

BAB VI

PENUTUP

6.1. Kesimpulan

1. Konsentrasi isomalt berpengaruh nyata sedangkan lama penyimpanan dan interaksi diantara kedua faktor tersebut tidak berpengaruh nyata terhadap viabilitas sel *Lactobacillus acidophilus* FNCC 0051 terimobil.
2. Lama penyimpanan berpengaruh nyata tetapi konsentrasi isomalt dan interaksi antara kedua faktor tidak berpengaruh nyata terhadap diameter *beads* yang terbentuk.
3. Konsentrasi isomalt tidak berpengaruh nyata terhadap *hardness* dan *cohesiveness* tetapi berpengaruh nyata terhadap *springiness beads* yang terbentuk.
4. Nilai ALT sel terimobil yang dihasilkan pada perlakuan lama penyimpanan hari ke-0 berkisar antara $9,0414\text{-}9,4771 \log \text{cfu/g beads}$ atau $1,1\cdot10^9\text{-}3,0\cdot10^9 \text{ cfu/g beads}$ sedangkan nilai ALT sel terimobil yang dihasilkan pada perlakuan lama penyimpanan hari ke-21 berkisar antara $9,1139\text{-}10,0414 \log \text{cfu/g beads}$ atau $1,3\cdot10^9\text{-}1,1\cdot10^{10} \text{ cfu/g beads}$.
5. Diameter *beads* berkisar antara 3,73 mm – 3,92 mm selama 21 hari penyimpanan.
6. Nilai *hardness*, *springiness*, dan *cohesiveness beads* berturut-turut berkisar antara 109,023 g-246,975 g ; 0,741-1,409 ; 0,499-0,759.

6.2. Saran

Semakin lama penyimpanan pemerangkapan mikroba probiotik semakin turun sehingga mengakibatkan jumlah sel yang lolos ke lingkungan lebih banyak yang diduga dapat menyebabkan perubahan karakteristik dari *carrier* yang dapat mempengaruhi penerimaan konsumen terhadap produk sinbiotik tersebut. Oleh karena itu, perlu dilakukan pengujian karakteristik *carrier* dengan perlakuan konsentrasi isomalt selama penyimpanan dan perlu dilakukan pengujian organoleptik untuk mengetahui tingkat penerimaan konsumen terhadap produk fermentasi dengan metode penjeratan(terimobil).

DAFTAR PUSTAKA

- Adams, C. 2009. *The Promising Potential of Prebiotics and Probiotics : Research Reveals Interesting Applications for Probiotic Bacteria and Their Frequent Partners in Health, Prebiotics.* http://www.nutraceuticalsworld.com/issues/2009-05/view_features/the-promising-potential-of-prebiotics-and-probiotics/ (2 September 2013).
- Aditya, A.M. 2012. *Pengaruh Pemberian Lactobacillus acidophilus terhadap Angka Kuman Usus Halus yang Diinfeksi Shigella dysentriiae.* <http://publikasi.umy.ac.id/index.php/pend-dokter/article/view/3931/3264> (5 September 5 2013).
- Akhiar, N.S.A.M. 2010. Enhancement of Probiotics Survival by Microencapsulation with Alginate and Prebiotics. Michigan. *MMG 445 Basis Biotechnology* 6:13-18.
- Alexandra, Drakoularakou, O. Hasselwander, M. Edinburgh, and A.C. Ouwehand. 2007. Lactitol, an Emerging Prebiotic: Functional Properties with a Focus on Digestive Health. USA. *Food Science and Technology Bulletin : Functional Foods* 3 (7) 73-82.
- Anal, A.K. and H. Singh. 2007. Recent Advances in Microencapsulation of Probiotics for Industrial Applications And Targeted Delivery. *Trends in Food Science and Technology* 18 240-251.
- Ann, E. Y., Kim Y., Oh S., Imm J. Y., Park D. J., Han K. S., Kim S. H. 2007. Microencapsulation of *Lactobacillus acidophilus* ATCC 43121 with Prebiotic Substrates Using a Hybridisation System. *Int. J. Food Sci Technol.*, 42:411-419.
- Ari, A, R. Muyorini, dan Y. Sri. 2010. Encapsulation of *Lactobacillus casei* Using Extrusion Technique As Starter Culture For Production of Dadih from Cow Milk. *Skripsi*. Bogor : Institut Pertanian Bogor.

