REFERENCES

Agblevor, F.A., Fu, J., Hames, B., and McMillan, J.D. (2004). Identification of Microbial Inhibitory Functional Groups in Corn Stover Hydrolysate by Carbon-13 Nuclear Magnetic Resonance Spectroscopy. Applied Biochemistry and Biotechnology, 119, 97–120.

Amrita, R., and Moholkar V.S. (2009). Biobutanol: a Viable Gasoline Susbstitute through ABE Fermentation. Accessed on 8 May 2012, <http://www.waset.org/pwaset/v39/9979.pdf>

Balat, M. (2011). Production of bioethanol from lignocellulosic materials via the biochemical pathway: A review. Energy Conversion and Management, 52, 858–875.

Baboukani, B.S., Vossoughi, M., Alemzadeh, I. (2012). Optimisation of dilute-acid pretreatment conditions for enhancement sugar recovery and enzymatic hydrolysis of wheat straw. Biosystems Engineering, 3, 166–174.

Bezerra, M.A., Santelli, R.E., Oliveira, E.P., Villar, L.S., and Escaleira, L.A. (2008). Response surface methodology (RSM) as a tool for optimization in analytical chemistry. Talanta, 76, 965–977.

Boonsombuti, A., Komolpis, K., Luengnaruemitchai, A., and Wongkasemjit, S. The enhancement of ABE fermentation through the regulation of ammonium acetate and D-xylose uptake from acid pretreated corncobs. (Unpublished data).

Chandel, A.K., Singh, O.V., Chandrasekhar, G., Rao, L.V., and Narasu, M.L. (2011). Bioconversion of novel substrate, *Saccharum spontaneum*, a weedy material into ethanol by *Pichia stipitis* NCIM3498. Bioresource Technology, 102, 1709–1714.

Chen, M., Xia, L., and Xue, P. (2007). Enzymatic hydrolysis of corncob and ethanol production from cellulosic hydrolysate. International Biodeterioration and Biodegradation, 59, 85–89.

Dien, B.S., Cotta, M.A., and Jeffries, T.W. (2003). Bacteria engineered for fuel ethanol production: current status. Applied Microbiology and Biotechnology, 63, 258–266.

Duff, S.J.B., and Murray, W.D. (1996). Bioconversion of forest products industry waste cellulosics to fuel ethanol: a review. Bioresource Technology, 55, 1–33.

Ezeji, T., Qureshi, N., and Blaschek, H.P. (2007). Butanol Production From Agricultural Residues: Impact of Degradation Products on Clostridium beijerinckii Growth and Butanol Fermentation. Biotechnology and Bioengineering, 97, 1460–1469.

Esteghlalian, A., Hashimoto, A.G., Fenske, J.J., and Penner, M.H. (1997). Modeling and optimization of the dilute-sulfuric-acid pretreatment of corn stover, poplar and switchhgrass. Bioresource Technology, 59, 129–136.

French, A.D. and Cintrón M.S. (2013). Cellulose polymorphy, crystallite size, and the Segal Crystallinity Index. Cellulose, 20, 583–588.

Gabhane, J.D., William Prince, S.P.M., Vaidya, A.N., Mahapatra, C.T. (2011). Influence of heating source on the efficacy of lignocellulosic pretreatment-A cellulosic ethanol perspective. Biomass and Bioenergy, 35, 96–102.

García, V., Päkkilä, J., Ojamob, H., Muurinena, E., and Keiskia, R.L. (2011). Challenges in biobutanol production: How to improve the efficiency? Renewable and Sustainable Energy Reviews, 15, 964–980.

Gámez, S., González-Cabriales, J.J., Ramírez, J.A., Garrote, G., and Vázquez, M. (2006). Study of the hydrolysis of sugar cane bagasse using phosphoric acid, Journal of Food Engineering, 74 , 78–88.

Gómez, S.M.R., Andrade, R.R., Santander, C.G., Costa, A.C., and Maciel, F.R. (2010). Pretreatment of sugar cane bagasse with phosphoric and sulfuric diluted acid for fermentable sugars production by enzymatic hydrolysis. Chemical Engineering Transaction, 20, 321–326.

