เอกสารอ้างอิง

กรมการจัดหางาน. 2554. **ทำน้ำส้มสายชูหมักจากน้ำมะพร้าว**. Available online: http://www.ismed.or.th/SME2/src/bin/controller.php?view=knowledgeInsite.KnowledgesDetail&p=&nid=&sid=69&id=571&left=84&right=85&level=3&lv1=3 [Online 23 Feb 2011].

กระทรวงสาธารณสุข. 2548. กระทรวงสาธารณสุข (ฉบับที่ 289) พ.ศ.2548ว่าด้วยเรื่อง นมเปรี้ยว

กองเกษตรเคมี. 2545. ฮอร์โมนพืชและธาตุอาหารพืชในน้ำหมักชีวภาพ. กรมวิชาการเกษตร กระทรวงเกษตรและสหกรณ์. 133 หน้า.

ทศพร ทองเที่ยง นฤมล จียโชค สุเมธ ท่านเจริญ ภาวิณี พัฒนจันทร์ และ ทรงพล คูณศรีสุข. 2548, รายงานฉบับสมบูรณ์ "โครงการศึกษาแนวทางพัฒนามะพร้าวและผลิตภัณฑ์จากมะพร้าว", มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี, 88 หน้า

ธารารัตน์ ศุภศิริ. 2542. PROBIOTIC: แบคทีเรียเพื่อสุขภาพ. วารสารวิทยาศาสตร์ 53(6). หน้า 357-360

นพมณี โทปุญญานนท์. 2545. การขยายพันธุ์พืชโดยวิธีการเพาะเลี้ยงเนื้อเยื่อ. ภาควิชาชีววิทยา คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้. 162 หน้า.

นรินทร์ ทองศิริ. 2531. เทคโนโลยีอาหารนม. พิมพ์ครั้งที่ 2. มหาวิทยาลัยเชียงใหม่. โรงพิมพ์ดาวคอมพิวกราฟิค. เชียงใหม่. 181 หน้า

ปิยะรัชช์ กุลเมธี. 2551. **การผลิตวุ้นมะพร้าว (วุ้นสวรรค์)**. Available online: http://www.agro.kmutnb.ac.th/e-learning/521302/6.php [Online 11 Dec 2010].

พรทิพย์ เฟื่องวรวงศ์ สุดารัตน์ ตรีเพชรกุล ทรงพล คูณศรีสุข และ แสงชัย เอกประทุมชัย. 2551. การศึกษาการใช้ประโยชน์วัสดุเหลือทิ้งจากกระบวนการแปรรูปมะพร้าวในจังหวัดประจวบคีรีขันธ์. วารสารมหาวิทยาลัยศิลปากร ปีที่ 28 ฉบับที่ 3 พ.ศ. 2551 ฉบับวิทยาศาสตร์และเทคโนโลยี, หน้า 13-31.

เพ็ญจันทร์ เมฆวิจิตรแสง จินดารัตน์ พิมพ์สมาน และ เลิศฤทธิ์ เลิศวัฒนวัลลี. 2542. **จลนพลศาสตร์และการขยายขนาดการผลิต *Acetobacter xylinum* ในเครื่องปฏิกรณ์ชีวภาพในระบบกะ (Batch)**

และกึ่งกะ (Fed-batch). ภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี.

มาตรฐานผลิตภัณฑ์ชุมชน. 2547. **น้ำหมักพืช**. Available online: http://app.tisi.go.th/cgi-bin/otop/stdsearch.pl [Online 15 June 2010].

วิเชียร ลีลาวัชรมาศ. 2541. โปรไบโอติก อาหารสุขภาพสำหรับมนุษย์และสัตว์. ตอนที่ 1.วารสารจาร์พาร์ 41. หน้า 50-53.

ศริสา ทวีแสง บวรศักดิ์ ลีนานนท์ และ สิงหนาท พวงจันทร์แดง. 2548. **การเหลือรอดชีวิตของเชื้อแบคทีเรียโพรไบโอติกในน้ำผลไม้ชนิดต่าง ๆ**. วารสารวิจัยมหาวิทยาลัยขอนแก่น ฉบับที่ 5 หน้า 77 – 88.