- Audet, P., C. Paquin, and C. Lacroix. 1988. Immobilized Growing Lactic Acid Bacteria with K-Carrageenan-Locust Bean Gum Gel. *Appl Microbiol Biotechnol* 29:11-18.
- Badan Standar Nasional. 1998. *SNI Susu UHT* (SNI 01-3950-1998). Jakarta: Dewan Standardisasi Nasional
- Banwart, G. J. 1981. *Basic Food Microbiology*. Abridged Ed. Westport: AVI Publishing Company, Inc.
- Bar, A. 1990. *Factorial Calculation Model for the Estimation of the Physiological Caloric Value of Polyols in Caloric Evaluation of Carbohydrates*. [N Hosoya, editor]. Tokyo: Research Foundation for Sugar Metabolism. pp. 209-257
- Bernardeau, M., J. P. Vernoux, S. H. Dubernet, and M. Gueguen. 2008. Safety Assessment of Dairy Microorganisms: The *Lactobacillus* Genus. *International Journal of Food Microbiology* 126:278-285.
- Binns, N. 2013. *Probiotics, Prebiotics, and The Gut Microbiota*. Belgium: ILSI Europe.
- Bolhuis, G. K., E. G. Rexwinkel, and K. Zuurman. 2009. Polyols as Filler-Binders for Disintegrating Tablets Prepared by Direct Compaction. Netherland, *Drug Dev and Ind Pharm*. 35(6):671-677.
- Bomba, A., R. Nemcova, S. Gancarcikova, R. Herich, P. Guba, D. Mudronova. 2002. Improvement of The Prebiotic Effect of Micoorganism by Their Combination with Metodextrins, Fructooligosaccharides and Polyunsaturated Fatty Acid, *British Journal of Nutrition*. Volume 88 September Supplement 2002.
- Brenntag Food and Nutrition Europe. 2011. *Hydrocolloids*. <http://www.brenntag-specialties-europe.com> (18 Januari 2014).
- Buddington, K. K., J. B. Donahoo, and R. K. Buddington. 2002. Dietary Oligofructose and Inulin Protect Mice from Enteric and Systemic Pathogens and Tumor Inducers, *J. Nutr.* 132:472-477.

- Burgain, J., C. Gaiani., M. Linder., J. Scher. 2011. Encapsulation of Probiotic Living Cells: From Laboratory Scale to Industrial. *Journal of Food Engineering.* 104:467-483.
- Calloway, D. H. & Murphy, E. L. 1968. The Use of Expired Air to Measure Intestinal Gas Formation, *Ann. N. Y. Acad. Sci.* 150:82-95.
- Capela, P., T.K.C. Hay, and N.P. Shah. 2006. Effect of Cryoprotectants, Prebiotics and Microencapsulation on Survival of Probiotic Organisms in Yoghurt and Freeze Dried Yoghurt. *Food Res. Int.* 39(2):203-11.
- Cardenas, A., W. A. Monal, F. M. Goycoolea, I. H. Ciapara, C. Peniche. 2003. Diffusion Through Membranes of The Polyelec-Trolyte Complex of Chitosan and Alginate, *Macromol. Biosci.* 3:535-539.
- Castilla, O.S., C.L. Calleros, H.S.G. Galindo, J.A. Ramrez and E.J.V. Carter. 2010. Textural Properties Alginate-Pectin Beads and Survivability of Entrapped *Lactobacillus Casei* in Simulated Gastrointestinal Conditions and Yoghurt. *Food Res. Int.*, 43: 111-117.
- Champagne, C.P.; N. Morin; R. Couture; C. Gagnon; P. Pelen. and C. Lacroix. 1992. The Potential of Immobilized Cell Technology to Produce Freeze-Dried, Phage-Protected Cultures of *Lactococcus Lactis*. *Food Research International* 25:419-427.
- Chandramouli, V., K. Kailasapathy, P. Peiris, and M. Jones. 2004. An Improved Method of Microencapsulation and Its Evaluation to Protect *Lactobacillus spp.* In Simulated Gastric Condition. *J of Microbiol Methods* 56:27-35.
- Chen, K. N., Chen M.J., Liu J. R., Lin C. W., and Chiu H. Y. 2005. Optimization of Incorporated Prebiotics as Coating Materials for Probiotic Microencapsulation. Taiwan. *J. of Food Sci.* 70(5):261-266.
- Chou, L.Z. and B. Weimer. 1999. Isolation and Characterization of Acid and Bile-Tolerant Isolates From Strains of *Lactobacillus acidophilus*. *J. Dairy Sci.* 82:23-31.

- Christl, S. U., Murgatroyd, P. R., Gibson, G. R. & Cummings, J. H. 1992. Production, Metabolism and Excretion of Hydrogen in The Large Intestine., *Gastroenterology* 102:1269-1277.
- Chukeatirote, E. 2003. Potential Use of Probiotics. *Songklanakarin J. Sci. Tech.* 5(2).
- Claesson, M. J., D. V. Sinderen, and P. W. O'Toole. 2007. The Genus *Lactobacillus*- A Genomic Basis for Understanding Its Diversity. *FEMS Microbiol. Lett.* 269:22-28.
- Collado, M. C., E. Isolauri, S. Salmien, and Y. Sanz. 2009. The Impact of Probiotic on Gut Health. *Curr Drug Metab.* 10(1):68-78.
- Cui, J., E.H. Holmes, T.G. Greene, P.K. Liu. 2000. Oxidative DNA Damage Precedes DNA Fragmentation after Experimental Stroke in Rat Brain. *FASE BJ* 14:955-967.
- Cummings, J. H., Gibson, G. R. & Macfarlane, G. T. 1989. Quantitative Estimate of Fermentation in The Hindgut of Man. *ActaVet. Scand.* 86:76-82.
- Cummings, J. H. & Macfarlane, G. T. 1991. A review: The Control and Consequences of Bacterial Fermentation in The Human Colon. *J. Appl. Bacteriol.* 70: 443-459.
- Cummings J.H., G.T. Macfarlane, H.N. Englyst. 2001. Prebiotic Digestion and Fermentation. *Am. J. Clin. Nutr* 73, 415S–420S.
- Dimantov, A., M. Greenberg, E. Kesselman, and Shimoni. 2003. Study of High Amylase Corn Starch as Food Grade Enteric Coating in A Microcapsule Model Systems. *Innov. Food Sci. Eng. Technol.* 5:93-100.
- Dommels, Y.E.M., R.A. Kemperman, Y.E.M.P. Zebregs, and R.B. Draisma. 2009. Survival of *Lactobacillus reuteri* DSM 17938 and *Lactobacillus rhamnosus* GG in the Human gastrointestinal Tract with