Gregg, D.J., and Saddler, J.N. (1996). Factors affecting cellulose hydrolysis and the potential of enzyme recycle to enhance the efficiency of an integrated wood to ethanol process. Biotechnology and Bioengineering, 51, 375–83.

Haaland, P.D. (1989). Separating signals from the noise. Experimental design in biotechnology, New York, Marcel Dekker 61–83.

Huang, L.P., Jin, B., Lant, P., and Zhou, J. (2005). Simultaneous saccharification and fermentation of potato starch wastewater to lactic acid by Rhizopus oryzae and Rhizopus arrhizus. Biochemical Engineering Journal, 23, 265–276.

Jeevan, P., Nelson, R., and Rena E.A. (2011). Optimization studies on acid hydrolysis of Corn cob hemicellulosic hydrolysate for Microbial production of xylitol. Journal of Microbiology and Biotechnology Research, 1, 114–123.

Jeffries, T.W., and Jin, Y.S. (2000). Ethanol and thermotolerance in the bioconversion of xylose by yeasts. Advances in Applied Microbiology, 47, 221–68.

Joglekar, A.M. and May A.T. (1987). Product excellence through design of experiments. Cereal Food World, 32, 857–868.

Jones, D.T., and Woods, D.R. (1986). Acetone–butanol fermentation revisited. Microbiological Reviews, 50, 484–524.

Kaliyan, N., and Morey, R.V. (2010). Densification characteristics of corn cobs. Fuel Processing Technology, 91, 559–565.

Keshwani, D.R., and Cheng, J.J. (2009). Switchgrass for bioethanol and other value-added applications: a review. Bioresource Technology, 100, 1515–1523.

Khuri, A.I. (2001). An overview of the use of generalized linear models in response surface methodology. Nonlinear Analysis, 47. 2023–2034.

Kim, S.B., Lee, S.J., Jang, E.J., Han, S.O., Park, C., Kim, S.W. (2012). Sugar recovery from rice straw by dilute acid pretreatment. Journal of Industrial and Engineering Chemistry, 18, 183–187.

Kim, T.H., Kim, J.S., Sunwoo, C., and Lee, Y.Y. (2003). Pretreatment of corn stover by aqueous ammonia. Bioresource Technology, 90, 39–47.

Kumar, R., Mago, G., Balan V., and Wymand, C.E. (2009). Physical and chemical characterizations of corn stover and poplar solids resulting from leading pretreatment technologies. Bioresource Technology, 100, 3948–3962.

Larsson, S., Quintana-Sainz, A., Reimann, A., Nilvebrant, N.O., and Jonsson, L.J. (1999). Comparison of different methods for the detoxification of lignocellulose hydrolysates of spruce. Applied Biochemistry and Biotechnology, 77, 91–103.

Lee, S.Y., Park, J.H., Jang, S.H., Nielsen, L.K., Kim, J., and Jung, K.S. (2008). Fermentative Butanol Production by Clostridia. Biotechnology and Bioengineering, 101, 209–228.

Martinez, A., Rodriguez, M.E., York, S.W., Preston, J.F., and Ingram, L.O. (2000). Effects of $Ca(OH)_2$ treatments ("overliming") on the composition and toxicity of bagasse hemicellulose hydrolysates. Biotechnology and Bioengineering, 69, 526–536.

Maddox, I.S., Steiner, E., Hirsch, S., Wessner, S., Gutierrez, N.A., Gapes, J.R., and 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.

McMillan, J.D. (1994). Pretreatment of lignocellulosic biomass. In: Himmel, M.E., Baker, J.O., Overend, R.P. (Eds.), Enzymatic Conversion of Biomass for Fuels Production, American Chemical Society, 292–324.

Mcwell, B., and Kristiansen, B. (1985). Effect of temperature upon growth rate and solvent production in batch of *Clostridium Acetobuttlicum*. Biotechnology Letters, 7, 499–502.

Menon, V., and Rao, M. (2012). Trends in bioconversion of lignocellulose: Biofuels, platform chemicals & biorefinery concept. Progress in Energy and Combustion Science, 38, 522–550.

Mercier, L., Pinnavaia, T.J. (1997). Access in mesoporous materials: advantages of a uniform pore structure in the design of a heavy metal ion adsorbent for environmental remediation. Advanced Materials, 9, 500–503.