สายชล ชิวปรีชา. 2520. **การศึกษาการใช้น้ำมะพร้าวเป็นแหล่งอาหารเลี้ยงเชื้อและเก็บเชื้อแบคทีเรียที่ผลิตกรดแลกติก**. ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาวิชาจุลชีววิทยา บัณฑิตวิยาลัย มหาวิทยาลัยเกษตรศาสตร์.

อโณทัย คมเศวต. 2519. **การศึกษาการเจริญของยีสต์โดยใช้น้ำมะพร้าวเป็นวัตถุดิบ.** ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาวิชาจุลชีววิทยา บัณฑิตวิยาลัย มหาวิทยาลัยเกษตรศาสตร์.

อัสนี จิระวิบูลย์เวช. 2548. การผลิตไดอะซิติลจากน้ำมะพร้าวโดยเชื้อ ***Lactobacillus pentosus***. ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาเทคโนโลยีชีวภาพ ภาควิชาเทคโนโลยีชีวภาพ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง. 142 หน้า.

Association Office Analytical Chemists International (AOAC), 1995. Official Methods of Analysis, 16th ed. The Association Office Agricultural Chemists, Verginia.

Dubios, M., Gilles, K.A., Hamilton, J.K., Roberts, D.A., Smith, F., 1956. Colorimetric methods for determination of sugars and related substances. Analytical Chemistry 28, 350-356.

Fonteles, T.V., Costa, M.G.M., de Jesus, A.L.T. and Rodrigues, S., 2011. Optimization of the Fermentation of Cantaloupe Juice by *Lactobacillus casei* NRRL B-442. Food bioprocess Technol. [Publish online 21 May 2011].

Fuller, R., 1989. Probiotics in man and animals. Journal of Applied Bacteriology 66(5), 365–378.

Irigoyen, A., Arana, I., Castiella, M., Torre, P. and Ibáñez F.C. 2005. Microbiological, physicochemical and sensory characteristics of kefir during storage. Food chemistry 90, 613-620.

Johnson, T.R. and Case, C.L., 1989. Laboratory Experiments in Microbiology. 2nd ed. The Benjamin Cummings Publishing Company. Inc. Califonia, 56-62.

Krishnankutty, S, 1987. Analysis of Mature and Tender Coconut Water. Available online: http://coconutboard.nic.in/tendnutr.htm [Online 17 December 2008].

Luckow, T., & Delahunty, C., 2004. Which juice is 'healthier'? A consumer study of probiotic non-dairy juice drinks. Food Quality and Preference 15, 751-759.

Mattila-Sadholm, T., Myllarinen, P., Crittenden, R., Mogensen, G., Fonden, R. and Saarela, M. 2002. Technological challenges for future probiotic foods. International Dairy Journal 12, 173-182.

Nakazawa, Y. and Hosono, A. 1992. Functions of Fermented Milk. Translated by Howells, B.W. Elsevier Science Publshers Ltd. Essex, England.

Nancib, N., Nancib, A., Boudjelal, A., Benslimane, C., Blanchard, F. and Boudrant, J. 2001. The effect of supplementation by different nitrogen sources on the production of lactic acid from date juice by *Lactobacillus casei* subsp. *rhamnosus*. Bioresource Technology 78, 149-153.

Pereira, A.L.F., Maciel, T.C., and Rodrigues, S. 2010. Probiotic beverage from cashew apple juice fermented with *Lactobacillus casei*. Food Research International. (article in press).

Rivera-Espinoza, Y. and Gallardo-Navarro, Y., 2010. Non-dairy probiotic products. Food Microbiology 27, 1-11.

Sheehan, V.M., Ross P. and Fitzgerald G.F., 2007. Assessing the acid tolerance and the technological robustness of probiotic cultures for fortification in fruit juices. Innovative Food Science and Emerging Technologies 8, 279–284.