- Daily Consumption of A Low-Fat Probiotic Spread. *Appl. Environ. Microbiol.* 75(19):6198-204.
- Eckles, C.H, W.B Comb and H. Macy. 1951. *Milk and Milk Product*. 4th Edition. New York: Mc Graw-Hill Book Company, Inc.
- Effendi, H. M. S. 2009. *Teknologi Pengolahan dan Pengawetan Pangan*. Bandung: Alfabeta.
- Eikmeier, H., H.J. Rehm. 1987. Stability of Calcium-Alginate During Citric Acid Production of Immobilized *Aspergillus niger*. *Appl Microbiol Biotechnol*. 26:105-111.
- Ellenton, J.C. 1998. *Encapsulation Bifidobacteria*. Master thesis. University of Guelph.
- Evans P.R., C. Piesse C., Y.T. Bak, and J.E. Kellow. 1998. Fructose-Sorbitol Malabsorption and Symptom Provocation in Irritable Bowel Syndrome: Relationship to Enteric Hypersensitivity and Dysmotility. *Scand. J. Gastroenterol* 33: 1158–1163.
- FAO/WHO. 2001. *Joint FAO/WHO Expert Consultation on Evaluation of Health and Nutritional Properties of Probiotics in Food Including Powder Milk with Live Lactic Acid Bacteria*. Amerian Cordoba Park Hotel, Cordoba, Argentina.
- FAO/WHO. 2002. *Joint FAO/WHO Working Group Report on Drafting Guidelines for the Evaluation of Probiotics in Food*. London.
- FAO/WHO. 2007. *FAO Technical Meeting on Prebiotics*. Italy.
- Fardiaz, S. 1989. *Mikrobiologi Pangan: Penuntun Praktek Laboratorium*. Bogor: IPB Jurusan Teknologi Pangan dan Gizi.
- Fernandez, B.F., M. E. Pardo, P. Humbert, R.Leon, J.M. Llovet, and M.A. Gassull. 1991. Role of Fructose-Sorbitol Malabsorption in the Irritable Bowel Syndrome. *Gastroenterology* 101: 1453–1454.
- FMC BioPolymer. 2003. *Alginates*. USA: FMC Corporation.

- Foschino, R., Fiori, E., a Galli, A. 1996. Survival and Residual Activity of *Lactobacillus acidophilus* Frozen Cultures under Different Conditions. *Journal of Dairy Research* 63:295–303.
- Gaman, P. M. and K. B. Sherington. 1992. *Ilmu Pangan: Pengantar Ilmu Pangan, Nutrisi, dan Mikrobiologi*. (Penerjemah: Gardjito, Naruki, Murdiati, dan Sardjono). Yogyakarta: Universitas Gadjah Mada Press.
- Gautier, A., B. Carpentier, M. Dufresne, Q. Vu Dinh, P. Paullier and C. Le gallais. 2011. Impact of Alginate Type and Bead Diameter on Mass Transfers and The Metabolic Activities of Encapsulated C3A Cells in Bioartificial Liver Applications, *European Cells and Materials*. 21:94-106.
- Gee, J.M., D. Cooke, S. Gorick, G.M. Wortley, R.H. Greenwood, A. Zumbe, and I.T. Johnson. 1991. Effectsof Conventional Sucrose-Based, Fructose-Based and Isomalt-Based Chocolates on Post Prandial Metabolism in Non-Insulin Dependent Diabetics. *Eur. J. Clin. Nutr.* 45:561–566.
- Gehring, F. and E.J. Karle. 1981. Sweetening Agent, Palatinit under Specific Consideration as to Microbiological and Caries-Prophylactic Aspects. *Z Ernahrung swiss* 20:96–106.
- Gilliland, S. E. 1989. *Acidophilus* Milk Products: A Review of Potential Benefits to Consumers. *J. Dairy Sci.* 72:2483-2494.
- Gilliland, S. E., and Lara, R. C. 1988. Influence of Storage at Freezing and Subsequent Refrigerator Temperature on b-galactosidase Activity of *Lactobacillus acidophilus*. *Applied Environmental Microbiology* 45(4):898–902.
- Gouin, S. 2004. Microencapsulation-Industrial Appraisal Of Existing Technologies And Trend. *Trends Food Sci Technol.* 15: 330-347.
- Gostner, A., M. Blaut, *et al.* 2006. Effect of Isomalt Consumption on Faecal Microflora and Colonic Metabolism in Healthy Volunteers. *Br. J. Nutr.* 95 (1): 40-50.

