

## REFERENCES

- Annous, B. and Blaschek, H.P. (1991) Isolation and characterization of *Clostridium acetobutylicum* mutants with enhanced amylolytic activity. *Applied and Environmental Microbiology*, 57(9), 2544–2548).
- Anonymous. “Cellulase.” Wikipedia. 16 October 2003. 10 July 2012 <<http://en.wikipedia.org/wiki/Cellulase>>
- Anonymous. “Butanol fuel.” Wikipedia. 19 July 2006. 13 June 2012 <[http://en.wikipedia.org/wiki/Butanol\\_fuel](http://en.wikipedia.org/wiki/Butanol_fuel)>
- Bahl, H., Andersch, W. and Braun, K. (1982) Effect of pH and butyrate concentration on the production of acetone and butanol by *Clostridium acetobutylicum* grown in continuous culture. *European Journal of Applied Microbiology and Biotechnology*, 14, 17–20.
- Bowles, L.K. and Ellefson, W.L. (1985) Effects of butanol on *Clostridium acetobutylicum*. *Applied and Environmental Microbiology*, 50, 1165–1170.
- Canilha, L., Santos, V.T.O., Rocha, G.J.M., Silva, J. B., Giulietti, M., Silva, S.S., Felipe, M.G.A., Ferraz, A., Milagres, A.M.F. and Carvalho, W. (2011) A study on the pretreatment of a sugarcane bagasse sample with dilute sulfuric acid. *Journal of Industrial Microbiology & Biotechnology*, 38(9), 1467–1475.
- Chen, C. and Blaschek, H. (1999a) Acetate enhances solvent production and prevents degeneration in *Clostridium beijerinckii* BA101. *Applied Microbiology and Biotechnology*, 52, 170–173.
- Chen, C. and Blaschek, H. (1999b) Effect of acetate on molecular and physiological aspects of *Clostridium beijerinckii* NCIMB 8052 solvent production and strain degeneration. *Applied and Environmental Microbiology*, 65, 499–505.

- Cornillot, E., Nair, R. V., Papoutsakis, E.T. and Soucaille, P. (1997) The genes for butanol and acetone formation in *Clostridium acetobutylicum* ATCC 824 reside on a large plasmid whose loss leads to degeneration of the strain. *Journal of Bacteriology*, 179(17), 5442–5447.
- Dürre, P. (2008) Fermentative Butanol Production. *Annals of the New York Academy of Sciences*, 1125(1), 353–362.
- Ennis, B.M. and Maddox, I.S. (1985) Use of *Clostridium acetobutylicum* P262 for production of solvents from whey permeate. *Biotechnology Letters*, 7, 601–606.
- Formanek, J., Mackie, R., Blaschek, H.P. (1997) Enhanced Butanol Production by *Clostridium beijerinckii* BA101 Grown in Semidefined P2 Medium Containing 6 Percent Maltodextrin or Glucose. *Applied and Environmental Microbiology*, 63, 2306–2310
- Gómez, S.M.R., Andrade, R.R., Santander, C.G., Costa, A.C. and Maciel, F.R. (2009) Pretreatment of sugar cane bagasse with phosphoric and sulfuric diluted acid for fermentable sugars production by enzymatic hydrolysis. paper presented at School of Chemical Engineering, University of Campinas, UNICAMP, Brazil
- Gu, Y., Hu, S., Chen, J., Shao, L., He, H., Yang, Y., Yang, S. and Jiang, W. (2009) Ammonium acetate enhances solvent production by *Clostridium acetobutylicum* EA 2018 using cassava as a fermentation medium. *Journal of Industrial Microbiology & Biotechnology*, 36, 1225–1232.
- Holtzapfel, M. (2003) *Encyclopedia of Food Science, Food, Technology and Nutrition*. London: Academic Press.
- Izard, A. and Goma, G. (1989) Effects of various alcoholic supplements on the growth rate of *Clostridium acetobutylicum* ATCC 824. *Applied Microbiology and Biotechnology*, 31, 179–183.

