

Abstracts of Senior Projects

The syllabus for most of the science and technology faculties of Assumption University requires the submission of a senior project prior to completion of a bachelor's degree. Many of these projects have been accomplished through scientific experimentation or investigation, the result of which is reported to the instructor responsible for the assignment. Although the report is kept with the instructor or, in some cases, at the Faculty's library, only a few people can have access of the report. It would be of some benefit to all concerned if the abstracts of these senior projects were published. Persons who are interested in reading the full report can do so by contacting the concerned instructor or library.

The "Abstracts of Senior Projects" have been published once in the AU J.T. 3(1): July 1999. AU J.T. is pleased to open a new column in the Journal entitled; "Abstracts of Senior Projects" as a forum for students of Assumption University and their supervisors, so they may have a chance to publicize their findings, as well as to exchange information with other students and staff of Assumption University and other institutions; while at the same time providing an incentive for young scientists to convey their work to colleagues, and other scientists as well.

This issue presents abstracts of senior projects from the Faculty of Biotechnology. Students and/or supervisors of other faculties are cordially invited to submit their abstracts for possible publication in the AU Journal of Technology. Kindly follow the format shown in this issue, in order to avoid laborious editing of your work.

Faculty of Biotechnology Academic Year 2001

Title: Chinese steamed bun whole wheat
By: Mr. Chinorot Thamajarak
Advisor: A. Nootrudee Siriboon

The substitution of all-purpose flour with whole-wheat flour at 0, 10, 20, 30, 40, and 50% to prepare Chinese steamed buns was studied. Chinese steamed buns were prepared using a sponge-dough method at three substitution steps, viz.: (i) at sponge process, (ii) at dough process, and (iii) as mixture flour in sponge dough. Sensory evaluation of 15 test panelists using a scoring system showed that 30% whole wheat flour could be used in substituting the all-purpose flour with good acceptable scores.

Title: The reduced calories of 'Thong Yot'
By: Ms. Bongkod Wariwaranun
Advisor: A. Pornpen Panjapiyakul

Research on the possibility to produce low calorie 'Thong Yot', a Thai sweet

dessert, by reducing egg yolk content with egg-yolk replacer and sugar substitute for

syruap was investigated. The experiment was divided into five parts. The first part was to determine the basic formula of 'Thong Yot' compared with those available in the markets. It was found that there was no significant difference between the sensory scores of the basic formula of both.

The second part was to study the characteristics of Thong Yot. This experiment was conducted to determine the calories of Thong Yot and its shelflife when kept in room temperature and in the refrigerator. Thong Yot had 376.87 kcal; it can be kept for four days in room temperature and more than 18 days in the refrigerator.

The third part was to determine the sugar substitute by using a sorbitol replacement as 10, 20, 30, 40, and 50%, and to determine their shelflife. The 40% sorbitol was preferred more by the panelists than the others. Mold was found in all Thong Yot after 12 days. However, its smell showed that decomposition took place after six days.

The fourth part was to determine the appropriate type and content of egg-yolk

replacers. These were locust bean gum, xanthan gum, modified starch N8991®, N780148® and E3000®. It was found that the sensory score of 8% modified starch N8991® was an acceptable egg-yolk replacer.

The last part was to minimize the egg-yolk content by varying fillers. The results showed that 75% egg yolk, waxy rice, and water 0.75 time were suitable for reducing calories in Thong Yot.

Title: The inhibition of *Rhizopus stolonifer* by herbs
By: Ms. Watcharaporn Watahong
Advisor: A. Nootrudee Siriboon

The anti-microbial activity of plant oils or extracts has been recognized for many years. In this experiment, the crude extracts from seven species of herbs: Japanese mint, ginger, lemongrass, turmeric, 'Phlai', garlic, and Asiatic pennywort (by macerated in 50 and 80% ethanol) and six herbal essential oils: Japanese mint, ginger, lemongrass, turmeric, 'Phlai' and garlic, were investigated for anti-microbial activity against *Rhizopus stolonifer* using two methods. The first, "Disc Diffusion Method", was to study the anti-microbial effect of herbal extracts and herbal essential oils by observing a clear zone diameter. The second, "Tube Dilution Test", was to determine the minimum inhibitory concentration (MIC) by observing the turbidity of the media in the first tube in the series that showed no turbidity. The ethanol extract from the bulbs of garlic and 'Phlai' could inhibit the organisms with the 18 and 16 mm of clear zone diameter, respectively. The lowest MIC of the crude extract from the bulb of garlicks and 'Phlai' were 0.032 and 0.064 µg/ml. The essential oils from ginger, lemongrass, turmeric, 'Phlai' and garlic had the inhibitory effect on the organisms. 'Phlai' oil gave the largest clear zone diameter (28 mm) and the lowest MIC of 0.002 µg/ml, indicating that it possesses the highest anti-microbial activity.