- Granato, D., G.F. Branco, A. G. Cruz, J.D.A.F. Faria, and N.P. Shah. 2010. Probiotic Dairy Products as Functional Foods. *Comprehensive Reviews in Food Science and Food Safety* 9: 455–470.
- Haralampu, S.G. 2000. *Resistant Starch-A Review of The Physicalproperties And Biological Impact of RS3. Carbohydrate Polymers.* 41: 285-292.
- Harti,A.S, R.A. Samsumaharto, dan Hosea. 2012. Efek Penambahan Chito-Oligosakarida Sebagai Prebiotik Terhadap Pertumbuhan *Lactobacillus acidophilus* FNCC 0051 Secara *In Vitro*. Surakarta. Jurnal Biomedika Vol. 5(1) : 2302-1306.
- Hartati,S., E. Harmayani, dan E.S. Rahayu. 2002. Perubahan Kimiawi dan Organoleptik Sari Buah Pepaya Nanas yang Disuplementasi *Lactobacilli* Probiotik selama Penyimpanan. Dalam *Seminar Nasional dan Pertemuan Tahunan Perhimpunan Ahli Teknologi Pangan Indonesia (PATPI)*: 263-271.
- Helferich, W and D . Westhoff. 1980 . All Absut Yoghurt Prentice-Hall, Mc. New Jersey : EngelWood-Cliffs.
- Homayouni, A., A. Azizi, M.R. Ehsani, S.H. Razavi, and M.S. Yarmand. 2008. Effect of Microencapsulation and Resistant Starch on The Probiotic Survival And Sensory Properties of Synbiotic Ice Cream. *Food Chemistry* 111 pp. 50-55.
- Hui, Y. H. 1992. *Dairy Science and Technology Handbook volume 1: Principles and Properties*. New York: VCH Publishers, Inc.
- Hutter, R. ,F. Boswart, and K. Irsigler. 1993. Insulin Verbrauch Von Typ-I-Diabetikern nach Oraler Gabe Von Isomalt. *Akt Ernahr* 18:149–154.
- ISAPP. 2009. *Clarification of the Definition of a Probiotic.* <http://www.isapp.net>. (21 Juni 2013).

- Jankowski, T., M. Zielinska, and Wysakowska. 1997. Encapsulation of Lactic and Bacteria with Alginate or Starch Capsules. *Biotechnol Technol.* 11:31-34.
- Kailasapathy, K. 2002. Microencapsulation of Probiotic Bacteria: Technology And Potential Application. *Current Issues in Intestinal Microbiology*, 3: 39-48.
- Kashima, K. and M. Imai. 2012. *Advanced Membrane Material from Marine Biological Polymer and Sensitive Molecular-Size Recognition for Promising Separation Technology*. <http://dx.doi.org/10.5772/50734> (18 Januari 2014).
- Kebary, K.M.K., S.A. Hussein, and R.M. Badawi. 1998. Improving Viability of Bifidobacterium and Their Effect on Frozen Ice Milk. *J. Dairy Sci.* 26: 319-337.
- Khalil, A.H., E.H. Mansour. 1998. Alginate Encapsulated *Bifidobacteria* Survival in Mayonnaise. *J. Food Sci.* 63:702-705.
- Khazaeli, P., A. Pardakhty, and F. Hassanzadeh. 2008. Formulation of Ibuprofen Beads by Ionotropic Gelation. *Iranian Journal of Pharmaceutical Research* 7 (3): 163-170.
- Khoiriyah, L.K. dan Fatchiyah. 2013. Karakter Biokimia dan Profil Protein Yoghurt Kambing PE Difermentasi Bakteri Asam Laktat (BAL). *J. Exp. Life Sci.* Vol. 3(1): 2338-1655.
- Kim, I.K., Y.J. Baek, and Y.H. Yoon. 1996. Effects of Dehydration Media and Immobilization in Calcium-Alginate on The Survival of *Lactobacillus casei* and *Bifidobacterium bifidum*. *Korean J Dairy Sci.* 18: 193-198.
- Kimestri and Asma Bio. 2013. Pengaruh Sukrosa terhadap Jumlah Bakteri dan Karakteristik Kimia pada Whey Kerbau Fermentasi. <http://repository.unhas.ac.id/handle/123456789/4770?show=full> (29 Oktober 2013).

- Kleessen, B., G. Stoof, J. Proll, D. Schmied, J. Noack, and M. Blaut. 1997. Feeding Resistant Starch Affects Fecal and Microflora and Short Chain Fatty Acid in Rats. *J Animal Sci.* 75:2453-2462.
- Klien, J., J. Stock, K.D. Vorlop. 1983. Pore Size and Properties of Spherical Calcium Alginate Biocatalysts. *Eur. J. Appl. Microbiol. Biotechnol.* 18:86-91.
- Klingeberg, Michael, Kozianowski, and Gunhild. 2004. *Use of Isomalt (Mixture of 1,6 gps and 1,1 gpm) as Prebiotic for the Production of a Medicament Used for the Treatment of Intestinal Diseases, Among Other Things.* United States Patent Application Publication US 2006/0147500 A1.
- Klinkenberg, G., K.Q. Lystad, D.W. Levine, and N. Dyrset. 2001. Cell Release from Alginate Immobilized *Lactococcus lactis* ssp. *Lactis* in Chitosan and Alginate Coated Beads. *J. Dairy Sci.* 84:1118-1127.
- Koo S, Cho Y, Huh C, Baek Y, Park J. 2001. Improvement of The Stability of *Lactobacillus casei* YIT 9018 by Microencapsulation Using Alginate and Chitosan. *J Microb Biotech.* 11:376-383.
- Krasaeko W., B. Bhandari, H. Deeth. 2003. Evaluation of Encapsulation Techniques of Probiotics for Yoghurt. *Int. Dairy J.* 13: 3-13.
- Krasaeko W., B. Bhandari, H. Deeth. 2004. The Influence of Coating Materials on Some Properties of Alginate Beads and Survivability of Microencapsulated Probiotic Bacteria. *Int. Dairy J.* 14:737-743.
- Kritchevsky, D. 1995. Epidemiology of Fiber, Resistant Starch and Colorectal Cancer. *Eur J. Cancer Prev.* 4: 345-352.
- Kvam, B. J., H. Grasdalen, O. Smidsrød, and T. Anthonsen. 1986. NMR Studies of The Interaction of Metal Ions with Poly(1,4-hexuronates). VI. Lanthanide(III) Complexes of Sodium (Methyl alpha-D-galactopyranosid) uronate and Sodium (Phenylmethyl alpha-D-galactopyranosid) uronate, *Acta Chemica Scandinavica*, B40:735-739.

