

Conference Paper

Liquid Smoke: *Rebung* Preservation in Canned Food for ASEAN Food Marketing

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Abstract

Nowadays, bamboo is the rarely plant which is not exist by the advantages. A lot of bamboo is used for raw materials. In addition, the bamboo could live in every climate seasons such as winter and summer. High velocity of bamboo also is used to get high yields level and has some advantages to be taken as food resources such as bamboo shoots (*rebung*). *Rebung* has also advantages in medical disciplines which has cellulose, protein, vitamin and mineral. If fat and sugar level is low, the quality of *rebung* product would not be longer. Moreover, natural preservative such as liquid smoke would be the alternative ones because there are some components such as phenyl, 4-methyl phenol, dodecanoate acid, methyl ester, tetratdecanoic acid and 2-methoxy-4-methylphenol which could use for food preservatives. Therefore, *rebung* production could be packed for increasing the marketing of food not only in home industry, but also in longer ways in canned food for ASEAN food marketing.

Keywords: Bamboo, Bamboo Shoots (*Rebung*), Liquid Smoke, Canned Food, ASEAN Food Marketing

1. Introduction

Bamboo is one of prospective plants which is woody, valuable, strong and fast-growing grass. It is available and commonly used throughout the country which grows easily in every region except extremely hot and cold. It is the complex system's plant which is an underground vegetative network called rhizome. As the member of grass family, it has some characteristic parts whose give health benefits for food resources such as bamboo shoots. Bamboo shoots are the component of bamboo family which is young and new canes that are harvested before they are 2 wk old or one-foot tall. It could be comparable to asparagus which are crisp and tender, with a flavor similar to corn. They vegetate at the base of a groove and usually filled by *glugut*. The morphology

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shapes like a cone. The important component of them is water which is contained around 85.63 % and has some fiber contents.

However, they are widely used in Asian cuisine. It is applied in canned food and commercially canned bamboo shoots are common but the better flavor and texture are locally grown bamboo. Bamboo shoots are well known in society as cuisine such as vegetables, spring rolls and the others. They also have protein, carbohydrate, fat, vitamin A, thiamin, riboflavin, vitamin C and mineral such as calcium, phosphor, iron and potassium. In addition, they have some health benefits because of potassium levels which is contained of 553 mg/100 mg could decrease cholesterol levels in blood. Based on the benefits, they also have some drawbacks such the societies are still a little bit known about bamboo shoots as Asian cuisine. Chinese people assume that bamboo shoots are beneficial food because of the daily menu for them. Consumption level of bamboo shoots around the world is about 2 000 000/yr and the biggest consumption (1 300 000/yr) is in China.

Moreover, this research is conducted to create a food product in canned packaging using natural preservation such as liquid smoke. Based on the smoke technology, it could preserve directly into canned food which could innovate the packaging food not only as a souvenir but also becomes the identity of Indonesian food to be announced in ASEAN. That occasion could lead food marketing in Indonesia to be more productive in using bamboo shoots as cuisine resources which is combined by using science and technology packaging. The process of this research is made the liquid smoke from coconut shells which is used pyrolysis method then smoked the food in canned materials.

In Indonesia, the highest consumption of bamboo shoots is in Semarang which is produced spring rolls as traditional snack in *Idul Fitri* and holiday which is increased two times to times. For the example, in the Pacific Northwest, some farmers are now growing bamboo shoots and they could be found in fresh condition, typically May through June. It could be reached in some grocery stores for canned bamboo shoots.

Moreover, the nutritious bamboo shoots have some advantages according to fat and kalori. A mere 14 cal are contained by one cup of half-inch long slices and half a gram of fat. Fiber in bamboo shoots also is the useful components that 2.5 g of fiber is provided the same serving size, which is approximately 10 % of recommended amount needed in a day. The cholesterol levels also could be controlled by fiber and plays a role in preventing colon cancer. They have lignin and phenolic acid which comes to natural substances in plants that phytochemicals is being the bamboo sprout's promise. Firstly, lignin could exhibit a number of substantial properties as a component of fiber

which could apply to have anticancer, antibacterial, antifungal and antiviral activity. Then, phenol acids are the potent antioxidants which help prevent cancer and the blood vessel injury that could cause atherosclerosis and have mild anti-inflammatory properties.