Sindhu, S.C. and N. Khetarpaul. 2001. Probiotic fermentation of indigenous food mixture: Effect on antinutrients and digestibility of starch and protein. J. of Food Comp. Anal. 14, 601-609.

Siuta-Cruce, P. and Goulet, J., 2001. Improving probiotic survival rates. Food Technology 55(10), 36–42.

Tripetchkul, S., Pundee, K., Koonsrisuk, S. and Akepratumchai, S., 2009, Utilization of Coconut Juice as Supplement in Composting of Coir Pith, The 21 st Annual Meeting of Thai Society for Biotechnology: TSB2009: Biotechnology: A Solution to

the Global Economic Crisis?, Queen Sirikit National Convention Center, Bangkok, Thailand, September 24-25, 2009, p 57 (CD rom)

Vinderola, C.G., Costa, G.a., Regenhardt, S. and Reinheimer, J.A. 2002. Influence of compounds associated with fermented dairy products on the growth of lactic acid starter and probiotic bacteria. International Dairy Journal 12, 579-589.

Witthuhn, R.C., Schoeman, T. and Britz, T.J. 2005. Characterisation of the microbial population at different stages of Kefir production and Kefir grain mass cultivation. International Dairy Journal 15, 383-389.

Wood, B.J.B. and Holzapfel, W.H. 1995. The Genera of Lactic acid Bacteria. London:Chapman&Hall. pp. 161-162.

Yoon, K., Woodams, E.E. and Hang Y.D., 2005, Fermentation of beet juice by beneficial lactic acid bacteria. Lebensm.-Wiss. U.-Technol. 38, 73-75

Yoon, K., Woodams, E.E. and Hang Y.D., 2006, Production of probiotic cabbage juice by lactic acid bacteria. Bioresource Technology 97, 1427-1430.

ภาคผนวก

International Conference on Agriculture and Agro-Industry (ICAAI2010)
Food, Health and Trade 19-20 November 2010

Preliminary Screening of Appropriate Probiotic Bacteria for Producing Health Drink from Mature Coconut Juice

Kanokwan Pundee[1], Saengchai Akeprathumchai[3] and Sudarut Tripetchkul[2,*]

[1]*Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi, Bangkok, Thailand 10150*
[2]*Division of Natural Resource Management, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand 10150*
[3]*Division of Biotechnology, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand 10150*

**Corresponding author. E-mail: sudarut.tri@kmutt.ac.th*

Abstract

Mature coconut juice, waste from the coconut processing industries, is rarely utilized and discarded in the area causing environmental pollution. This study proposed to solve this problem and, at the same time, add value to mature coconut juice by producing "health drink". Therefore, the aim of study was to identify lactic acid bacteria suitable for producing "health drink" from mature coconut juice. Four types of inocula were used, including *Lactobacillus acidophilus*, *L. casei*, *L. delbrueckii* and drinking yogurt commercially available in the market. The results revealed that mature coconut juice supplemented with 5% sucrose could satisfactorily support growth of the adopted inocula providing that viable cell count of as high as 7 log CFU/mL could be achieved within 12 hrs post inoculation at 37°C. However, only mature coconut juice fermented with *L. casei* whose qualities expressed in terms of viable cell count (9.16 log CFU/mL), pH (3.9) and acidity expressed as lactic acid (0.37%) conformed well with fermented milk and plant bioextract standard specified by the Ministry of Public Health of Thailand (2005) and Thai Industrial Standards Institute (2004), respectively.