Mohagheghi, A., Ruth, M., and Schell D.J. (2006). Conditioning hemicelluloses hydrolysates for fermentation: Effects of overliming pH on sugar and ethanol yields. Process Biochemistry, 41, 1806–1811.

Mussatto, S.I. and Teixeira, J.A. (2010). Lignocellulose as raw material in fermentation processes. Communicating Current Research, Technology abd Education Topics in Applied Microbiology and Microbial. Biotechnology, 2, 897–907.

Napoli, F. (2012). Development of an integrated process for butanol production. Accessed on 8 May 2012

< http://www.fedoa.unina.it/4273/1/Fabio_Napoli.pdf >

Olofsson, K., Bertilsson, M., and Lidén, G. (2008). A short review on SSF – an interesting process option for ethanol production from lignocellulosic feedstocks. Accessed on 10 September 2012, < http://www.biomedcentral.com/content/pdf/1754-6834-1-7.pdf>

Palmqvist, E., Almeida, J., and Hahn-Hägerdal, B. (1999). Main and interaction effects of acetic acid, furfural, and p-hydroxybenzoic acid on growth and ethanol productivity of yeasts. Biotechnology and Bioengineering, 63, 46–55.

Palmqvist, E., and Hahn-Hägerdal, B. (2000). Fermentation of lignocellulosic hydrolysates. I: inhibition and detoxification. Bioresource Technology, 74, 17–24.

Pan, X., Gilkes, N., and Saddler, J.N. (2006). Effect of acetyl groups on enzymatic hydrolysis of cellulosic substrates. Holzforschung, 60, 398–401.

Patakova, P., Maxa, D., Rychtera, M., Linhova, M., Fribert, P., Muzikova, Z., Lipovsky, J., Paulova, L., Pospisil, M., Sebor, G., and Melzoch, K. (2011). Perspectives of Biobutanol Production and Use. Biofuel's Engineering Process Technology, Marco Aurélio dos Santos Bernardes (Ed.), ISBN: 978-953-307-480-1, InTech, Accessed on 8 May 2012, <http://www.intechopen.com/books/biofuel-s-engineering-process-technology/perspectives-of-biobutanol-production-and-use>

Purwadi, R., Niklasson, C., and Taherzadeh, M.J. (2004). Kinetic study of detoxification of dilute-acid hydrolyzates by $Ca(OH)_2$. Journal of Biotechnology, 114, 187–198.

Qureshi, N., and Blaschek, H.P. (1999). Butanol recovery from model solution/fermentation broth by pervaporation: evaluation of membrane performance. Biomass and Bioenergy, 17, 175–184.

Qureshi, N., Saha, B.C., Dien, B., Hector, R.E., Hughes, S.R., and Cotta, M.A. (2008). Butanol production from wheat straw by simultaneous saccharification and fermentation using Clostridium beijerinckii: Part I-Batch fermentation. Biomass and Bioenergy, 32, 168–175.

Qureshi, N., Saha, B.C., and Cotta, M.A. (2008). Butanol production from wheat straw by simultaneous saccharification and fermentation using Clostridium beijerinckii: Part II-Fed-batch fermentation. Biomass and Bioenergy, 32, 176–183.

Qureshi, N., Saha, B.C., Dien, B., Hector, R.E., and Cotta, M.A. (2010). Production of butanol (a biofuel) from agricultural residues: Part I-Use of barley straw hydrolysate. Biomass and Bioenergy, 34, 559–565.

Ranatunga, T.D., Jervis, J., Helm, R.F., McMillan, J.D., and Wooley, R.J. (2000). The effect of overliming on the toxicity of dilute acid pretreated lignocellulosics: the role of inorganics, uronic acids and ether-soluble organics. Enzyme and Microbial Technology, 27, 240–247.

Redding, A.T., Wang, Z.Y., Keshwani, D.P., Cheng, J. (2011). High temperature dilute acid pretreatment of coastal Bermuda grass for enzymatic hydrolysis. Bioresource Technology, 102, 1415-1424.

Rezaei, F., Richard, T.L., and Logan, B.E. (2008). Enzymatic hydrolysis of cellulose coupled with electricity generation in a microbial fuel cell. Biotechnology and Bioengineering, 101, 1163–1169.

