Potential Tempe Product of Universitas Sumatra Utara in Supporting Food Security in North of Sumatera, Indonesia

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Abstract. Tempe, a traditional Indonesian food which high-level vegetable protein. Tempe contains of vitamin B, calcium, iron, fiber, antioxidants and antibiotics. Various types are identified in Indonesia called are soybean tempe, gembus tempe, koro bean tempe, green bean tempe, red bean tempe, menjes tempe, lambtoro tempe, lupine tempe, seeds munggur tempe, kratok tempe, cassava tempe and bongkrek tempe. This research was conducted by UD Berkah and Product Tempe of Universitas Sumatera Utara on June 2018 until July 2018 at Pasar 1 Tanjung Sari Medan, North of Sumatera. The main ingredients used are soybeans, chocolate bars, milk milo powder, green tea powder, and chilli powder to add flavours of various processed of tempe. The tools used are cutting knife, stove, plastic presses, plastic packaging. The number of products Tempe of Universitas Sumatera Utara are 200 packs in plastic @100 mg, 250 mg and 500 mg per weeks. Tempe sold in mendoan tempe, tempe of chips, flavoured green tea tempe, red chilli tempe, and chocolate tempe are very popular in community of Medan, North Sumatra. University of North Sumatra offers solutions to solve problems of partners (Small and Medium Enterprises = SMEs) UD Berkah and Product Tempe of Universitas Sumatera Utara with provision of drilled and slicing machine of tempe, improve of human resources and processing technology and marketing used by media mass and online. The potency of processing tempe of various forms and flavours into high nutritious food products is predicted to support community food security in Medan, North of Sumatera.

1. Introduction
Tempe, traditional food has been known for centuries, especially in the cultural of Javanese society, especially in Yogyakarta and Surakarta. "Tempe", for example by mentioning the name of dish jae santen tempe (a kind of tempe with coconut milk) and kadhele tempe srundengan (In chapters 3 and chapter 12 of Serat Centhini manuscript). The other available historical records the tempe was originally produced from black soybeans, derived from traditional rural Javanese societies - possibly developed in the Mataram area of Central Java, and developed before the 16th century. In the age of Java Kuno, there is a white food made from sago flour called tumpi. Fresh white tempe is seen to have similarity with the food of the tumpi. From 1875 in a Dutch-Javanese dictionary, another source said that tempe making began in the era of Cultivation in Java. At that time, the people of Java were forced to use the results of the yard, such as cassava, sweet potatoes and soybeans, as a source of food. In addition, there is also an opinion that tempe may be introduced by Chinese people who produce similar foods, ie fermented soy koji1 using Aspergillus fungus. Furthermore, the technique of making
tempe distributed throughout Indonesia, in line with the spread of Java society migrate to all parts of the country [1].

Indonesia is the largest tempe producer in the world and the largest soybean market in Asia. As much as 50% of Indonesian soybean consumption is made in the form of tempe, tofu by 40%, and 10% in other products (such as tauco, soy sauce, etc.). The average consumption of tempe per person per year in Indonesia is estimated at around 6.45 kg. At the time of Japanese occupation in Indonesia, prisoners of war who were fed tempe were spared from dysentery and malnutrition. According to Onghokham, the protein-rich tempe has saved the health of Indonesia's densely populated and relatively low-income residents. In the late 1960s and early 1970s there were a number of changes in the manufacture of tempe in Indonesia. Plastics (polyethylene) replaces banana leaves to wrap tempe, leaf-based yeast (produced in 1976 by the Indonesian Institute of Sciences and mostly used by the Indonesian Tempe Producers Cooperative, Kopti) began to replace traditional laru, and imported soybeans [2].

Tempe production increased and industry began to be modernized in the 1980s, thanks in part to Kopti's presence on March 11, 1979 in Jakarta and in 1983 had more than 28,000 tempe, oncom and tofu producers [3]. The technical standard for tempe set forth in the Indonesian National Standard and applicable since 9 October 2009 is SNI 3144: 2009. In this standard, soybean tempeh is defined as "the product obtained from the fermentation of soybean seeds using Rhizopus sp."

In 1895, Prinsen Geerlings (chemist and microbiologist from the Netherlands) made the first attempt to identify of tempe. The first tempe company in Europe was started in the Netherlands by immigrants from Indonesia and popular since 1946. Later, in 1958 by Yap Bwee Hwa, the first Indonesian to conduct scientific research on tempe. In Japan, tempe was studied since 1926 but only started commercially produced around 1983. In 1984, there were 18 tempe companies in Europe, 53 in America and 8 in Japan. Tempe were founded in the People's Republic of China, India, Taiwan, Sri Lanka, Canada, Australia, Latin America and Africa too.