Based on the benefits, bamboo shoots can lead the alternative food either fast or canned food. The nutrients also can prove that the safety consumption based on health in society. But there are some risks that bamboo shoots still have problems in preservation ways. Some of bamboo sprout still use conventional ways that need efforts to keep them well such some preservation might be applied to spend natural resources in a significance amounts such as salt, boiled water, turmeric and the crucial ways that borax as the synthetic chemicals become the preservation in bamboo canned. Furthermore, there must be a preservation which can be led by safety environment and food for society. Nowadays, liquid smoke will be an alternative one as the natural preservation in fish, not only on animal but also in some vegetables. It is the right path to use liquid smoke as the preservation in bamboo sprout canned because the composition of liquid smoke can reduce the risks of dangerous effects for human body. The materials that contain in liquid smoke are the natural materials such as coconut shell as the burning material which is converted into liquid. Then, the liquid has boiled to be liquid smoke that brings phenol, 4-methyl phenol, dodecanoate ethyl, methyl ester, tetradecanoate acids and 2-methoxy-4metilphenol which can use for bio-preserved in food especially for canned food.

According to Suzuki et al. [1], there are 16 major bamboo types traded in the international market such as bamboo shoots. The overview of world trade in 2012, the global export value reached USD 276 000 000, the world export of bamboo products are accounted for 15 % and growing steadily year by year. It remained around USD 220 000 000 before 2010 and up to USD 276 000 000 in 2012. Japan is the largest importer in 2012, some USD 160 400 000 worth of bamboo shoots have been imported and accounting for 59 % of the world import. The EU and USA also the important importers, there was a USD 55 200 000 import value by the EU and USD 40 400 000 by USA, respectively accounting for 20 % and 15 % of world import. Japan, EU and USA make up 95 % of the world total. Therefore, there is a big opportunity in ASEAN community to rise up the bamboo shoots consumption based on natural preservation to get some profits and safety food in the future by liquid smoke. There are some enormous examples of bamboo products in bamboo shoots that will be important for national economic and international trade based on their quality and value.

TABLE 1: Bamboo products and their value.

| | Quantity 1 000 t | | | Value (million USD) | | |
|----------------------------|------------------|--------|--------|---------------------|-------|-------|
| | 1 990 | 2 000 | 2 005 | 1 990 | 2 000 | 20 05 |
| China | | | | | | |
| Bamboo shoots | 82 | 346 | 467 | 193 | 539 | - |
| Bamboo building timber | 165 | 400 | - | - | - | - |
| Bamboo pulp | 177 | 300 | 500 | - | - | - |
| Utensils | 90 880 | - | - | 10 | | |
| India | | | | | | |
| Bamboo shoots | - | - | 8 | - | - | 1 |
| Utensils | - | - | 6 | - | - | - |
| Other plant products | - | - | 4 | - | - | 13 |
| Indonesia | | | | | | |
| Bamboo shoots | - | - | 1 | - | n.s | - |
| Republic of Korea | 2 | 1 | - | n.s | 2 | - |
| Myanmar | 11 992 | 20 418 | 73 988 | 49 | 25 | 47 |
| Bamboo shoots | n.s | 1 | 1 | n.s | n.s | n.s |
| Utensils | 354 | 296 | 459 | 47 | 20 | 20 |
| Other plant products | 11 638 | 20 121 | 73 528 | 2 | 5 | 27 |
| Philippines (utensils) | 45 | 72 | - | 2 | 3 | - |
| Turkey (ornamental plants) | - | 3 | 4 | n.s | - | - |

Table 1 represents a summary of the bamboo products and value presented in country reports. The current status of bamboo statistics are scattered and incomplete according to the submitted data which are collected using various methodologies. It is potential to reduce pressure on naturally generated forests which is recognized as a wood substitute. The fuelwood or charcoal are 40 % recorded removal from forests according to [2].