- Langkilde, A.M., H. Andersson, T.F. Schweizer, and P. Wursch. 1994. Digestion and Absorption of Sorbitol, Maltitol and isomalt from The Small Bowel. A Study In Ileostomy Subjects. *Eur. J. Clin. Nutr.* 48:768–775.
- Larisch, B.C., D. Poncelet, C.P. Champagne, and R.J. Neufeld. 1994. Microencapsulation of *Lactococcus lactis* subsp. Creamoris. *J Microencap.* 11: 189-195.
- Le Blay, G., C. Michel, H.M. Blottiere, and C. Cherbut. 1999. Enhancment of Butyrate Production in The Rat Caecocolonic Tract by Long-Term Ingestion O Resistant Potato Starch. *Brit. J. Nut.* 82:419-426.
- Levitt, M. D., Gibson, G. R. & Christi, S. U. 1995. *Gas Metabolism in The Colon*. In: *Human Colonie Bacteria. Role in Physiology, Pathology and Nutrition* (Gibson, G. R. & Macfarlane, G. T., eds.). Boca Raton, FL: CRC Press.
- Lisal, J.S. 2005. Konsep Probiotik dan Prebiotik untuk Modulasi Mikrobiota Usus Besar. *Medical Nusantara* 26 : 256-262.
- Lee, K.I. and T.R. Heo T.R. 2000. Survival of *Bifudobacterium Longum* Immobilized in Calcium Alginate Beads in Simulated Gastric Juices and Bile Salt Solution. *Appl. Environ. Microbiol.* 66: 869-973.
- Livesey, G., 2003. Health Potential of Polyols as Sugar Replacers, with Emphasis on Low Glycaemic Properties. *Nutrition Research Reviews* 16:163-191.
- Lupton, J.R. 2004. Microbial Degradation Products Influence Colon Cancer Risk: The Butyrate Controversy, *J. Nutr.* 134:479–482.
- Macfarlane, G.T., J.H. Gummings. 1991. The Colonic Flora, Fermentation and Large Bowel Digestive Function. In SF Phillips, JH Pemberton And RG Shorter (Eds.). *The Large Intestine: Physiology, Pathophysiology and Disease*. New York: Raven Press.

- Macfarlane G., Steed H., Macfarlane S. 2008. Bacterial Metabolism and Health Related Effects of Galactooligosaccharides and Other Prebiotics. *J. Appl. Microbiol.* 104: 305–344.
- Maduningsih, G.L. 2008. Stabilitas Bakteri Probiotik *Lactobacillus acidophilus* dan *Bifidobacterium longum* dalam Yogurt Susu Kambing di dalam Saluran Pencernaan Tikus. [*Skripsi*]. Program Studi Teknologi Hasil Ternak, Fakultas Peternakan, Institut Pertanian Bogor. Bogor.
- Makarova, K., A. Slesarev, Y. Wolf, A. Sorokin, B. Mirkin, E. Koonin, A. Pavlov, N. Pavlova, V. Karamychev, N. Polouchine, V. Shakhova, I. Grigoriev, Y. Lou, D. Rohksar, S. Lucas, K. Huang, D. M. Goodstein, T. Hawkins, V. Plengvidhya, D. Welker, J. Hughes, Y. Goh, A. Benson, K. Baldwin, J.-H. Lee, I. Díaz-Muñiz, B. Dosti, V. Smeianov, W. Wechter, R. Barabote, G. Lorca, E. Altermann, R. Barrangou, B. Ganesan, Y. Xie, H. Rawsthorne, D. Tamir, C. Parker, F. Breidt, J. Broadbent, R. Hutzins, D. O'Sullivan, J. Steele, G. Unlu, M. Saier, T. Klaenhammer, P. Richardson, S. Kozyavkin, B. Weimer, and D. Mills. 2006. Comparative Genomics of The Lactic Acid Bacteria. *Proc. Natl. Acad. Sci. USA.* 103(42): 15611–15616.
- Mandal, S., Puniya, A.K. and Singh, K. 2006. Effect of alginate concentration on survival of encapsulated *Lactobacillus casei* NCDC-298. *International Dairy Journal* 16: 1190-1195.
- Martinsen, A., C. Skjak-Braek, and Smidsrod. 1989. Alginate as Immobilization Material: 1. Correlation Between Chemical And Physical Properties of Alginate Gel Beads. *Biotechnol Bioeng.* 33:79-89.
- Marx, J.L. 1989. *A revolution in Biotechnology*. Cambridge: Cambridge University.
- Masuda, H. 1988. *Superabsorbent Polymers, 1st Ed.* Tokyo: Kyoritsu Publishing Co.