Keywords: health drink, lactic acid bacteria, mature coconut juice

Introduction

Thailand is one of the top ten exporters of coconut (FAO, 2010) with the total coconut production of approximately 1.51 MT in 2008 given that Prachuab kirikhan is the largest coconut producer with 0.53 MT coconut produced (Agricultural Extension Office of Prachuap Khiri Khan Province, 2008). Most of coconuts were further processed commercially leading to large amount of wastes generated such as coir pith, coconut shell and coconut juice (Thongthieng et al., 2005). Even though mature coconut juice was employed as raw material for the production Nata de coco, compost and bioextract preparation, large quantity was inattentively discarded causing in turn adverse effect to environment (Fuangworawong et al., 2008). Since

coconut juice contains several beneficial nutritional elements such as sugar (0.1%), protein (0.1%) and trace elements, potassium (247 mg%) in particular (Krishnankutty, 1987; Mekvichitsaeng et al., 1999; Thoboonyanonth, 2002), it is a raw material of high potential for the production of heath drink which effectively reduces wastes generated from coconut processing industry and, at the same time, lessens environmental problem.

Probiotics are live microbial dietary Supplement, which beneficially affects the hosts by improving its intestinal microflora balance (Fuller, 1989). Probiotic microorganisms also improve digestion and produce nutrients such as amino acids, lactic acid and vitamins K and B. Most probiotic products available in the market are diary-base in nature, e.g., yogurt, fermented milk and kefir (Siuta-Cruce and Goulet, 2001). Presently, probiotics supplemented fruit and vegetable juice rich in mineral, vitamin and fiber are as well available commercially for health conscious but lactose in tolerant consumers (Luckow and Delahunty, 2004; Yoon et al., 2005; Sheehan et al., 2007; Prachyakij et al., 2008).

Microorganisms bestowing probiotics effect were *Bifidobacteria* and *Lactobacilli* including *Lactococcus*, *Enterococcus*, *Saccharomyces* and *Propionibacteria* (Rivera-Espinoza and Gallardo-Navarro, 2010). Qualities of probiotics supplemented health drink relate directly to amount of live microorganisms present in the product. According to the fermented milk standard of Thailand (Ministry of Public Health of Thailand, 2007), the live probiotic bacteria present in the product should be at least 7 logCFU/mL. As several factors, i.e., types of microorganism, pH and the presence of inhibitory substance, play significant role on probiotics viability in growth medium (Taweesaeng et al., 2005; Yoon et al., 2005; Sheehan et al., 2007), therefore, growth as well as viability of probiotic bacteria varied from one type of growth medium to another (Taweesaeng et al., 2005). For instance, *Lactobacillus acidophillus*, *L. casei* and *L. delbrueckii* grew comparatively well in beet juice, however, solely *L. casei* remained viable at the detectable level of more than 1×10^7 CFU/mL after storing at 4°C for 4 weeks (Yoon et al., 2005). This study aimed at selecting appropriate probiotic bacteria for the production of health drink from mature coconut juice.

Materials and Methods

Materials

Mature coconut juice was collected from coconut processing plant. Chemical characteristics of mature coconut juice were provided in Table 1. Mature coconut juice supplemented with 5% sucrose was sterilized at 2000 psi and 121°C for 15 minutes.

Table 1 Chemical characteristics of mature coconut juice

Characteristics	Mature coconut juice
Moisture content (%)	96.82±0.02
Ash (%)	16.58±0.52
pH	5.77±0.02
Acidity (%as lactic acid)	0.05±0.01
Brix (°)	3.6±0.1
Total sugar (μg/ml)	21.87±3.05

Probiotics Inocula

Four inocula were employed as follows: (i) commercially available drinking yogurt, (ii) *L. acidophilus* TISTR 450, (iii) *L. casei* TISTR 390 and (iv) *L. delbrueckii* TISTR326. The three lactobacilli were cultivated at 37°C for 24 hrs in MRS broth (Himedia Laboratories, PVT LTD.).

Preparation of health drink using mature coconut juice

Experiments consist of 4 treatments according to the types of inocula specified previously in probiotics inocula section. 5% inoculum was employed. Each treatment was then incubated at 37°C for 72 hrs. Small sample was collected at 0, 6, 12, 18, 24, 48 and 72 hrs.

Analytical

Total acidity expressed as % lactic acid was determined by titrating against 0.1 N NaOH using phenophthalien as indicator (AOAC, 1995). Cell viability was enumerated by total plate count for 48 hrs at 37°C (Johnson and Case, 1989).