- Jeffries, T. and Sreenath, H. (1988) Fermentation of hemicellulosic sugars and sugar mixtures by *Candida shehatae*. Biotechnology and Bioengineering, 31, 502–506 (1988).
- Jones, D.T., Woods, D.R. (1986) Acetone—Butanol Fermentation Revisited. Microbiological Reviews, 50, 484—524.
- Kang, K.E., Jeong, G.T. and Park, D.H. (2011) Pretreatment of rapeseed straw by sodium hydroxide. Bioprocess and Biosystems Engineering, 35(5), 705–713.
- Kanouni, El.A., Zerdani, I., Zaafa, S., Znassni, M., Loutfi, M. and Boudouma, M. (1998) The improvement of glucose/xylose fermentation by Clostridium acetobutylicum using calcium carbonate. World Journal of Microbiology & Biotechnology, 14, 431–435.
- Knoshaug, E.P. and Zhang, M. (2008) Butanol Tolerance in a Selection of Microorganisms. Applied Biochemistry and Biotechnology, 153, 13–20.
- Kumar, M. and Gayen, K. (2011) Developments in biobutanol production: New insights. Applied Energy, 88, 1999–2012.
- Lee, S.M., Cho M. O., Park C. H., Chung Y., Kim J. H., Sang B. and Um Y. (2008) Continuous Butanol Production Using Suspended and Immobilized Clostridium beijerinckii NCIMB 8052 with Supplementary Butyrate. Energy & Fuels, 22, 3459–3464.
- Maddox, I.S., Steiner, E., Hirsch, S., Wessner, S., Gutierrez, N.A., Gapes, J.R., Schuster, K.C. (2000) The Cause of “Acid Crash” and “Acidogenic Fermentations” During the Batch Acetone—Butanol—Ethanol (ABE—) Fermentation Process. Journal of Molecular Microbiology and Biotechnology, 2, 95–100.
- Marchal, R., Rebeller, M. and Vandecasteele, J.P. (1984) Direct bioconversion of alkali-pretreated straw using simultaneous enzymatic hydrolysis and acetone

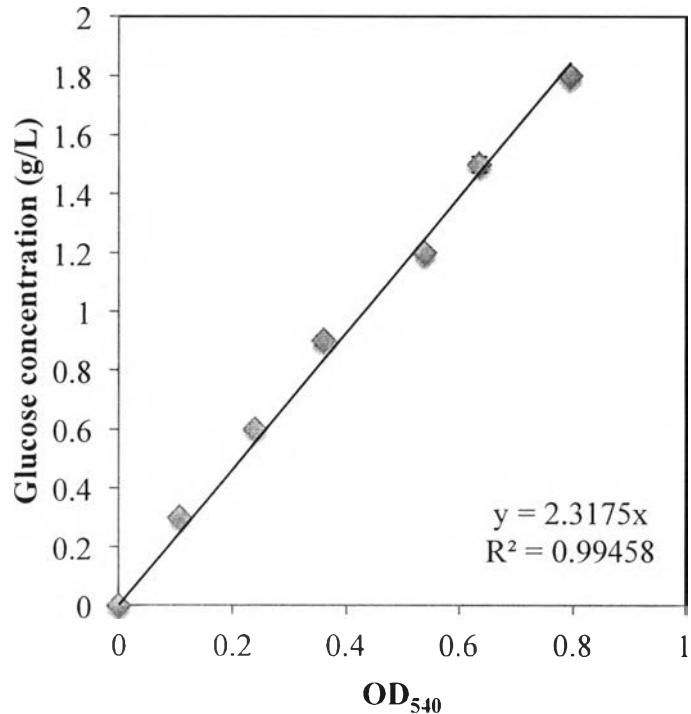
- butanol production. *Biotechnology Letters*, 6, 523–528.
- Martinez, A., Rodriguez, M., York, S., Preston, J. and Ingram, L. (2000) Effects of  $\text{Ca}(\text{OH})_2$  treatments (“overliming”) on the composition and toxicity of bagasse hemicellulose hydrolysates. *Biotechnology and Bioengineering*, 69(5), 526–536.
- Moreira, A.R., Ulmer, D.C. and Linden, J.C. (1981). Butanol toxicity in the butylic fermentation. *Biotechnology & Bioengineering Symposium*, 11, 567–579.
- Nolling, J., Breton, G., Omelchenko, M., Makarova, K., Zeng, Q., Gibson, R., Lee, H., Dubois, J., Qiu, D., Hitti, J., Wolf, Y., et al. (2001) Genome sequence and comparative analysis of the solvent-producing bacterium *Clostridium acetobutylicum*. *Journal of Bacteriology*, 183(16), 4823–4838.
- Parekh, S.R., Parekh, R.S. and Wayman, M. (1988) Ethanol and butanol production by fermentation of enzymatically saccharified  $\text{SO}_2$ -prehydrolysed lignocellulosics. *Enzyme and Microbial Technology*, 10, 660–668.
- Phillips J.A. and Humphrey A.E. (1983) *An overview of process technology for the production of liquid fuels and chemical feedstocks via fermentation*. San Francisco: Benjamins Cummings.
- Ounine, K., Petitdemange, H., Raval, G. and Gay, R. (1985) Regulation and Butanol Inhibition of D-Xylose and D-Glucose Uptake in *Clostridium-acetobutylicum*. *Applied and Environmental Microbiology*, 49, 874–878.
- Qureshi, N., Ezeji, T.C., Ebener, J., Dien, B.S., Cotta, M.A. and Blaschek, H.P. (2008) Butanol production by *Clostridium beijerinckii*. Part I: Use of acid and enzyme hydrolyzed corn fiber. *Bioresource Technology*, 99(13), 5915–5922.
- Redding, A.P., Wang, Z., Keshwani, D. R. and Cheng, J.J. (2010) High temperature dilute acid pretreatment of coastal Bermuda grass for enzymatic hydrolysis. *Bioresource Technology*, 102(2), 1415–1424.