Tempe is a food made from fermentation to soybean seeds or some other ingredients that use several types of Rhizopus molds, such as Rhizopus oligosporus, R. oryzae, R. stolonifer or R. arrhizus. This fermentation preparation is commonly known as "yeast tempe". Tempe is widely consumed and produced is not only in Indonesia, but is worldwide. Indonesia is also trying to develop a superior strain of Rhizopus to produce a faster of Soja sp, quality, or improve the nutritional content of tempe [4], [5], [6]. According to [7], [8], [9], [10] are benefits of tempe consists:

a. Protein contained in tempe is very high, easily digested so as to overcome diarrhea.

b. Contains iron, an antioxidant flavoid to decrease blood pressure.

c. Contains superoxide desmutase that can control radicals free, good for heart patients.

d. Anemia prevention. Anemia is characterized by low levels of hemoglobin because of the lack of availability of iron (Fe), copper (Cu), zinc (Zn), protein, folic acid and vitamin B12, in which the elements are contained in tempe.

e. Anti infection. Survey results show that tempe contains anti-bacterial compounds produced by coral tempe (R. Oligosporus) is a useful antibiotic minimize the incidence of infection.

f. Hypocholesterol Power. The content of polyunsaturated fatty acids in tempebersifat can lower cholesterol levels.

g. It has anti oxidant properties, refuses cancer.

h. Prevent multiple nutritional problems (due to deficiency and excess nutrients) along with various diseases that accompany it, both of degenerative infection.

i. Prevent the occurrence of hypertension.

j. High calcium content, tempe can prevent osteoporosis.i.e. Anti infection. Survey results show that tempe is contain of anti-bacterial compounds produced by coral tempe (R. oligosporus) is a useful antibiotic minimize the incidence of infection.

2. Materials and Methods
This research was conducted on June 2018 until July 2018 at Pasar 1 Tanjung Sari Medan, North of Sumatera. The main ingredients used are tempe from soybeans, chocolate bars, milk milo powder,
green tea powder, and chilli powder to add flavours of various processed of tempe. The tools used are cutting knife, stove, plastic presses, plastic packaging.

3. Results and Discussions

3.1. Making Process of Tempe
In Indonesia, there are various methods of making tempe, generally consists of boiling, stripping, soaking and acidification, leaching, inoculation with yeast, packing, and fermentation [11], [12], [13], [14], [15] such as described into below.

3.1.1. Boiling
In the early stages of making tempe, soybean seeds are boiled. This boiling stage serves as a hydration process, that is to make soybean seeds as much as possible. Boiling is also intended to soften the soybeans so that later can absorb the acid at the immersion stage.

3.1.2. Peeling
Seed soybean skin peeled at stripping stage so that the fungi will be produces of mycelium can penetrate the soybean seed during the fermentation process. Peeling can be done by hand, trampled with legs, or with seeds paraphernalia.

3.1.3. Immersion and Acidification
After peeling, soybean seeds soaked. The purpose of the immersion stage is to hydrate the soybean seeds and allow the occurrence of natural lactic acid fermentation in order to obtain the acidity required for the growth of the fungi. Fermentation of lactic acid occurs characterized by the appearance of the acidic smell of and buih in the immersion water due to the growth of Lactobacillus bacteria. When the lactic acid bacteria growth is not optimum (eg in countries of tidy, acid needs to be added to the water of immersion) lactic acid fermentation and acidification is also beneficial to increase nutritional value and eliminate toxic bacteria.

3.1.4. Washing
The final washing process is carried out to remove any dirt that may be formed by lactic acid bacteria and to keep the soybean seeds off. Bacteria and faeces can inhibit fungi growth.

3.1.5. Inoculation with Yeast
Inoculation is done by addition of inoculum, ie yeast tempe or laru. The inoculum may be a mold that grows and dried on a waru or teak leaf (called usar, traditionally used), spore mould of tempe in flour medium (wheat, rice, or tapioca, sold in the market), or pure of R. oligosporus culture tempe in outside of Indonesia). Inoculation can be done by two steps, namely (1) dispersion of inoculum on the surface of cold and dried soybeans, then mixed evenly before wrapping; or (2) the inoculum may be mixed immediately at the time of immersion, allowed to remain for a while, then dried.

3.1.6. Wrapping and Fermentation
After inoculation, the soybean seeds are wrapped or placed in a container for fermentation. Various wrapping materials or containers can be used (eg banana leaves, waru leaves, teak leaves, plastics, glass, wood, and steel), as long as it allows air entry because the mold needs oxygen to grow. Leaf or plastic wrapping materials are usually stuck with punctures. The seeds of the wrapped soybeans are left to process the fermentation process. In this process the mould grows on the surface and penetrates the soybean seeds, uniting them into tempeh. Fermentation can be performed at a temperature of 20°C-37°C for 18-36 hours. The shorter fermentation time is usually for tempe which uses much higher inoculum and temperature, while traditional process using laru from leaves usually takes fermentation time up to 36 hours [16], [17] and [18].
3.2. Appropriate Technology (AT)
Appropriate technology (AT) is a technology tailored to the needs within a certain timeframe to improve the welfare of the community [18]. In the application of AT, must be taken into account some fundamental aspects, namely: (1) Selection of types and levels of technology to be implemented should be done by the user community with (2) The need to pay attention to the culture of the user community, (3) the need to share tasks in the implementation of technology by the user community, (4) Please note the environmental conditions of the user community, both from natural resources and human resources, 5) It is important to note the availability of facilities required in the operation, maintenance and upgrading of the technology to be used, (6) Please note the security aspects during the application of technology [19].