2. Literature review



Figure 1: Bamboo shoots.

2.1. Bamboo shoots composition

Bamboo shoots are the plant cultivation of bamboo products. They have significant positives alternative for health benefits especially in food resources. The compositions of nutrients, minerals and vitamins are:

TABLE 2: The nutrients of bamboo shoots.

| Nutrients | Minerals | Vitamins |
|-------------------|----------------|-----------------|
| Dietary Fiber 9 % | Potassium 15 % | Vitamin B6 12 % |
| Carbohydrate 2 % | Manganese 13 % | Thiamin 10 % |
| Protein 5 % | Copper 9 % | Vitamin C 7 % |
| Calories 1 % | Zinc 7 % | Vitamin E 5 % |

The young, edible bamboo plants that just emerged from the ground are bamboo shoots which are generally 20 cm to 30 cm, weight almost to a pound (0.453 592 kg) and tapering at one end. Their weight and size are depending on noticeable location, depth and nutrition of the soil, watering and drainage conditions, temperatures, pH and soil fertility. The temperature climate of bamboo runs while shoots in the spring and claspers, while in the late summer and fall. They will become tough and woody

to delicate their aroma when they allowed growing well such as in the late summer and fall, the shoots manufacture sugars in the rhizome that produce the roots. The tiny hairs of bamboo shoots cover the shoots by the sheaths which are black, brown, yellow or purple.

Fresh bamboo shoots can be stored in the refrigerator for up to two wk which will be a bitter taste if kept longer than this and sunlight exposes the shoots. The refrigerator which is unpeeled bamboo shoots in the crisper drawer, they can be also either cooked or frozen.

2.2. Quality of bamboo shoots

As one of the favorite food around the world, bamboo shoots become as the choice of significantly Asian cuisine. In contrast, the processing and marketing industry of bamboo shoots are hardly organized. The products are weak in standardization but bamboo shoots can highlight the benefits according to their physical, chemical, nutritional, sensory and antimicrobial qualities which could be derived from them. Firstly, the white meat will turn to yellowish and revealed when the Culm sheath is peeled off then cooked on the day of harvest, it will be very sweet taste. Although the cyanogenic glycosides, called taxiphyllin, [2-(b-D-glucopyranosyloxy)-2-(4-hydroxyphenyl) acetone rile are known very bitter. Secondly, they are low in fat and cholesterol but very high in potassium, carbohydrate and dietary fibers. Furthermore, vitamins, amino acids and anti-oxidants are activematerials in bamboo shoots could be processed in food processing industries into beverages, medicines or health foods. Thirdly, they contain 0.5 % low total fats, 5.70 % high carbohydrates, 3.9 % proteins, 1.1 % minerals and 88.8 % moisture which can decrease the total serum and serum LDL cholesterol in rats and total liver lipids $1.61 \text{ mg} \cdot \text{L}^{-1}$ of liver cholesterol. They also contain some minerals elements which can helpful for growth and development of children called lysine and useful for anti-aging properties called germaclinium. Some materials also can be extracted from bamboo shoots such as flavones, phenols and steroids which are important edible. Then, they have potentially toxic cyan glycoside which turn on disruption of the plant cell from hydrolytic enzyme and decomposes as an aldehyde or a ketone into hydrocyanic acid. The acid varies depending upon genetic and environmental factors, location of cultivation, season and soil type even though the homo-geneticist acid is for pungent taste of bamboo shoots. However, sugar contents, amino acids contents such as acid, glutei acid, glycogen and tannin which influence the

taste. While the deliciousness taste is covered by amino acids and tannins decrease by increasing the offensive taste.

Based on the antimicrobial qualities, bamboo shoots can be extracted into capsules and tablets. Bamboo shoots usually used as appetizers and they can use for cleaning wounds, mixed with palmjaggery to induce parturition and abortion. *B. vulgaris*, sap from the inside of bamboo shoots can be used for curing jaundice which is filled with antimicrobial qualities and used in preparation of steroidal drugs in Java. In medicine, antioxidant becomes the form in South East Asia and used in natural preservative in Japan.