- Saha, B.C. and Cotta, M.A. (2006) Ethanol Production from Alkaline Peroxide Pretreated Enzymatically Saccharified Wheat Straw. Biotechnology Progress, 22(2), 449–453.
- Saha, B.C. and Cotta, M.A. (2010) Comparison of pretreatment strategies for enzymatic saccharification and fermentation of barley straw to ethanol. New Biotechnology, 27(1), 10–16.
- Schell, D.J., Farmer, J., Newman, M. and McMILLAN, J.D. (2003) Dilute-sulfuric acid pretreatment of corn stover in pilot-scale reactor. Applied Biochemistry and Biotechnology, 105(1), 69–85.
- Sigma-Aldrich. "Enzymes for Alternative Energy Research" sigmaaldrich.com. 6 February 2013 <[http://www.sigmaaldrich.com/life-science/metabolomics/enzyme-explorer/analytical-enzymes/enzymes-for-aer.html#cellulase\\_activities](http://www.sigmaaldrich.com/life-science/metabolomics/enzyme-explorer/analytical-enzymes/enzymes-for-aer.html#cellulase_activities)>
- Soni, B., Das, K. and Ghose, T. (1982) Bioconversion of Agro-Wastes Into Acetone Butanol. Biotechnology Letters, 4, 19–22.
- Sulzenbacher, G., Shareck, F., Morosoli, R., Dupont, C. and Davies, G. J. (1997) The Streptomyces lividans Family 12 Endoglucanase: Construction of the Catalytic Core, Expression, and X-ray Structure at 1.75 Å Resolution. Biochemistry, 36(51), 16032–16039.
- Sun, Z. and Liu, S. (2010) Production of n-butanol from concentrated sugar maple hemicellulosic hydrolysate by Clostridia acetobutylicum ATCC824. Biomass and Bioenergy, 39, 39–47.
- Um, B. and Karim, M. (2003) Effect of sulfuric and phosphoric acid pretreatments on enzymatic hydrolysis of corn stover. Applied Biochemistry and Biotechnology, 105, 115–125.
- Vázquez, M., Oliva, M., Téllez-Luis, S.J. and Ramírez, J.A. (2007) Hydrolysis of sorghum straw using phosphoric acid: Evaluation of furfural production.