- Mc. Neely, W. H. and D. J. Petitt. 1973. *Algin Industrial Gum Polysaccharides and Their Derriavatives*. New York: Academic Press.
- Meydani, S.N. and W.K. Ha. 2000. Immunologic Effects of Yoghurt. *Am. J. Clin. Nutr.* 71(4):861-72.
- Mitchell, H. 2006. *Sweeteners and Sugar Alternatives in Food Technology*. UK: Blackwell Publishing Ltd.
- Mock, E., A. Lyman-Holt, S. Rochefort. 2012. *The Gel Bead Process: A Journey to Jell-O Land*. http://engineering.oregonstate.edu/momentumbk12/feb05/M!_GelBeads_final021405.pdf (16 Januari 2014).
- Mohammadi, N., h. Ahari, M. Fahimdanesh, M.A.K. Zanjani, A.A. Anvar, and E. Shokri. 2013. Survival of Alginate-Prebiotic Microencapsulated *Lactobacillus acidophilus* in Mayonnaise Sauce. Iran. *Iranian Journal of Veterinary Medicine* 6(4):259-264.
- Monedero V., G. P. Martines, and M. Yebra. 2010. Perspectives of Engineering Lactic Acid Bacteria for Biotechnological Polyol Production. *Appl. Microbiol. Biotechnol.* 86: 1003–1015.
- Mortazavian, A., S.H. Razavi, M.R. Ehsani, and S. Sohrabvandi. 2007. Principles and Methods of Microencapsulation of Probiotic Microorganisms. *Iranian Journal of Biotechnology* 5(1) 1-18.
- Mozzi, F., G. Rollan, G.S. Giori, G, F.G. Valdez. 2001. Effect of Galactose and Glucose on The Exopolysaccharide Production and The Activities of Biosynthetic Enzymes in *Lactobacillus casei* CRL 87. *J. Appl. Microbiol.* 91:160-7.
- Muchtadi, T.R. dan Sugiono. 1992. *Ilmu Pengetahuan Bahan Pangan*. Bogor: Pusat Antar Universitas Pangan dan Gizi Institut Pertanian Bogor.
- Muir, J.G., Z.X. Lu, G.P. Young, D.C. Smith, G.R. Dollier, and D. O'DeaK. 1995. Resistant Starch in The Diet Increase Breathe

- Hydrogen and Serum Acetate in Human Subjects. *American J. Clin. Nutr.* 61:792-799.
- Murtiari, E. 2012. Total Probiotik Susu Kambing Fermentasi Menggunakan Starter Probiotik *Lactobacillus acidophilus* FNCC 0051 Selama Inkubasi. Semarang. *Jurnal Teknologi Pangan dan Hasil Pertanian Vol. 7(1)* : 28-37.
- Nabors, L. O. dan R. C. Gelardi. 1991. *Alternative Sweeteners, 2nd edition.* New York: Marcel Dekker, Inc.
- Naidu, A. S., and R.A. Clemens. 2000. Probiotics. In: Naidu A. S. (ed.) *Natural Food Antimicrobial Systems.* Florida :CRC Press.
- Nazzaro, F., F. Fratianni, R. Coppola, A. Sada, P. Orlando. 2009. Fermentative Ability of Alginate-Prebiotic Encapsulated *Lactobacillus Acidophilus* and Survival under Simulated Gastrointestinal Conditions. *J. Funct. Foods.* 1(3):319-323.
- O'Sullivan, O., J. O'Callaghan, A. S. Vegas, O. McAuliffe, L. Slattery, P. Kaleta, M. Callanan, G. F. Fitzgerald, R. P. Ross, and T. Beresford. 2009. Comparative Genomics of Lactic Acid Bacteria Reveals A Niche-Specific Gene Set. *BMC Microbiol.* 9: 1471-2180.
- O'Toole, P.W. and Cooney, J.C. 2008. Probiotic Bacteria Influence The Composition and Function of The Intestinal Microbiota. *Interdisciplinary Perspectives on Infectious Diseases*, 2008:175285.
- Ouwehand, A.C. and Salminen, S.J. 1998. The Health Effects of Viable and Non-Viablecultured Milk. *Intl. Dairy J.* 8: 749–758.
- Petzoldt, R., P. Lauer, M. Spengler, and K. Schofling. 1982. Palatinite in Type II Diabetics. Effect on Blood Glucose, Serum-insulin, C-Peptide and Free Fatty Acids. *Dtsch. Med. Wochenschr* 107:1910–1913.
- Phillips, J., J.G. Muir, A. Birkett, Z.X. Lu, G.P. Jones, K. O'Dea, and G.P. Young. 1995. Effect of Resistant Starch on Fecal Bulk and