TABLE 3: Traditional fermented bamboo based food products.

| Country | Items |
|------------------------------|---|
| Indonesia | <i>Gulei rebung, sayur lodeh</i> |
| Thailand | <i>Naw-mai-dong, naw-mai-dorng</i> |
| Vietnam | <i>Used as vegetables, in stir-fry dishes</i> |
| Philippines | <i>Labong, Ginataang Labong, Dinengdeng na Labong</i> |
| Nepal and Bhutan | <i>Alu-tama, Tchang, Mesu</i> |
| India (NE states and Orissa) | <i>Khorisa-tenga, Ushoi, Shoibun, Soidon, Iromba, Ekung, Hiring</i> |

2.3. Liquid smoke as natural preservative

The use of liquid smoke as an alternative for food product preservative should exist in Indonesia because some countries has implemented it into their products such as UK, Canada, Japan, etc for more than 50 yr. Liquid smoke is the product of preservative from coconut shell extraction which has benefits as agricultural waste to be used in food preservatives. It use the waste of coconut shell as one of plenty natural woods in Indonesia that are potential to be used as raw material of liquid smoke.

Wood preservative development as an environmentally-friendly is needed to replace synthetic chemicals. The use of pyrolytic tar from biomass fast pyrolysis, pyrolysis oil, pyroligneous acids from slow pyrolysis as wood preservatives [3-5]. Wood carbonization process for charcoal production produces liquid by-products and the lighter fraction is pyroligneous acids called *Nam Sam Kwan Mai* which must be decanted for sediment tar [6]. The acids also have been applied in agricultural and veterinary purposes. The main variables that determine liquid smoke product yield

and characteristic are temperature, rate of heat transfer, particle size, atmosphere of pyrolysis, vapor and composition biomass. The impart flavor, color, texture use for providing enhanced shelf life for food products.

Chemical compound is contained of thousands small of group smoke which tend to have similar structure both in vapors and droplets but different in the quantity depending the hardness wood. The carcinogenic compound shows the possibility of improper smoking process [7]. It is important that the implementation of liquid smoke can be used widely in Indonesia as natural preservative.

2.4. Liquid smoke application in canned food

Canned food using liquid smoke technology have been widely used in foodstuffs such as meatball and fish preservation through 1.0 % to 5 % liquid smoke. Meanwhile, liquid smoke application for increasing the shelf of canned food still has not observed yet. Thus, this research conduct to know the effect of liquid smoke as natural preservation in canned food through food technology application.

Meatball smoked processing have been begun through 0 %, 1 %, 1.5 %, 2 % and 2.5 % concentration of liquid smoke which have been dissolved in aquadest. The meat which has been cleaned then saturated in liquid smoke concentration for 30 min. After that, the meat is dried in 40 °C to 80 °C for packaging in canned food.

3. Materials and Methods

3.1. Chemical processing of liquid smoke

Generally, liquid smoke process contains three steps that are pyrolysis, condensation and re-distillation. According to [8], liquid smoke has some compositions such as: 81 % to 92 % water, 0.22 % to 2.9 % phenol, 2.8 % to 4.5 % acids, 2.6 % to 4.6 % carbonyl and 1 % to 17 % tar. Meanwhile, according to Bratzler et al. [9], the main condensate of wood smoke is 24.6 % carbonyl, 39.9 % carboxylate acids, 15.7 % phenol. The smoke components use for anti-microbial, anti-oxidant, aroma controlling, flavor and color. Studies from, liquid smoke from coconut shell contains seven main components which are phenol, 3-methyl-1,2-siklopentanon, 4-ethyl-2-methoxyphenol,

2-methoxy-4-methylphenol, 4-ethyl-metoxyphenol, 2,6-dimethoxyphenol and 2,5-dimethoxy benzyl alcohol [10], and the important components of liquid smoke are 1,2-benzendikarboksilat and diethyl ester which can produce 4.27 % to 11.30 % acetate acids, 2.10 % to 5.13 % phenol and 8.56 % to 15.32 % acetone.