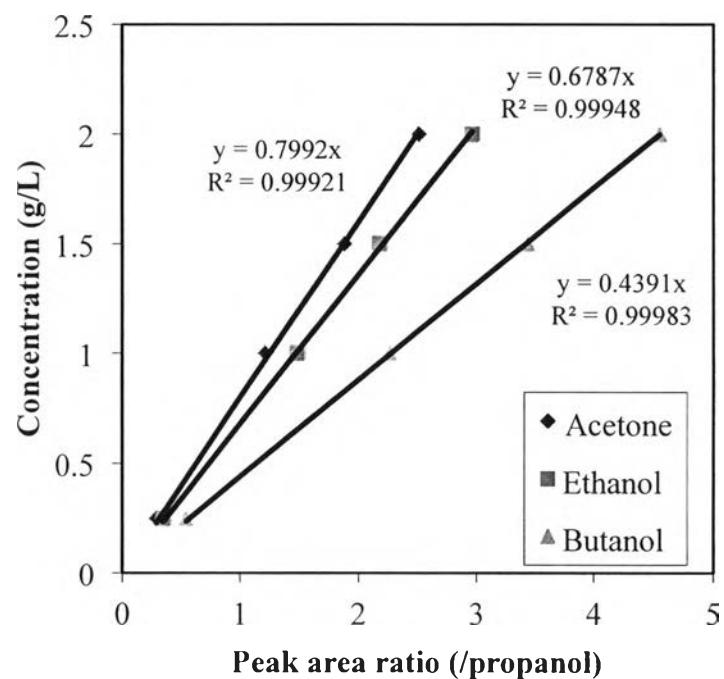
- Bioresource Technology, 98(16), 3053–3060.
- Wang, Z., Keshwani, D.R., Redding, A.P. and Cheng, J.J. (2010) Sodium hydroxide pretreatment and enzymatic hydrolysis of coastal Bermuda grass, *Bioresource Technology*, 101(10), 3583–3585.
- Weil, J.R., Dien, B., Bothast, R., Hendrickson, R., Mosier, N.S. and Ladisch, M. R. (2002) Removal of Fermentation Inhibitors Formed during Pretreatment of Biomass by Polymeric Adsorbents. *Industrial & Engineering Chemistry Research*, 41(24), 6132–6138.
- Zhang, R., Lu, X., Sun, Y., Wang, X. and Zhang, S. (2011) Modeling and optimization of dilute nitric acid hydrolysis on corn stover. *Journal of Chemical Technology and Biotechnology*, 86(2), 306–314.
- Zheng, Y. and Pan, Z. (2009) Overview of biomass pretreatment for cellulosic ethanol production. *International Journal of Agricultural and Biological Engineering*, 2(3), 51–67.