Statistical Analysis

All experiments were carried out in triplicate. Results were expressed as mean±standard deviation. Analysis of variance (ANOVA) and least significant digit (LSD) were conducted using Minitab 14 (Minitab Inc., USA).

Results and Discussion

pH and acidity

Thai Industrial Standards Institute (2004) and the Ministry of Public Health of Thailand (2005) have specified, respectively, that pH of less than 4.3 and acidity (as % lactic acid) of higher than 0.3% should be attained for plant bioextract and fermented milk product in order for the product to be considered acceptable. It is obvious from Figure 1 that both pH and acidity conformed well to those of the standard when *L. acidophilus* and *L. casei* were employed as inocula at 12 and 18 hrs post inoculation, respectively. However, both pH and acidity of the product prepared using commercial drinking yogurt and *L. delbrueckii* as inocula took longer to reach standard at 24 and 48 hrs post inoculation, respectively, which may be due to the fact that longer lag phase was observed (Figure 2).

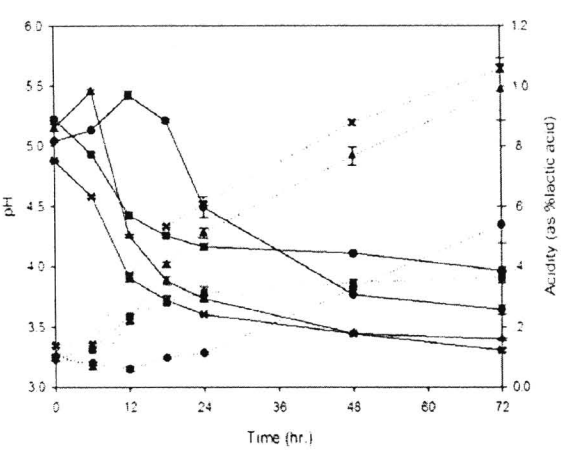

Figure 1 Changes of pH (——) and acidity (····) during fermentation of health drink from mature coconut juice using commercial drinking yogurt (•), *L. acidophilus* (▲), *L. casei* (×), *L. delbrueckii* (■) as inocula

Further, fermentation with commercial drinking yogurt and *L. delbrueckii* as inocula yielded much lower lactic acid production than those obtained with *L. acidophilus* and *L. casei* ($p<0.05$) providing that the lowest lactic acid

concentration (0.36%) was detected when *L. delbrueckii* was use as inoculum. On the contrary, fermentation with *L. casei* led to the highest lactic acid concentration and the lowest pH of approximately 1.06% and 3.31, respectively, which was significantly different from other preparation ($p<0.05$).

Growth and survival of probiotic bacteria

Results obtained in Figure 2 show that mature coconut juice supplemented with 5% sucrose could satisfactorily support growth of all inocula, namely, commercial drinking yogurt, *L. acidophilus, L. casei* and *L. delbrueckii*, exceeding 7 log CFU/mL. Both *L. acidophilus* and *L. casei* grew well during the first 6 hrs post inoculation whereas high growth of drinking yogurt inoculum and *L. delbrueckii* noted after 6 hrs of inoculation. At 12 hrs post inoculation, product prepared with *L. casei* yielded the highest viable count, approximately 9.16±0.03 log CFU/mL ($p<0.05$), whereas the viable counts accomplished with commercial drinking yogurt, *L. acidophilus,* and *L. delbrueckii* were, respectively, 8.56±0.07, 7.98±0.05 and 7.83±0.03 log CFU /mL.

As can be observed from Figure 2 that, at 24 hrs of fermentation, except for the commercial dirnking yogurt inoculums, viable count declined accordingly due probably to an increase in acidity of the medium, which is inappropriate for growth (Sheehan et al., 2007). Considering microbial acid resistance and survivability at 72 post inoculation, coconut juice fermented with *L. acidophilus* and *L. delbrueckii* showed the reduction rate relative to that of 24 hrs of 0.84 and 0.38 log CFU/mL/day, respectively. When *L. casei* was employed as inoculums the lowest reduction rate of 0.27 log CFU/mL/day was achieved indicating that *L. casei* is more acid resistant than *L. acidophilus* and *L. delbrueckii* (Figure 2), thus, remained more viable.