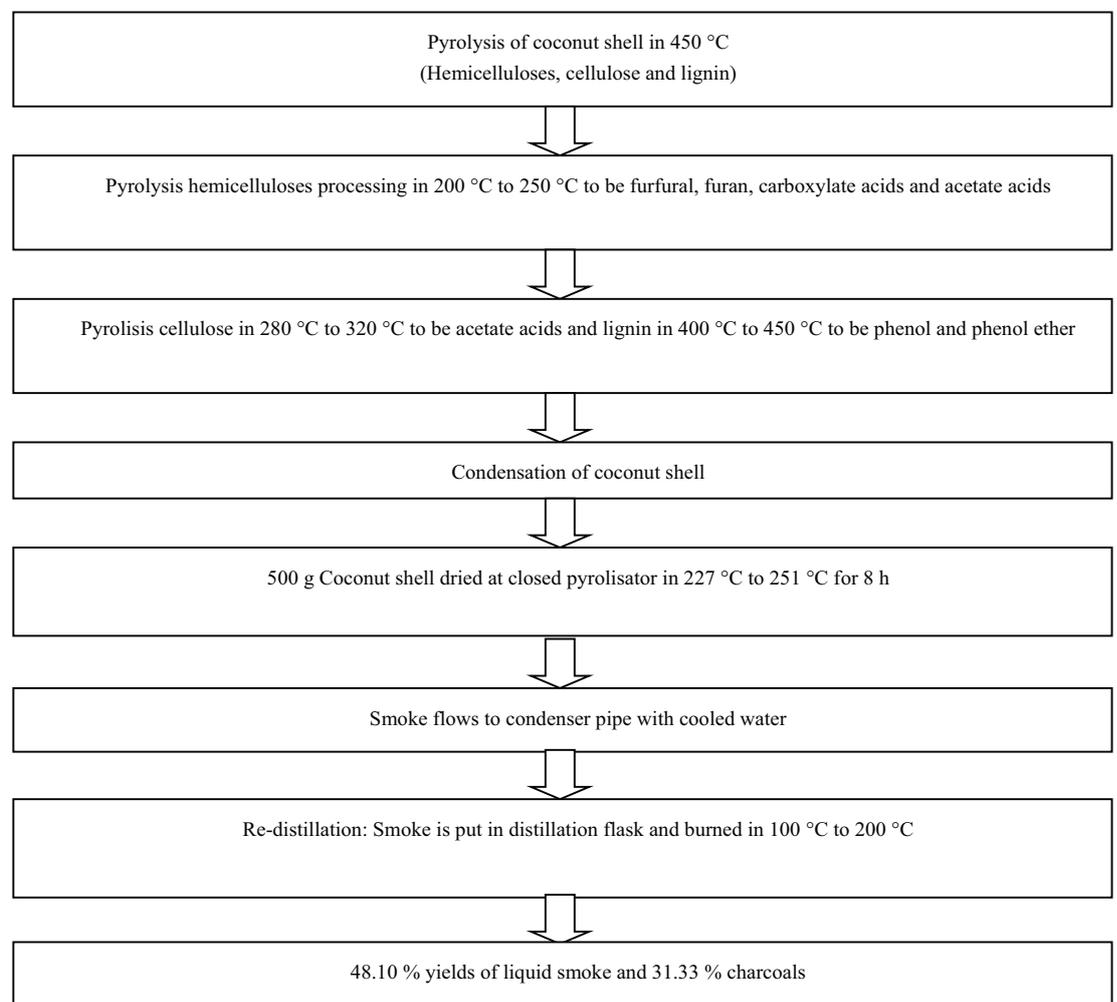


Figure 2: Liquid smoke processing.

3.2. Bamboo shoots using liquid smoke as preservation

The main characteristic of liquid smoke that is compatible as natural preservation because of the phenol, carbonyl and acids contents. Those have strong ability to preserve and coloring of food products. Moreover, those strong components could increase the preservation lifetime as antibacterial, antioxidant, aroma and coloring. According to standardization of preservative, determines the smoke food safety.