Title: Cereal tofu

By: Ms. Khanittha Inprasit
Advisors: A. Peechaya Jirathumkitkul and A. Pornpen Panjapiyakul

Cereal tofu is a new type of food. The mixing of soybeans with broken-rice flour becomes a nutritional bargain with respect to protein, and increases the value and improves the quality of rice. This experiment used varying the percentage of broken-rice flour contents (10, 20, 30, and 40%) and three types of juices (lemon, orange, and pineapple) as coagulants. The results showed that, the 30% broken-rice flour was a suitable formula for the cereal-tofu product with lemon juice as coagulant, but the volume of the product was less attractive when compared with control (MgSO₄). Modified starch was added to improve the volume and texture by using two types of modified starch (E 1000J and E 3000M) and varied the contents (0.5, 1.0 and 1.5%). The results showed that E 1000J was better than E 3000M, as the latter produced an undesirable jelly-like texture. The addition of modified starch (E 1000J) should be limited to not more than 1.0% E 1 000J. The highest acceptance, the panelists preferred no additional modified starch at 30% broken-rice flour content in cereal-tofu product.

Title: Ethyl alcohol production from rice straw
By: Ms. Radawadee Boonyasettha
Advisor: Dr. Churdchai Cheowtirakul

The objectives of this project were to isolate and identify cellulolytic organisms, which can produce cellulase to degrade cellulose, to explore the effective method of hydrolyzing cellulose from rice straw to mono- and disaccharide and attempt to produce alcohol by using cellulose from rice straw as the raw material. More than 100 strains of culture were isolated from rice straw to determine the cellulase production. *Cellulomonas* sp. was used as a control in this study. The cellulolytic activity of the culture was detected by using several methods including; alcohol determination, glucose determination by using DNS reagent, crude fiber determination and protein determination. The results showed that only five strains, Nos. 33, 34, 35, 36, and 37 produced acceptable ranges of clear zone on CMC medium, which had a higher diameter of clear zone than the control strain for cellulose production. The

methods, which were used to find the cellulolytic activity of cultures, did not show good results. From the experiment of all five-selected strains, strain No. 37 seems to be the best cellulose degrader for cellulase production. These studies should be repeated. Greater attention needs to be given to the method of the detection of cellulolytic activity during the time of incubation, in which the change is so small.

Title: Production of tempeh from various legumes
By: Ms. Supang Chuprasit
Advisor: A. Nootrudee Siriboon

Most 'tempeh' is made from soybeans. Tempeh is cultured cake of beans. It is made from fermented dehulled bean using *Rhizopus oligosporus*. Although soybean tempeh is delicious and digestible, *R. oligosporus* can grow well in other grain legumes as well. This project was aimed at studying how to prepare tempeh from different grain legumes, which were groundnut, mungbean, kidney bean, and cowpea.

R. oligosporus was able to ferment and grow on all legumes, producing thick white mycelium covering the bean. The tempehs were deep fried in palmoil for 2-3 min., depending on the type of legumes. All tempehs were rated in comparison with soybean tempeh. The result showed that groundnut tempeh was not significantly different from soybean tempeh. Chemical analysis, however, showed that groundnut tempeh contained the highest amount of fat and the lowest amount of protein among the five legumes tested.

Title: A survey of the lotus and water lily (Nymphaeaceae) for their compositional values and utilizational trends
By: Ms. Siripan Thrisorarak
Advisor: A. Nootrudee Siriboon

Most people know the lotus and water lily well, but no one knows the details on their advantages. This project was aimed at studying the composition of the lotus and water lily to improve and develop new products, which can be made from them. Two kinds of plants, lotus (*Nelumbo nucifera*) and waster lily (*Nymphaea lotus*), were studied.

The fresh part of a raw sample was used to determine the moisture content, ash (including soluble and insoluble ash), and rude fiber. The sample was dried with a hot-air oven to determine fat and protein, respectively.

The results showed the compositional values in each parts of the plants. More than 90% was the moisture content. The stem contained high amounts of crude fiber. In the floating parts, lipids were a bit high, but less in proteins and ash contents.