Romero, I., Moya, M., Sanchez, S., Ruiz, E., Castro, E., and Bravo, V. (2007). Ethanolic fermentation of phosphoric acid hydrolysates from olive tree pruning, Industrial Crops and Products, 25, 160–168.

Satimanont, S., (2012). Dilute Phosphoric Acid Pretreatment of CornCob for Biofuels Production, M.S. Thesis, The Petroleum and Petrochemical College, Chulalongkorn University.

Horváth, S.I., Sjöde, A., Alriksson, B., Jönsson, L.J., and Nilvebrant, N.-O. (2005), Critical conditions for improved fermentability during overliming of acid hydrolysates from spruce. Applied Biochemistry and Biotechnology, 124, 1031–1044.

Schell, D.J., Ruth, M.F., and Tucker, M.P. (1998). Modeling the enzymatic hydrolysis of dilute acid pretreated douglas Fir. In: 20th Symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, May 3-7; 1998.

Segal, L., Creely, J.J., Martin, A.E., and Conrad C.M. (1959). An empirical method for estimating the degree of crystallinity of native cellulose using the X-Ray diffractometer. Textile Research Journal, 29(10), 786–794.

Sun, Y., and Cheng, J., (2002). Hydrolysis of lignocellulosic materials for ethanol production: A review. Bioresource Technology, 83, 1–11.

Tangmanasakul, K., (2011). Combined Acid Pretreatment and Enzymatic Hydrolysis of Corn Cobs, M.S. Thesis, The Petroleum and Petrochemical College, Chulalongkorn University.

Voget, C.E., Mignone C.F., and Ertola R.J. (1985). Influence of temperature on solvents product from whey. Biotechnology Letters, 7, 607–610.

Wang, Y., and Blaschek, H.P. (2011). Optimization of butanol production from tropical maize stalk juice by fermentation with *Clostridium beijerinckii* NCIMB 8052. Bioresource Technology, 102, 9985–9990.

Yoshida, M., Liu, Y., Uchida, S., Kawarada, K., Ukagami, Y., Ivhinose, H., Kaneko, S., and Fukuda, K. (2008). Effect of cellulose crystallinity, hemicelluloses, and lignin on the enzymatic hydrolysis of miscanthus sinensis to monosaccharides. Bioscience, Biotechnology, and Biochemistry, 72, 805–810.

Yu, Y., Lou, X., and Wu, H. (2008). Some recent advances in hydrolysis of biomass in hotcompressed water and its comparisons with other hydrolysis methods. Energy and Fuels, 22, 46–60.

Zheng, Y., Pan, Z., and Zhang, R. (2009). Overview of biomass pretreatment for cellulosic ethanol production. Accessed on 1 May 2012 <www.ijabe.org/index.php/ijabe/article/viewFile/168/83>

Zhou, J., Wang, Y.H., Chu, J., Zhuang, Y.P., Zhang, S.L., and Yin, P. (2008). Identification and purification of the main components of cellulases from a mutant strain of Trichoderma viride T 100-14. Bioresource Technology, 99, 6826–6833.

APPENDICES

Appendix A Stainless Steel Reactor

The reactor is an acid resistant stainless steel which can resist the acid corrosion. Moreover, this reactor has performance to operate under high temperature and pressure. The total volume of reactor 1 L. The reactor system was combined with a temperature control, coil heater with ceramic plate, pressure gauge, pressure release valve and, mechanic agitation to create homogeneous system. The figure of stainless steel reactor and its system is shown in Figure A1.