The policy of utilizing AT in the formulation of regulation has been regulated in the term "Regional Initiative" of Regional Autonomy Number 4 of 2001. The objectives are to: (1) "increase the knowledge and skills of the community in using AT for capacity building and production quality, (2)" information services and help people to get the required of AT, (3) "increase the added value for the economic activities of the community" (4) "Increase the competitiveness of the superior product area [20]."

Professor Dr. Ir. C. Hanny Wijaya from Department of Food Science and Technology, Faculty of Agricultural Technology, Bogor Agricultural University (IPB) makes the right technological innovations that can accelerate the process of making of tempe so it can save costs. This technology is expected to be a solution to overcome quality problems that are less constant if done with traditional methods.

"Fast Tempe" is a tempe made with chemical acidification using Glucono Delta-Lactone (GDL) to reduce the duration of soybean acidification. Fast Tempe Technology has an eco-friendly advantage for saving water and reducing wastewater dyeing and speeding up the process of making of tempe. In addition, the resulting tempe has a more stable quality and taste [18].

"The advantages that exist in this technology are expected to contribute in overcoming quality, environmental and economic problems faced by tempe craftsmen scattered throughout Indonesia," said Prof. Hanny. According to Prof Hanny, this technology can also be an alternative solution for local governments as well as regulatory agencies Micro Small and Medium Enterprises (SMEs) and the environment in performing its role as a determinant of policy and public service agencies.

The number of planned products is 200 packs in plastic measuring 100 mg, 250 mg and 500 mg per weeks from Small and Medium Enterprises/SMEs of UD Berkah and Product Tempe of Universitas Sumatera Utara. Tempe sold are mendoan tempe, tempe of chips, flavoured green tea tempe, red chilli tempe, and chocolate tempe are very popular in community of Medan, North Sumatra. University of North Sumatra offers solutions to solve problems of partners (Small and Medium Enterprises = SMEs) with provision of drilled and slicing machine of tempe, improve of human resources and processing technology and marketing used by media mass and online.

3.3. Various Tempe Made from Soybeans
Table 1 shows the composition of the processed tempe produced and in the distribution of weekly discharge of Product Tempe Universitas Sumatera Utara in Pasar 1 Tanjung Sari, consisting of tempe mendoan, tempe of chips, flavoured green tea tempe, red chilli tempered chocolate tempe. The most popular tempe is the tempe and chocolate tempe tempo, while the least consumed is red chilli tempe and Flavoured green tea tempe.
Table 1. Composition of the processed various tempe produced in Pasar 1 Tanjung Sari, Medan, Northern Sumatera

| No | Types of Tempe         | Quantity packages in week (total in Rp) | Noted  |
|----|------------------------|----------------------------------------|--------|
|    |                        | 100 g                                  | 250 g  | 500 g  |        |
| 1  | Mendoan tempe          | 30@2000 (60.000)                       | 30@5000 (150.000) | 30@10000 (300.000) | Week   |
| 2  | Tempe of chips         | 50@3000 (150.000)                      | 50@6000 (300.000) | 50@12000 (600.000) | Week   |
| 3  | Flavoured green tea tempe | 30@5000 (150.000)                  | 30@10000 (300.000) | 30@15000 (450.000) | Week   |
| 4  | Red chilli tempe       | 30@5000 (150.000)                      | 30@6000 (180.000) | 30@15000 (450.000) | Week   |
| 5  | Chocolate tempe        | 60@5000 (300.000)                      | 60@10000 (600.000) | 60@20000 (1.200.000) | Week   |

Figure 1. Flowchart of various tempe processing of Universitas Sumatera Utara

Figure 2. Drilled Machine of Tempe
4. Conclusions
The number of products various tempe are 200 packs in plastic @100 mg, 250 mg and 500 mg per weeks. Tempe sold in mendoan tempe, tempe of chips, flavoured green tea tempe, red chilli tempe, and chocolate tempe are very popular in community of Medan, North Sumatra. University of North Sumatra offers solutions to solve problems of partners (Small and Medium Enterprises = SMEs) UD Berkah and Product Tempe of Universitas Sumatera Utara with provision of slicing machine tempe, improve of human resources and processing technology and marketing used by media mass and online. The potency of processing tempe of various forms and flavours into high nutritious food products is predicted to support community food security in Medan, North Sumatra.

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