- Fermentation-Dependent Events in Human. *American J. Clin. Nut.* 62:121-130.
- Picot, A. and C. Lacroix. 2004. Encapsulation of *Bifidobacteria* in Whey Protein Microcapsules and Survival in Simulated Gastrointestinal Conditions and in Yoghurt. *International Dairy Journal* 14:505-515.
- Prangdimurti, E., N.S. Palupi, F.R. Zakaria . 2007. *Metode Evaluasi Nilai Biologis Karbohidrat dan Lemak*. <http://xa.yimg.com/kq/groups/20875559/932235840/name/modul12.pdf> (19 Oktober 2013).
- Prevost H and C. Divies. 1992. Cream Fermentation By A Mixed Culture of *Lactococci* Entrapped in Two-Layer Calcium Alginate Gel Beads. *Biotechnol. Let.* 14 583-588.
- Priadi, A. dan L. Natalia. 2006. Infeksi *Ornithobacterium rhinotracheale* (ORT) pada Ayam di Indonesia. *JITV* 11:61-68.
- Priyanto, G. 1987/1988. *Teknik Pengawetan Pangan*. Yogyakarta: Pangan Antar Universitas Pangan dan Gizi.
- Rahayu, K. 1989. *Mikrobiologi Pangan*. Universitas Gadjah Mada Press. Yogyakarta.
- Rahayu, E. S. 2008. *Probiotic for Digestive Health. Food Review-Referensi industri dan teknologi pangan Indonesia*. <http://www.foodreview.biz/login/preview.php?view&id=55932> (2 September 2013).
- Rahayu, W.P., F. Kusnandar, and W.E. Prayitno. 2011. Stability of Viable Counts of Lactic Acid Bacteria during Storage of Goat Milk Soft Cheese. Bogor. *Microbiol.* Vol. 5(4) : 149-153.
- Ray, B. 2001. *Fundamental Food Microbiology*. 2nd ed. New York: CRC Press.

- Reid, G., C. Zalai., and G. Gardiner. 2001. Urogenital Lactobacilli Probiotics, Reliability, and Regulatory Issues. *J. Dairy Sci.* 84(E Suppl.):E164-E169.
- Rodriguez-Huezo, M. E., C. Lobato-Calleros, J. G. Reyes-Ocampo, O. Sandoval-Castilla, C. Pérez -Alonso, D. J. Pimentel-González. 2011. Survivability of Entrapped *Lactobacillus rhamnosus* in Liquid- and Gel-Core Alginate Beads During Storage and Simulated Gastrointestinal Conditions, *Revista Mexicana de Ingeniería Química.* 10(3):353-361.
- Rokka, S. and P. Rantamäki, 2010. Protecting Probiotic Bacteria by Microencapsulation: Challenges for Industrial Applications. *Eur. Food Res. Technol.* 231: 1-12.
- Rosenthal, A.J. 1999. *Food Texture Measurement and Perception.* Maryland: An Aspen Publication.
- Roy, D., J. Goulet, A. Leduy. 1987. Continues Production of Lactic Acid from Whey Permeate by Free and Calcium-Alginate Entrapped *Lactobacillus helveticus*. *J. Dairy Sci.* 70: 506-513.
- Rumessen J.J., Gudmand-Hoyer E. 1998. Fructans of Chicory: Intestinal Transport and Fermentation of Different Chain Lengths and Relation to Fructose and Sorbitol Malabsorption. *Am J. Clin. Nutr.* 68: 357–364.Suh, H.J., Noh, D. O., Kang, C. S., Kim, J. M., dan Lee, S. W. 2003. Thermal Kinetics of Color Degradation of Mulberry Fruit Extract. *Nahrung Food* 47 (2): 132-135.
- Sardjono dan D. Wibowo. 1988. *Mikrobiologi Pengolahan Pangan.* Yogyakarta: Proyek Peningkatan/Pengembangan Perguruan Tinggi Universitas Gadjah Mada.
- Sarmento, et al. 2007. Alginate or Chitosan Nanoparticles are Effective for Oral Insulin Delivery. *Pharmaceutical research* 24(12):2198-2206.
- Saunders D.R., Wiggins H.S. 1981. Conservation of Mannitol, Lactulose, and Raffinose by the Human Colon. *Am. J. Physiol.* 241: G397–G402.

- Science Photo Library. 2013. *Lactobacillus acidophilus*. <http://sciencephotolibrary.tumblr.com/post/33441648147/lactobacillus-acidophilus-is-a-lactic-acid> (1 September 2013).
- Senok, A.C. 2009. Probiotics in the Arabian Gulf Region. *Food & Nutrition Research*. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2651754/pdf/FNR-53-1842.pdf>. (2 September 2013).
- Sheu, T.Y., R.T. Marshall. 1991. Improving Culture Viability Infrozen Dairy Desserts by Microencapsulation. *J. Dairy Sci.* 74: 107-111.
- Sheu, T.Y., R.T. Marshall. 1993. Microentrapment of *Lactobacilli* In Calcium Alginate Gel. *J. Food Sci.* 54(3): 557-561.
- Shitandi, A., M. Alfred, and M. Symon. 2007. Probiotic Characteristic Of *Lactococcus* Strain From Local Fermented Amaranthus Hybrydus And Solanum Nigrum. *African Crop Science Confrence Proceedings* 8:1809-1812.
- Shah, N. P. 2007. Functional Cultures and Health Benefits. *Int. Dairy J.* 17:1262-1277.
- Shah, N.P. dan R.R. Rarula. 2000. Microencapsulation of Probiotic Bacteria and Their Survival in Frozen Fermented Dairy Desserts. *Aust. J. Dairy Technol.* 55: 139-144.
- Silalahi, J. 2006. *Makanan Fungsional*. Yogyakarta:Kanisius.
- Silvester, K.R., H.N. Englyst, and J.H. Gummings. 1995. Recovery of Starch From Whole Diets Containing Resistant Starch Measured in Vitro and Fermentation of Effluent. *American J. Clin. Nut.* 62: 403-411.
- Smidsrød, O., & Haug, A. 1968. Dependence upon Uronic Acid Composition of Some Ion-Exchange Properties of Alginates. *Acta Chemica Scandinavica*, 22, 1989-1997.