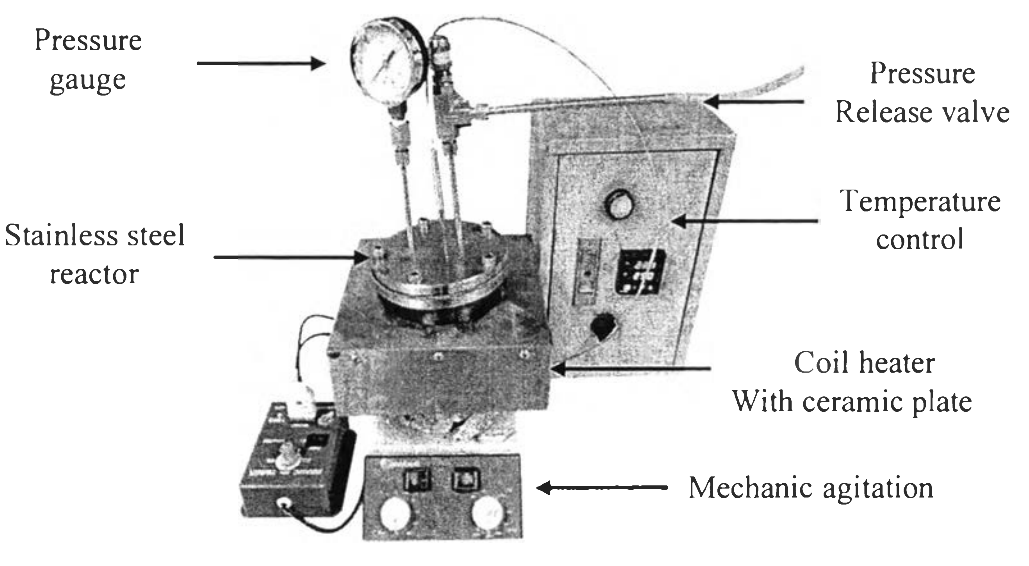

Figure A1 Stainless steel reactor.

Appendix B Retention Time and Calibration Curve of Monomeric Sugar and Furfural by HPLC

The quantity of monomeric sugars yield and furfural in fermentable sugars which got from pretreatment and enzymatic hydrolysis process were determined by HPLC equipped with a refractive index detector (Series 200 LC/S/N291N5060508, Perkin Elmer) using an Aminex-HPX 87H column (300 mm x78 mm, Bio-Rad Lab, USA) and a guard column (30 mm x 4.6 mm, Bio-Rad Lab, USA) under these following conditions: flow rate 0.60 ml/min, mobile phase 0.005 M of H_2SO_4 and column temperature was fixed at 60 °C.The retention times of monomeric sugar in both fermentable sugars are shown in Table B1. It showed that there are 3 monomeric sugars, which are glucose, xylose, arabinose, and one inhibitor compound. In order to determine the quantity of monomeric sugar, calibration curve of each monomeric sugar is necessary. Figure B1 shows the calibration curve of monomeric sugar and furfural.

Table B1 Retention time of monomeric sugar

Monomeric sugar	Retention time (min)
Glucose	9.30
Xylose	9.93
Arabinose	10.84
Mannose	N/A
Galactose	N/A
Acetic acid	15.11
Butyric acid	21.15
Furfural	52.35