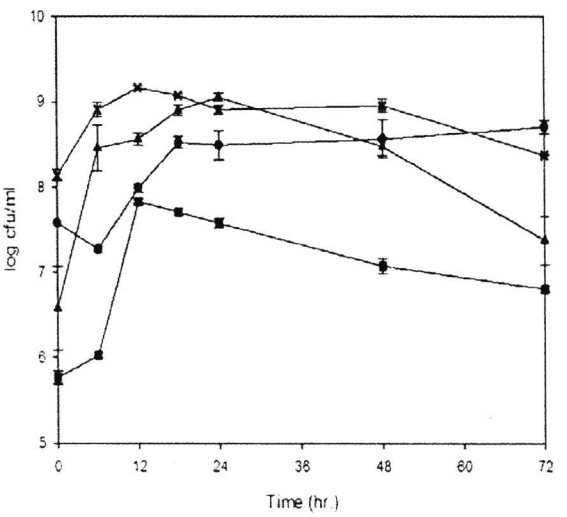

Figure 2 Viable cell counts during fermentation of health drink from mature coconut juice using commercial drinking yogurt (•), *L. acidophilus* (▲), *L. casei* (×), *L. delbrueckii* (■) as inocula

The quality of health drink from mature coconut juice

According to plant bioextract and fermented milk standards specified by the Thai Industrial Standards Institute (2004) and The Ministry of Public Health of Thailand (2005), respectively, the preparation using *L. casei* as inoculums reached standard the fastest with the highest viable cell count (9.16 log CFU/mL) within 12 hrs of fermentation ($p<0.05$). Additionally, medium inoculated with *L. delbrueckii* led to the lowest viable cell count of 7.57 log CFU/mL at 24 hrs of fermentation (Table 2).

Table 2 Qualities of health drink from mature coconut juice at various inoculum

Inocula	Time (hr.)	Viable cell count (log CFU/mL)	pH	Acidity (% as lactic acid)
Drinking Yoghurt	48	8.56 ± 0.23^{c}	3.77 ± 0.01^{c}	0.33 ± 0.00^{c}
L. acidophilus	18	8.90 ± 0.06^{b}	3.88 ± 0.04^{b}	0.41 ± 0.01^{a}
L. casei	12	9.16 ± 0.03^{a}	3.90 ± 0.03^{b}	0.37 ± 0.01^{b}
L. delbrueckii	24	7.57 ± 0.06^{d}	4.16 ± 0.03^{a}	0.31 ± 0.02^{d}
Standards		7^{**}	4.3^{*}	0.3^{**}

Note: * Thai Industrial Standards Institute (2004); **The Ministry of Public Health of Thailand (2005); Values within a column followed by different letters are significantly different ($p<0.05$).

Results found were in good agreement with that of Chewpreecha (1977) who reported that *L. casei* grew comparatively well on coconut juice supplemented with peptone, yeast extract, sodium acetate, ammonium citrate and Tween 80 at 1, 0.5, 0.5, 0.2 and 0.1% in comparison with MRS broth given that viable cell count of *L. delbrueckii* was also the lowest even when cultivated on MRS medium.

Conclusions

Four types of inocula, *Lactobacillus acidophilus*, *L. casei*, *L. delbrueckii* and commmerical drinking yogurt, were examined for their growth and acid resistance capability on mature coconut juice. *L. casei* was the most suitable in terms of growth and acid tolerantce. The qualities of the health drink, both the amount of viable count, pH and lactic acid production, conformed well to the fermented milk and plant bioextract standards specified by the Ministry of Public Health of Thailand (2005) and Thai Industrial Standards Institute (2004), respectively, within 12 hours of fermentation.

Acknowledgement

This study was financially supported by the commission of Higher Education (The Western Network).