Title: The study on making pomegranate wine
By: Ms. Tharinee Leethanweesup
Advisor: Dr. Churdchai Cheowtirakul

At present, Thai people prefer to consume Thai wine much more than ever. This may be because the country has been facing an economic crisis. Pomegranate or 'Thapthim' is widely grown in Thailand, and stands a good chance to be developed into many value-added products. However, because of its characteristics and price, pomegranate is not a very popular fruit. It can be used as a very fine raw material for wine making. Pomegranate wine, mixed with a little vodka and sugar has a good taste and can be expected to be a new product which will be popular in the future.

Title: Production of paper from lotus leaf
By: Ms. Arisa Chaicharnudomsuk
Advisor: A. Nootrudee Siriboon

Lotus (*Nelumbo nucifera* L.) is known as a sacred flower and has been used as a revered flower in Buddhism since ancient times. In the fresh markets or supermarkets, lotus flowers are sold in a lotus-leaf wrapping bundle. That is how its leaves are used. Most of the time, the leaves are discarded after use as any packaging waste. This project is aimed at studying the possibility of producing pulp from lotus leaves by using chemical pulping and incorporating it with mulberry fiber, or unbleached paper to make lotus-leaf paper. In chemical pulping, NaOH at the concentration of 10 and 15% by weight was used to extract the pulp. The pulp was bleached with 10, 20, and 30% chlorine solution at room temperature for 10 hrs. and then formed into paper. Lotus fiber alone could

not be used to produce paper due to its short fiber. Combining the lotus pulp with paper mulberry, or 'Po Sa', fiber or unbleached paper made it possible to obtain hard paper. The best lotus-leaf paper was obtained from incorporating paper-mulberry fiber and lotus-leaf fiber, in the ratio of 1:1. The lotus-leaf fiber is made from 15% NaOH extraction and 10 or 20% chlorine. The paper was light brown with red to yellow specks embedded in the paper. They exhibited tensile strength of 3.8 to 3.3 kg/m², respectively.

Title: The survey of borax adulteration in foods from fresh markets and supermarkets in Bangkok

By: Ms. Atchara Seatea

Advisor: A. Pornpen Panjapiyakul

Borax (sodium borate, Na₂B₄O₇·10H₂O) is often misused as a food additive in many kinds of Thai preserved foods including preserved meat and meatball. Borax can be made complex with organic matter to be more crispy and elastic. However, this additive has been forbidden by the Thai FDA for many years due to their findings of acute and chronic toxic manifestations, such as: gastro intestinal irritation, including nausea, vomiting, and hemorrhagic gastroenteritis. High doses may lead to shock and death due to cardiovascular collapse.

The survey of borax adulteration was made in 12 fresh markets and 8 supermarkets in Bangkok. Seven types of foods, namely: minced pork, pickled mango, Thap Thim Krop, pickled Chinese cabbage, pork ball, fish ball and beef ball, were sampled from these markets. All samples were determined for their borax content by semi-quantitative methods.

The results showed that some foods in the fresh markets were adulterated with borax more than those in the supermarkets. The borax adulteration was 80% in minced pork, 47% in pickled mango, 35% in pork ball, 33% in Thap Thim Krop, 20% in pickle Chinese cabbage and beef ball, and 6% in fish ball from both the fresh markets and supermarkets. The highest of borax adulteration in foods was in minced pork, especially all fresh markets in Bangkok.

Title: formulation of sweetened guava paste from unpicked guava (*Psidium guajava* L.)

By: Ms. Thosathorn Kruthanawat

Advisor: A. Nootrudee Siriboon

The study on formulation of sweetened guava paste was conducted, using unpicked fruits from Bancha Thun Orchard at Bang Lane, Nakhon Pathom. Three formulae with varying ratios of sugar to water were prepared and tested with 30 taste panelists twice. The selected formula contained 63.5% guava fresh, 20% water, 13% sugar, 1 % glucose syrup, 1 % citric acid, and 1.5% salt, which composed of 33.7% moisture content, 3.11% reducing sugar, 32.27% total sugar and 0.39% acidity. Maturity as measured by the starting Brix from 5 to 12 had no affect on the sensory attributes, but there was significant difference in reducing sugar percentage ($\alpha = 0.05$). Three varieties of guava: Bangkok Apple, Yen #2 and Paen Si Thong were compared. It was found that Yen 2 obtained the highest score in color (7.28), texture (7.35), and overall acceptance (7.98) with taste (7.35) less than Paen Si Thong (7.40). During the process, the color changed and became darker because of non-enzymatic browning reaction. KMS was added to improve the color. It slowed down the reaction only in the beginning, but could not prevent the color change. Consumer acceptance resulted in products made from Paen Si Thong due to its sweetness. The finished product can be sold at a profit of 100 Baht/kilo from the investment of 50 Baht/kilo with 250% profit.