N/A; Not Available

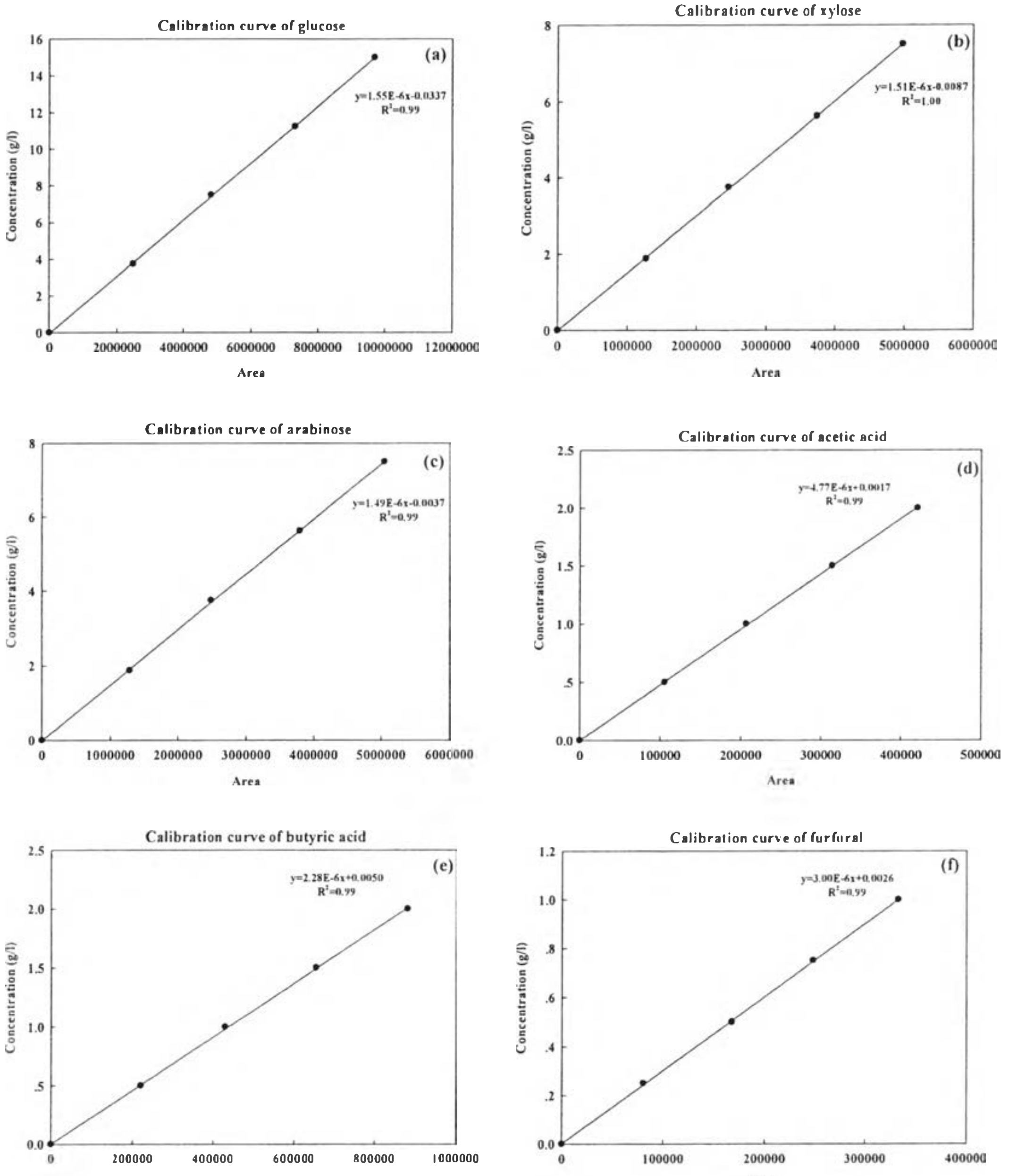

Figure B1 Calibration curve of monomeric sugar and furfural in fermentable sugars. Symbols; (a) calibration curve of glucose, (b) calibration curve of xylose, (c) calibration curve of arabinose, (d) calibration curve of acetic acid, (e) calibration curve of butyric acid, and (f) calibration curve of furfural.

Appendix C Retention Time and Calibration Curve of Acetone-Butanol-Ethanol by GC

During the simultaneous saccharification and fermentation step, monomeric sugars were fermented to acetone-butanol-ethanol by *Clostridium Beijerinckii* TISTR1461 for an optimal time and the acetone-butanol-ethanol yield was detected by Gas Chromatrography at the petroleum and petrochemical college, Chulalongkorn University. In order to determine the quantity of acetone-butanol-ethanol in product, the calibrational curve of acetone-butanol-ethanol is required. Figure C1 shows the calibration curve of standard acetone-butanol-ethanol under various concentrations in the range 0.5 g/l to 2 g/l using propanol as an internal standard.