TABLE 4: Quality Requirements and Smoke Food Safety.

| Component | Unit | Requirement |
|------------------|-------------------|---------------------------|
| Organoleptic | 1 to 8 | Minimal 7 |
| ALT | colony/g | Maximal 1.5×10^5 |
| Escherichia coli | APM/g | Maximal > 3 |
| Salmonella | /25 g | Negative |
| Vibrio cholera | /25 g | Negative |
| Staphylococcus | colony/g | Maximal 1.0×10^3 |
| Water | Mass fraction (%) | Maximal 60 |
| Histamine | mg/kg | Maximal 100 |
| Salt | Mass fraction (%) | Maximal 4 |

Below is the preparation of bamboo shoots diagram using liquid smoke which is as natural preservation.

The preparation of bamboo shoots could be proceed using conventional ways regarding the demand products which is suitable for home industry to prepare their consumer needs. Based on that, the industries could count their income directly by slicing the bamboo. The preparation would not spend much more time if the industry could anticipate their needs. However, it must present a convenient technology to preserve the bamboo shoots while slicing, weighing, draining, oiling, pre-cooking until incubation step that could ease and accelerate the preparation through some tools.

Furthermore, one of the significant steps above is when the food is oiled by liquid smoke which is directly into the canned. Smoking technology appears the suitable way for vast industry to increase their income in bamboo shoots product. Liquid smoke also could be made by people themselves that is not only for bamboo shoots but also for another food regarding to be preserved. This technology accomplishes food application process in marketing area through canned food because of the liquid smoke processing.

Therefore, canned food becomes one of the right modeling to introduce conventional food that could be sold in ASEAN through science and technology packaging. It would rise the capacity of tourism interest for buying bamboo shoots product in canned food that could be found in their home countries especially South East Asia. This would be a comprehensive way to vast this product through ASEAN food marketing regarding canned food that could ease to be consumed everywhere.

