
Degradation process Depolymerase Enzymatic Degradation Fed-batch fermentation  
Feeding strategies Molar fractions PHA concentration  
Poly(3-hydroxybutyrate-co-4-hydroxybutyrate) SEM observation Sequential feeding  
Solvent cast films Time-dependent changes Weight loss

#### Engineering controlled terms:

Copolymers Degradation Dissolved oxygen Enzymes Feeding Leaching  
Oleic acid

#### Engineering main heading:

Fermentation

#### Species Index:

Acidovorax Cupriavidus

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### Funding text

Acknowledgments The authors wish to thank the Ministry of Science, Technology and Innovation (MOSTI), Malaysia for providing the research grant and for the USM Fellowship awarded to A. Nor Faezah that has resulted in this article. The authors also wish to thank Ismail Hakimi Ibrahim for his assistance in this project.

ISSN: 09593993

DOI: 10.1007/s11274-011-0697-3

CODEN: WJMBE

Document Type: Article

Source Type: Journal

Original language: English

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