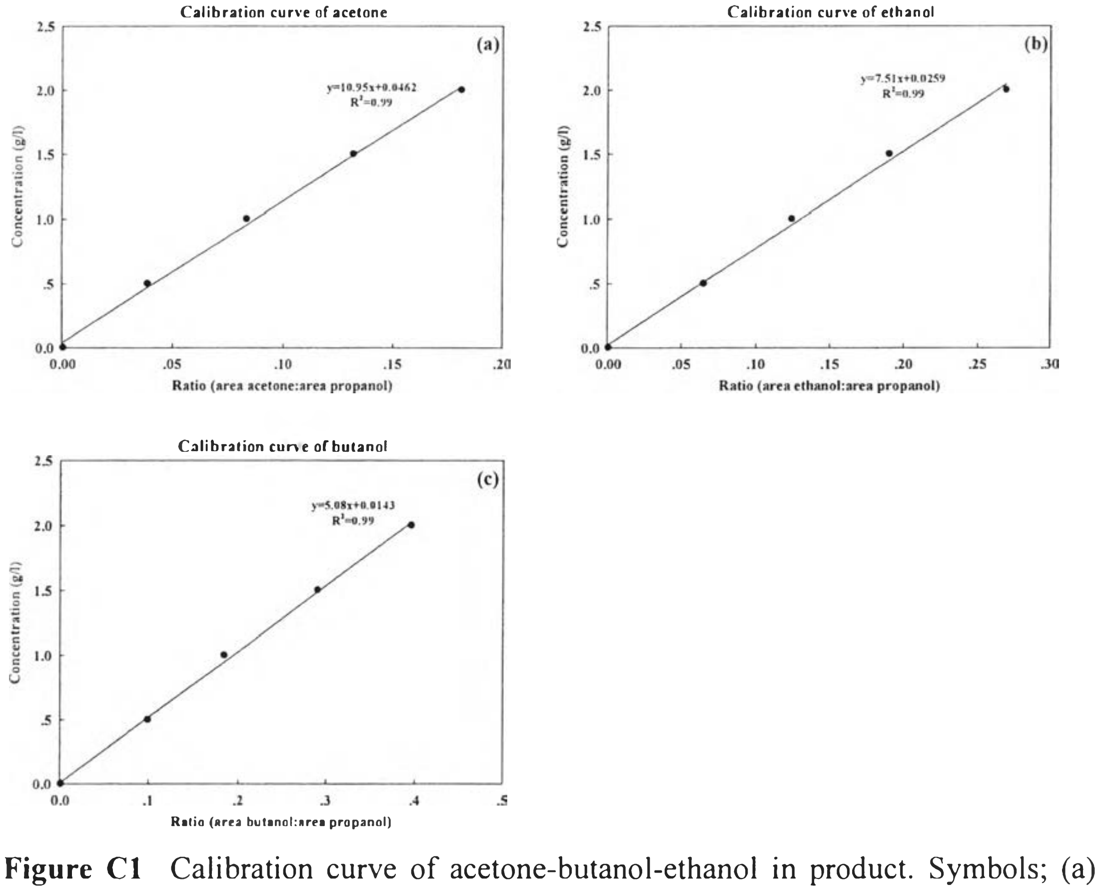

Figure C1 Calibration curve of acetone-butanol-ethanol in product. Symbols; (a) calibration curve of acetone, (b) calibration curve of ethanol, and (c) calibration curve of butanol.

Appendix D Citrate-Phosphate Buffer

Citrate-Phosphate Buffer; pH range 2.6 to 7.0

(a) 0.1 M Citric acid; 19.21 g/l (M.W. 192.1)

(b) 0.2 M Dibasic sodium phosphate; 35.6 g/l (dihydrate; M.W. 178.0) or 53.6 g/l (heptahydrate; M.W. 268.0)

Mix citric acid and sodium phosphate solutions in the proportions indicated and adjust the final volume to 100 ml with deionized water. Adjust the final pH using a sensitive pH meter.

Table D1 Citrate-Phosphate Buffer

0.2 M Na_2HPO_4 (ml)	0.1 M citrate (ml)	pH
14.1	35.9	3.4
16.1	33.9	3.6
17.7	32.3	3.8
19.3	30.7	4.0
20.6	29.4	4.2
22.2	27.8	4.4
23.3	26.7	4.6
24.8	25.2	4.8
25.7	24.3	5.0
26.7	23.3	5.2
27.8	22.2	5.4
29.0	21.0	5.6
30.3	19.7	5.8
32.1	17.9	6.0
33.1	16.9	6.2
34.6	15.4	6.4
36.4	13.6	6.6
40.9	9.1	6.8
43.6	6.5	7.0

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Proceedings

1. Nantapipat, J., Luengnaruemitchai, A., and Wongkasemjit, S. (2013, April 23) Butanol Production from Corncobs by Simultaneous Saccharification and Fermentation (SSF). Proceedings of The 4nd Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 19th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.
2. Nantapipat, J., Luengnaruemitchai, A., and Wongkasemjit, S. (2013, April 29-30) A Comparison of Dilute Sulfuric and Phosphoric Acid Pretreatments in Biofuel Production from Corncobs. International Conference on Chemical, Biological and Environmental Engineering (ICCBE 2013), Paris, France.