References

Agricultural Extension Office of Prachuap Khiri Khan Province, 2008. Coconut production statistics. Available online: http://prachuap.doae.go.th/statistics%20plant/statistics%20fruit/fruit%202544.xls [Online 22 March 2009].

Association Office Analytical Chemists International (AOAC), 1995. Official Methods of Analysis, 16th ed. The Association Office Agricultural Chemists, Virginia.

Chewpreecha, S., 1977. Studies on Using Coconut Juice as Basal Medium for Enrichment and Maintenance of Lactic Acid Bacteria. Department of Microbiology Science. Kasetsart University, Thailand.

FAO, 2010. Top ten-coconut production in the world. Available online:http://faostat.fao.org/site/567/default.aspx#ancor [Online 3 May 2010].

Fuangworawong, P., Tripetchkul, S., Koonsrisuk, S., Akeprathumchai, S., 2008. Study on Availability and Utilization of Wastes from Coconut Processing in Prachuapkirikarn Province. Silpakorn University Journal 28 (3): 13-31.

Fuller, R., 1989. Probiotics in man and animals. Journal of Applied Bacteriology 66(5): 365–378.

Johnson, T.R. and Case, C.L., 1989. Laboratory Experiments in Microbiology. 2nd ed. The Benjamin Cummings Publishing Company. Inc. California: 56-62.

Krishnankutty, S, 1987. Analysis of Mature and Tender Coconut Water. Available online: http://coconutboard.nic.in/tendnutr.htm [Online 17 December 2008].

Luckow, T., & Delahunty, C., 2004. Which juice is 'healthier'? A consumer study of probiotic non-dairy juice drinks. Food Quality and Preference 15: 751-759.

Mekvichitsaeng, P., Pimsamarn, J., Lerdwattanawanlee, L., 1999. Kinetic and Scale-up of Acetobacter Xylinum in Batch and Fed-Batch Process. Department of Chemical Engineering. King Mongkut's University of Technology Thonburi, Thailand.

Prachyakij, P., Charernjiratrakul, W. and Kantachote, D., 2008. Improvement in the quality of a fermented seaweed beverage using an antiyeast starter of *Lactobacillus plantarum* DW3 and partial sterilization. World J Microbiol Biotechnol 24: 1713-1720.

Rivera-Espinoza, Y. and Gallardo-Navarro, Y., 2010. Non-dairy probiotic products. Food Microbiology 27: 1-11.

Sheehan, V.M., Ross P. and Fitzgerald G.F., 2007. Assessing the acid tolerance and the technological robustness of probiotic cultures for fortification in fruit juices. Innovative Food Science and Emerging Technologies 8: 279–284.

Siuta-Cruce, P., and Goulet, J., 2001. Improving probiotic survival rates. Food Technology 55(10): 36–42.

Taweesang, S., Leenanon, B. and Phoungchandang, S. 2005. Survival of probiotic bacteria in different kinds of fruit juices. Khon Kaen University Research Journal 5: 77-88.

Thai Industrial Standards Institute, 2004. Plant bioextract standards. Available online:http://app.tisi.go.th/cgi-bin/otop/stdsearch.pl [Online 15 June 2010].

The Ministry of Public Health of Thailand, 2005. Fermented milk standards. Available online:http://www.fda.moph.go.th/fda-net/html/product/food/ntfmoph/ntf289.pdf [Online 15 June 2010].

Thoboonyanonth, N., 2002. Expansion by the Plant Tissue Culture. Department of Biology. Faculty of Science. Maejo University, Thailand.

Thongthieng, T., Jeyashoke, N., Tanchareon, S., Patanachan, P. and Koonsrisuk, S., 2005. Development of coconut and products from coconut. King Mongkut's University of Technology Thonburi, Thailand.

Yoon, K., Woodams, E.E. and Hang Y.D., 2005, Fermentation of beet juice by beneficial lactic acid bacteria. Lebensm.-Wiss. u.-Technol. 38: 73-75