Title: The study of microbial spoilage in sweetened bael fruit

By: Ms. Prangthip Komolwanich

Advisor: A. Nootrudee Siriboon

The objectives of this project were to: (1) study the organoleptic and microbiological changes of sweetened bael fruit stored for ten weeks, (2) identify the osmophilic yeast causing spoilage to sweetened bael fruit, and (3) study the traditional process of making sweetened bael fruit. Four samples were obtained from Pat Rio Market (A), Saphan Mai Market (B), Mae Klong Market (C), and Petchaburi Market (D) at the costs of 60, 80, 70

and 70 Baht/kg, respectively. The changes in organoleptic properties were observed; the color of A changed from bright reddish (IOR 5/14) to reddish brown (IOR 5/12) while B changed from bright orange red (5YR 6/14) to orange-brown (5YR 6/12). Slightly putric smells and moldy flavors were detected in the 3rd and the 4th weeks. The shelflife of the products varied from 4-6 weeks. Three strains of osmophilic yeast were isolated as *Z. rouxii*, *Z. bailii*, and *Z. bisporus* with 81.25, 10.42, and 8.33%, respectively. The product made from charcoal stove was sweeter, but higher after taste than that made from the propane stove which was bitter and astringent. The texture was different, firm and sandy in the former and watery in the latter.

Title: The study of low cost modified media with variable formula for substitution of yeast malt (YM) medium by using yeast (*Saccharomyces cerevisiae*)

By: Mr. Chatchai Satsitapong

Advisor: Dr. Churdchai Cheowtirakul

The purpose of this experiment was to find substantial low-cost media in substitution for YM medium for growing yeast (*Saccharomyces cerevisiae*). The mixing compounds used for this experiment for making modified media are easy to find, as it is easy to prepare. Thirteen formulae of modified media were formulated in comparison to YM medium; however, only eight modified media formulae showed visibility growth of yeast, whereas five of them failed to show any sign of visibility. Based on money saving factor, formula F7 exhibited the highest percentage of money saving up to 30.52%, but in comparing the growth visibility, formula F5, showed a similar growth factor to YM medium with money saving up to 9.92% which seemed to be the most appropriate one.

Title: The study of protoplast fusion between *Oenococcus oeni* (malolactic fermentation bacteria) and *Saccharomyces cerevisiae* (yeast) for industrial wine production

By: Ms. Patchanee Yasurin

Advisor: Dr. Churdchai Cheowtirakul

Malolactic fermentation is accepted as a secondary stage of industrial premium wine production, in which malic acid will be converted into lactic acid, which will make red wine pleasant in both taste and flavor. At this stage, *Oenococcus oeni* is responsible for the aging process and it can take years to complete. In order to decrease the time duration for the ageing process in industrial premium wine production, therefore the improvement of strains which can perform both alcoholic and malolactic fermentation for industrial wine production was studied. The techniques of protoplast fusion between *Oenococcus oeni* (malolactic fermentation bacteria) and *Saccharomyces cerevisiae* (yeast) was explored for this purpose. More than 1000 new fusant strains were obtained, but only eight new fusant strains were found able to serve the purpose. After subculture, the fusants to the second batch of wine production, those new fusant strains reduce their malolactic fermentation property, but still perform alcoholic fermentation property. These fusants had a characteristic of yeast-like organisms. The eight fusant strains were named as *Saccharomyces cerevisiae* var. MLF 31 CCPY, MLF 135 CCPY, A4LF 146 CCPY, MLF 148 CCPY, MLF 253 CCPY, MLF 317 CCPY, MLF 353 CCPY, and MLF 501 CCPY.

Title: Effects of Makluea (*Diospyros mollis* Griff.) on coconut toddy fermentation

By: Ms. Supamard Chooyim

Advisor: Dr. Charoen Charoenchai

Coconut toddy is an alcoholic beverage made from fermentation of the coconut sap. 'Makluea' is added to the sap to initiate fermentation. However, the role of Makluea in fermentation is not fully understood. In this study, the effect of Makluea on the fermentation of coconut toddy was investigated. It was found that fermentation with Makluea gave the toddy a higher alcohol contents, lower acidity, and higher consumption of sugar. The wood itself did not contain yeast for fermentation, but it may help to promote yeast growth. The yeast that was found in coconut toddy was identified as *Saccharomyces cerevisiae*.