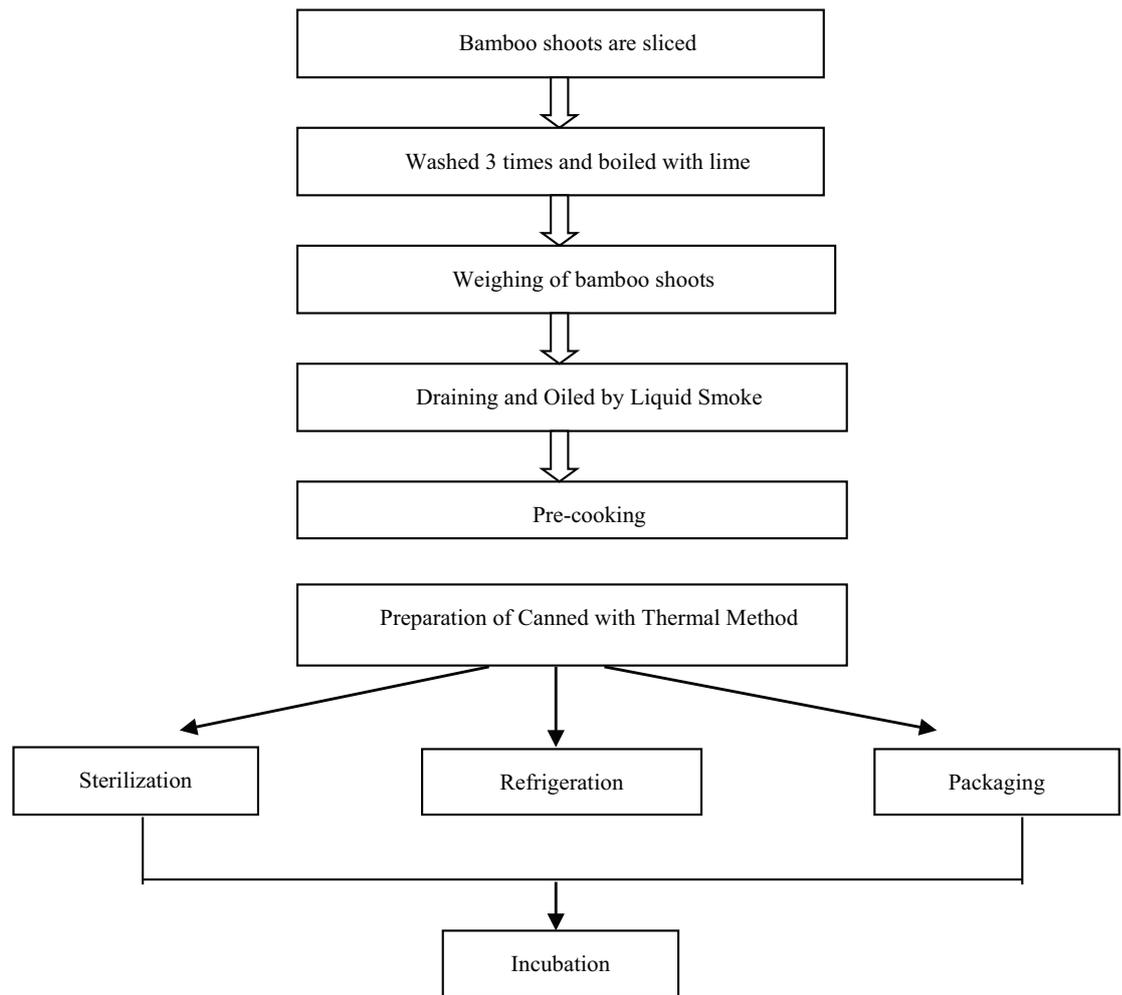


Figure 3: Bamboo shoots preparation.

4. Results and Conclusions

According to the liquid smoke that can be used for food products as natural preservation, bamboo shoots have some benefits including their health nutrients and also the cultivation of bamboo to preserve by liquid smoke. In addition, not only as the preservation, but also the competitive new products of bamboo shoots that is beneficial for canned food by thermal method. It also can be counted by the effectiveness of coconut shell for canned food preservative. The desirable facts for using liquid smoke as natural preservation are gaining more safety in food preservation, low cost preparation to preserve and ease to be applied in home industry.

When the food is preserved by using liquid smoke, it could deserve a benefit to serve the food using canned materials which would impress people to consume in sufficient way through the size and packaging. Smoke technology in liquid smoke could accelerate the preservation directly into the canned which could guarantee the



Figure 4: Bamboo shoots product.

food based on their health nutrients. The technology also has spent low cost to be produced because it has used materials from coconut shell that is wasted in some areas. Moreover, it would become a recycle and reused application to reduce waste in our environment to be more effective and efficient in the future.

Bamboo shoots have been as the commercial food products in South East Asian which are imported in much numbers rather than exported by themselves. It becomes the tragic phenomena if bamboo shoots still cannot be implemented to be one of country investments in food security. According to Fig.4, spring rolls from Semarang which is used bamboo shoots for food marketing but it is too rarely that the production in canned food as a souvenir either for tourism or society consumption in ASEAN regional. However, spring rolls have not being an identity yet to introduce as the food resources that could lead Southeast Asia marketing. In Indonesia, spring rolls only consume for primer consumption rather than as the tertiary ones which could be sold in traditional market neither in national market nor international market. The phenomena require science and technology to raise spring rolls production through food marketing area.

The food that contains bamboo shoots must be safety and health to be consumed around the world in the future. According to this, liquid smoke could be as an innovative and valuable ways for preserving the bamboo shoots canned for food products that

could be exported more. Liquid smoke also becomes the new application which could preserve food in canned and its composition including some nutrients; it is not like the preservation which could give dangerous effects such as cancer in long term. The safety components of liquid smoke as natural preservation squeeze the bamboo shoots to be healthier in canned food. The main importers and exporters of bamboo shoots for food products are rarely from Indonesia and the highest ones is Japan which is the South East Asian regions. Therefore, it leads the spring rolls to be the main food in ASEAN especially in Indonesia to be produced through liquid smoke technology in canned which could be applied by home industry to go their income up.

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