## APPENDIX

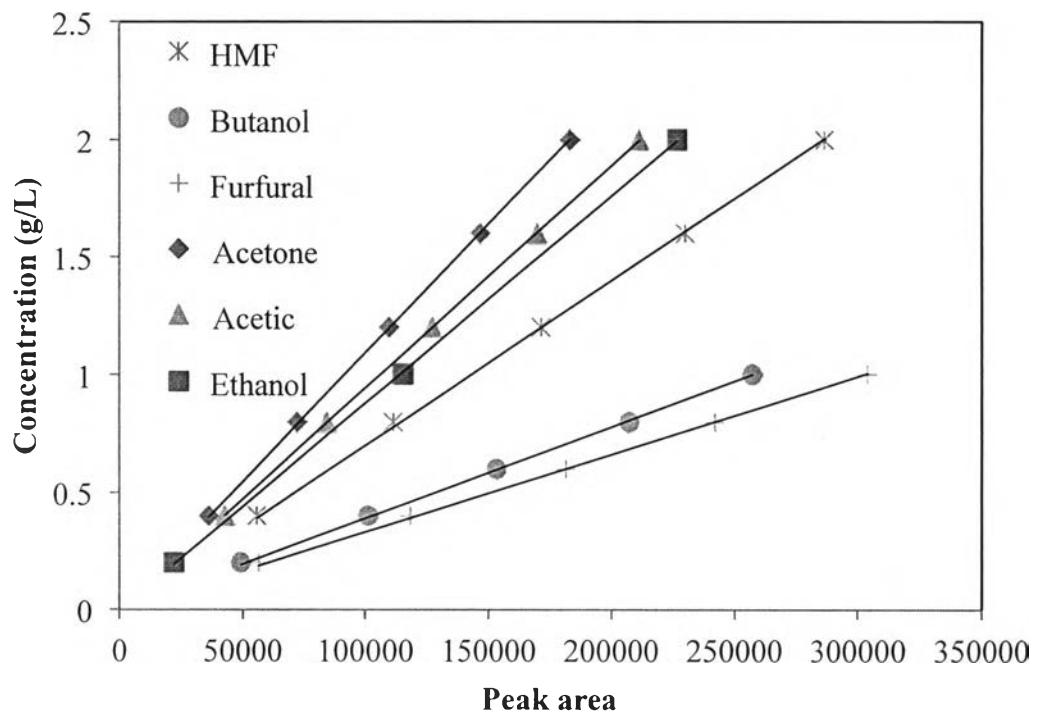
### Standard curve of chemical analysis



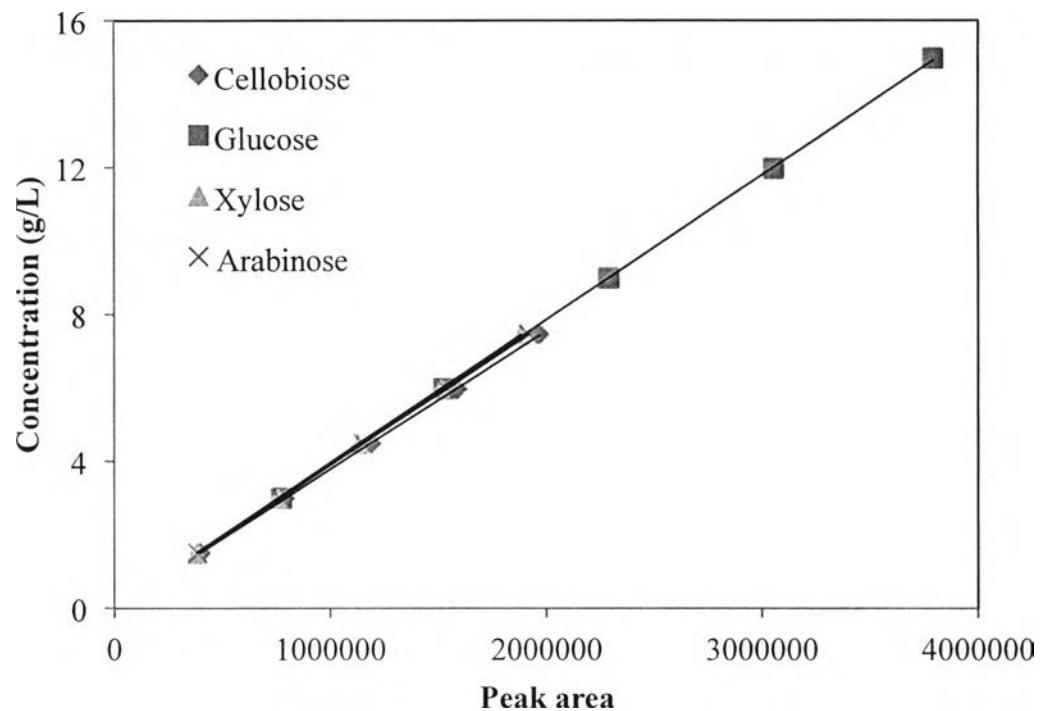
**Figure A1** Standard curve of glucose assay



**Figure A2** Standard curve of acetone, butanol, and ethanol from INNOWAX GC column



**Figure A3** Standard curve of acetone, butanol, ethanol, acetic acid, furfural, and HMF from HPX87H HPLC column



**Figure A4** Standard curve of glucose, xylose, arabinose, and cellobiose from HPX87H HPLC column

## CURRICULUM VITAE

**Name:** Mr. Akarin Boonsombuti

**Date of Birth:** July 29, 1984

**Nationality:** Thai

**University Education:**

2004–2007 Bachelor Degree of Science (Physics), Faculty of Science,  
Kasetsart University, Bangkok, Thailand

**Publications:**

1. Boonsombuti, A.; Luengnaruemitchai, A.; Wongkasemjit, S. (2013) Enhancement of enzymatic hydrolysis of corncob by microwave-assisted alkali pretreatment and its effect in morphology. *Cellulose*, in press.
2. Boonsombuti, A.; Komolpis, K.; Luengnaruemitchai, A.; Wongkasemjit, S. (2013) Enhancement of ABE fermentation through regulation of ammonium acetate and D-xylose uptake from acid pretreated corncobs. *Annals of Microbiology*, in press.
3. Boonsombuti, A.; Komolpis, K.; Luengnaruemitchai, A.; Wongkasemjit, S. Sulfuric pretreatment of corncob for batch fermentation of butanol production by *Clostridium beijerinckii* TISTR1461, being prepared.
4. Boonsombuti, A.; Luengnaruemitchai, A.; Wongkasemjit, S. Effect of Acid Pretreatment of Corncobs to the Fermentability of *C. beijerinckii* TISTR 1461 for Biobutanol Production, being prepared.

**Proceedings:**

1. Boonsombuti, A.; Luengnaruemitchai (2011, October 10-14) Optimized condition for biobutanol production from acid pretreated corncobs using *C. beijerinckii*. *Proceeding of the ISAF XIX 2011 (19th International Symposium on Alcohol Fuels)*, Verona, Italy.

**Presentations:**

1. Boonsombuti, A.; Luengnaruemitchai (2010, June 27-July 2) The comparative study of glucose consumption between *C. acetobutylicum* and *C. beijerinckii*. Paper presented at Renewable energy 2010 join with the 4th International solar energy society conference asia pacific region, Yokohama, Japan.