2002). It has been drawing much attention as a good candidate for biodegradable and biocompatible plastic material which can be produced from renewable raw materials. Possible applications of PHB include the following: packaging films and containers, biodegradable carriers for controlled chemical and drug release, disposable items, surgical pins and sutures, wound dressings and bone replacements (Lee and ve Choi, 1999).

In this study, production capability of *Bacillus* sp. which was isolated from various areas in Turkey was examined. The hydrolysis products were chosen as carbon sources for the production of poly-3-hydroxybutyric acid (PHB) by *Bacillus* sp. Accumulation of PHB granules in the organism was analyzed by Sudan black method. In shaking flask experiments, the utilization of molasses and peach pulp as a cheap substrate was compared to the utilization of mineral medium for bacterial growth under balanced conditions as well as for the production of PHB under nitrogen limitation. The amount of synthesized PHB was determined as crotonic acid by spectrophotometer (Gerhardt et al., 1994).

Highest PHB (72.2%) production was found in minimal synthetic medium. Highest yield of PHB were 7.92% and 7.78% in the containing molasses and pulp media, respectively.

Keywords: Polyhydroxyalkanoates; *Bacillus* sp.; Molasses; Peach pulp

References

Choi, J.I., Lee, S.Y., 1997. Process analysis and economic evaluation for poly(3-hydroxybutyrate) production by fermentation. Bioprocess. Eng. 17, 335–342.
Gerhardt, P., Murray, R.G.E., Wood, W.A., Krieg, N.R., 1994. Methods for General and Molecular Bacteriology. American Society for Microbiology, Washington, DC, p. 628.
Jacquel, N., Lo, C.-W., Wei, Y.-H., Wu, H.-S., Wang, S.S., 2008. Isolation and purification of bacterial poly(3-hydroxyalkanoates. Biochem. Eng. J. 39 (1), 15–27.
Lee, S.Y., ve Choi, J.I., 1999. Polyhydroxyalkanoates biodegradable polymer. Man. Ind. Microbiol. Biotechnol., 616–627 (Chapter 51).
Ustian, T., 2002. Bacterial plastics. Wisc. Edu. Biojournals 21, 1–4.

doi:10.1016/j.jbiotec.2008.07.937

V4-O-063

Enzymatic hydrolysis of treated palm oil empty fruit bunches fibre (EFB) using combination alkali-microwave techniques

Fazlena Hamzah, Ani Idris*

Department of Bioprocess, Faculty of Chemical Engineering and Natural Resources Engineering, Universiti Teknologi Malaysia, 41020 Skudai, Johor, Malaysia

E-mail address: ani@fkkksa.utm.my (A. Idris).

Combination of alkali-microwave pre-treatment on empty fruit bunches (EFB) fibre changed the morphology and properties of the EFB fibre as observed through scanning electron microscope (SEM) and Fourier transformed infrared spectroscopy (FT-IR). Pre-treatment process raptures the lignin and hemicellulose component inside the fibre, thus leaving available cellulose for hydrolysis process (Vlasenko et al., 1996). Most of the silica component and any impurities on the surface of the raw EFB fibre were removed during pre-treatment process, leaving an empty cauldron on the treated EFB surface. Furthermore, an internal structure of pre-treated EFB fibre showed a clear macrofibril compared to the untreated EFB fibre. The microfibrils of pre-treated fibre were separated from the initial connected structure and this exposed the cellulose to hydrolysis, thus increased the external surface area and the porosity of the pre-treated fibre (Xu et al., 2007). Generally, raw EFB fibre consists of 44.2% alpha cellulose, 33.5% hemicellulose and 20.4% lignin, respectively (Astima et al., 2002). After treating with alkali-microwave, cellulose composition increased to 64%, while hemicellulose and lignin composition reduced to 26% and 8%, respectively. Cellulose composition is also much higher in microwave treatment compared with conventional pre-treatment. Alkali-microwave pre-treated EFB fibre gave 30% soluble glucose higher than conventional pre-treatment when it was hydrolyzed with combination of cellulase and Novozyme 188. The optimum conditions obtained for hydrolysis process were at pH 5, 50 °C and 5:1 cellulase to Novozyme 188 ratio.

Keywords: Alkali; Microwave; Pre-treatment; Cellulose; Enzymatic hydrolysis

References

Astima, A.A., Husin, M., Anis, M., 2002. Preparation of cellulose from oil palm empty fruit bunches via ethanol digestion: effect of acid and alkali catalysts. J. Oil Palm Res. 14, 9–14.
Vlasenko, E.Y., Ding, H., Labavitch, J.M., Shoemaker, S.P., 1996. Enzymatic hydrolysis of pre-treated rice straw. Bioresour. Technol. 59, 109–119.
Xu, Z., Wang, Q., Jiang, Z.H., Yang, X.X., Ji, Y.Z., 2007. Enzymatic hydrolysis of pre-treated soybean straw. Biomass Bioenergy 31, 162–167.

doi:10.1016/j.jbiotec.2008.07.938

V4-O-069

Accumulation of polyhydroxybutyrate by a *Serratia* sp.

Lynne E. Macaskie[1,*], Ping Yong[1], Marion Paterson-Beedle[1], Harriet Lugg[2], Rachel L. Sammons[2], Peter M. Marquis[2], Mitra Kashani[3], Mike Jenkins[3], Artemis Stamboulis[3]

[1] *Unit of Functional Bionanomaterials, School of Biosciences, The University of Birmingham, Birmingham B15 2TT, UK*
[2] *School of Dentistry, University of Birmingham, Birmingham B4 6NN, UK*
[3] *School of Metallurgy and Materials Science, The University of Birmingham, Birmingham B15 2TT, UK*

E-mail address: L.E.Macaskie@bham.ac.uk (L.E. Macaskie).

Polyhydroxyalkanoates (PHAs) are microbial storage polymers typically deposited during unbalanced growth, e.g. by limitation for nitrogen or phosphorus in the presence of an excess of carbon source (Anderson and Dawes, 1990). Of these, polyhydroxybutyrate (PHB) (Anderson and Dawes, 1990) has received attention as a potential precursor for biodegradable plastics. A *Serratia* sp. has been used to biomanufacture nanoscale hydroxyapatite (HA) with potential use in dental and orthopaedic applications and for water purification (Thackray et al., 2004). Bio-synthesis of HA uses calcium, citrate and glycerol 2-phosphate (G2P). G2P is hydrolysed enzymatically with biomineralization of resulting HPO_4^{2-} ions and Ca^{2+} in the structured exocellular space, with consumption of the citrate by the bacteria. The residual cells show large intracellular electron-transparent inclusion bodies. These were identified as polyhydroxybutyrate (PHB) by analysis of molecular fragments by GC–MS and by FTIR spectroscopy of the isolated bio-PHB in comparison with a commercial reference material. Mass balance analysis (citrate consumed) together with measurement of the extracted material indicated PHB accumulation to up to 77% of the bacterial dry weight. As far as we are aware this is the first report of PHB accumulation by an enterobacterial strain, although the use of genetically modified *Escherichia coli* has been used previously (Binstock and Schulz, 1981). The use of a natural *Serratia* sp. overcomes the constraints of using genetically modified organisms, while the economic attractiveness is enhanced by the