- Smidsrod, O. and G. Skjak-Braek. 1990. Alginate for Cell Immobilization. *Trends in Food Sci Technol.* 8:71-75.
- Sultana, K., G. Godward, N. Reynolds, R. Arumugaswamy, P. Peiris, and K. Kailasapathy. 2000. Encapsulation of Probiotic Bacteria with Alginate-Starch and Evaluation of Survival in Simulated Gastrointestinal Conditions and in Yoghurt. *Int. J. Food Microbiol.* 62: 47-55.
- Sun, W. and M.W. Griffiths. 2000. Survival of *Bifidobacteria* In Yogurt And Simulate Gastric Juice Following Immobilization In Gellanxanthan Beads. *Int. J. Food Microbiol.* 61: 17-25.
- Surono, I.S. 2004. *Probiotik Susu Fermentasi dan Kesehatan*. Jakarta : Yayasan Pengusaha Makanan dan Minuman Seluruh Indonesia (YAPMMI).
- Suskovic,J., K.Blazenka, G.Jadranka and M.Srecko. 2001. Role of Lactic Acid Bacteria And *Bifidobacterium* In Symbiotic Effect. *Food Technol.. Bioteclunol.* 39 :227-235.
- Tadesse, K., Smith, D. & Eastwood, M. A. 1980. Breath H₂ and CH₄ Excretion Patterns in Normal Man and in Clinical Practice. *Q. J. Exp. Physiol.* 65:85-97.
- Tamime, A. Y. dan R. K. Robinson. 2007. *Tamime and Robinson's Yogurt Science and Technology (third edition)*. Cambridge England : Woodhead Publishing Limited.
- Tanaka H., M. Masatose, I.A. Veleky. 1984. Diffusion Characteristics of Substrates in Calcium-Alginate Beads. *BiotechnolBioeng.* 26: 53-58.
- The International Commission on Microbiological Specifications for Foods. 1980. *Microbial Ecology of Foods: Factors Affecting Life and Death of Microorganisms*. Volume 1. Florida: Academic Press, Inc.
- Thompson, D.B. 2000. Strategies for The Manufacture of Resistant Starch. *Trends in Food Sci. Technol.* 11: 245-253.

- Topping, D. L., and P. M. Clifton. 2001. Short-chain Fatty Acids and Human Colonic Functions: Roles of Resistant Starch and Nonstarch Polysaccharides. *Physiol. Rev.* 81:1031-1063.
- Truelstrup-Hansen, L., P.M. Allan-Wojtas, Y.L. Jin, and A.T. Paulson. 2002. Survival of Free and Calcium-Alginate Microencapsulated *Bifidobacterium spp.* in Simulated Gastro-Intestinal Conditions. *Food Microbiol.* 19: 35-45.
- Weichselbaum, E. 2009. Probiotics and Health: A Review of The Evidence. *Nutrition Bulletin* 34: 340–73.
- Widodo, W. 2003. *Bioteknologi Industri Susu*. Yogyakarta : Lacticia Press.
- Wilm, K.H. 2012. *Future of Global Nutrition*. <http://www.ourfood.com.pdf> (20 Januari 2014).
- Winarno, F. G. 1996. *Teknologi Pengolahan Rumput Laut*. Jakarta: Pustaka Sinar Harapan.
- Winarno, F. G. dan I. E. Fernandez. 2007. *Susu dan Produk Fermentasinya*. Bogor: M-BRIO Press.
- Winarti, S., E. Harmayani, Y. Marsono, and Y. Pranoto. 2013. Effect of Inulin Isolated from Lesser Yam (*Dioscorea esculenta*) on the Growth of Probiotics Bacteria and SCFA Formation during Fermentation. Yogyakarta, *Inter. Research Journ. Of Microbio.* 4(2):53-63.
- Wolin, M. J. & Miller, T. L. 1983. *Carbohydrate Fermentation*. In: *Human Intestinal Microflora in Health and Disease* (Hentges, D. J., ed.). U.K, London: Academic Press.
- Yeo, S. K and Liang, M. T. 2010. Effect of Prebiotics on Viability and Growth Characteristics of Probiotics in Soymilk, *J.Sci Food Agric.* 90:267-275.
- Yusmarini, R. Indrati, T. Utami, dan Y. Marsono. 2010. Aktivitas Proteolitik Bakteri Asam Laktat Dalam Fermentasi Susu Kedelai. Riau. *J. Teknol. dan Industri Pangan* Vol. 21(2).
- Zhou, Y., E. Martins, A. Groboilloot, C.P. Champagne, R.J. Neufeld. 1998. Spectrophotometric Quantification of Lactic Acid Bacteria in Alginate

and Control of Cell Release with Chitosan Coating. *J. Appl. Microbiol.* 84: 342-348.

Zumbe, A., A. Lee, dan D. Storey. 2001. Polyols in Confectionery: The Route to Sugar-free, Reduced Sugar and Reduced Calorie Confectionery, *British Journal of Nutrition*. 85:S31-S45.