Optimization on Maltodextrin Concentration and Inlet Spray Drying Temperature in Producing Edamame (Glycine max L. Merr.) Milk Powder: Nutritional and Microbiological Profile

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Abstract. Edamame powdered milk products have not produced on an industrial scale until the present. It is an excellent opportunity to develop nutrient-rich edamame to become a product with a high global market demand. The production of edamame milk powder has essential factors that contribute to sensory attributes, there is a concentration of maltodextrin as a filler and also encapsulating agent and inlet temperature of spray drying inlet for producing milk powder. The research aims to determine the optimal concentration of maltodextrin and inlet spray drying temperature to produce edamame milk powder based on the response of sensory analysis. Based on the results of the study, the concentration of maltodextrin 129.91 g/L (12.99%) and the spray dryer temperature 131°C were the optimal factor points of the sensory attribute responses analyzed using a nine-scale Hedonic Scale Scoring. Color with response 8.5, aroma 8.25, taste 7.8, and texture 8.35. The optimal product has a moisture content of 2.31 ± 0.04%, total dissolved solids of 19.89 ± 0.02°Brix, the solubility of 95.23 ± 0.38%, and yield of 24.25%.

Keywords: Optimization, Mattodextrin Concentration, Inlet Spray, Edamame

1. Introduction
Edamame is an immature soybean that commonly harvested before its mature age and already in the pod. The main differences between edamame and soybeans are size, color, hardness, aroma, and also nutritional content. Edamame contains high levels of protein, sucrose, phytoestrogens, steroids, ascorbic acid, β-carotene, vitamins B1 and B12, and fiber. Edamame has become more popular among people in developed countries. They have consumed edamame for fulfilling a healthy lifestyle.

Edamame is one of the primary export commodities from Jember, East Java. Edamame produced is intended for export to various countries, especially Japan. One of Edamame's exporter is PT. Mitra Tani Dua Tujuh located in Jember. The company produces 9,000 tons of edamame on average annually. PT. Mitra Tani Dua Tujuh produces 7,650 tons of edamame for the export market, while 1,350 tons remaining sold locally. Edamame that did not meet export quality, sold in a peeled form (Mukimame). However, selling Mukimame without any further processing did not increase its value-added. Therefore, the company looking for any method to develop Mukimame into value-added products. Based on some consideration, edamame milk product was chosen to develop.
It is an excellent opportunity to produce edamame milk powder in Indonesia because it has not produced on an industrial scale. The continuous supply of raw materials from PT Mitra Tani Dua Tujuh is one of the benefits for the company if they plan to produce edamame milk powder for the industrial scale. Edamame milk powder is also rarely found in the global market. Another reason was that edamame milk becomes an alternative source of protein for people who suffer from lactose intolerance [14]. Also, vegetarians can consume Edamame milk. Edamame milk powder also has a longer shelf life than liquid products. Hence, it becomes an advantage for processing edamame into milk (extract) powder.

The concentration of fillers and drying methods are essential to consider in producing edamame milk powder. The use of carriers or fillers may also improve the physical properties, especially the reconstitution properties of powders. In the food industry, one of the most commonly used materials as a carrier or filler is maltodextrin. Maltodextrin is hydrolysis products of starches, and they are a mixture of saccharides with a broad molecular weight distribution between polysaccharides and oligosaccharides. Maltodextrins are known to improve particle size, bulk density, hygroscopicity, solubility, and caking properties [7,8,11].

The suitable method for producing edamame is spray drying. Spray drying commonly uses in industry for converting a liquid matter into powder. Spray drying is the most widely used commercial method for drying kinds of milk because the rapid time of heat contact and the high rate of evaporation give a high-quality product with relatively low cost [14]. Spray drying is also suitably used for drying heat-sensitive materials. A spray-drying system for soymilk has characterized at various combinations of inlet air temperature, feed rate, and atomizer speed on outlet air and product temperatures, thermal, and evaporative efficiencies [16], and particle size of spray-dried soymilk powders [17]. The study aims to optimize maltodextrin concentration as filler and inlet spray drying temperature by the response of sensory attributes in producing edamame milk powder.

2. Materials and Method

2.1. Materials
Frozen-peeled edamame (Mukimame) supplied by PT. Mitra Tani Dua Tujuh (Jember, East Java, Indonesia). Mukimame stored at -10°C in the freezer before the extraction process. Maltodextrin, with a dextrose equivalent (DE) value of 15 purchased from Lihua Starch Co. Ltd. (China).

2.2. Production of Edamame milk powder using Spray Drying
Frozen edamame thawed at room temperature (±27°C) for 1 hour. Edamame ground with boiled water with a ratio of edamame:water (1:5 mass/volume) to produce puree. The hot puree was filtered using nylon filter clothes to obtain edamame milk. Maltodextrin was added to edamame milk with various concentrations (Table 1), stirred 100 rpm for 15 minutes.

Mixtures of edamame milk and maltodextrin in various concentrations were fed into a spray dryer (Buchi Mini Spray Dryer B-290, Buchi Labortechnik AG, Switzerland) by a peristaltic pump, and atomized to small droplets by a nitrogen-pressure atomizer with 4 bar air pressure in a co-current airflow system. The inlet air temperature set at various temperatures (Table 1) and constant feed flow rate at 5 mL/minutes. Finally, the powder then collected from the cyclone, and samples taken for further analysis.

2.3. Edamame milk powder characterization

2.3.1. Physical properties. The moisture content of 2 g samples determined by drying to constant mass at 110°C, according to method AOAC (2000). Total solids (°Brix) and color (L, a, b value) measured by hand refractometer (ATAGO, Japan) and color reader (Konica Minolta, Japan), respectively. Solubility (%) of edamame milk powder determined using method [19].

2.3.2. Sensory evaluation. The main observation is the sensory attribute (color, taste, aroma, and texture) using Hedonic Scale Scoring from 80 panelists [4]. Edamame powdered milk with optimal sensory attribute preference physicochemically analyzed with comparable Mandala 525 soybean milk powder.
2.3.3. Proximate analysis. Proximate analyses for fat, carbohydrate, and protein contents of the spray-dried edamame milk powder were carried out using AOAC methods [20]. All tests were carried out in triplicate and the mean calculated.

2.3.4. Vitamin content. Determination of vitamin B1 (thiamin), B2 (riboflavin), B9 (folic acid) conducted by modification of method developed by [15] using ultra-performance liquid chromatography (UPLC) with photometric diode array (PDA) detector. Vitamin A, C, D, and E determined using high-performance liquid chromatography (HPLC) coupled with DAD detector. Vitamin B12 (Cyanocobalamin) and K determined using liquid chromatography-mass spectrometry (LC-MS-MS) with a PDA detector.

2.3.5. Microbial content. Total plate count (TPC) of edamame milk powder value was carried out using the Indonesian National Standard (SNI) 2970:2015 point A.10.2. Total Mold count analyzed using ISO 21527 – 2:2012 method. Salmonella sp. content determined using SNI 2970:2015 point A.10.2. Method of SNI ISO 4831:2012 conducted to determined Coliform content.

2.4. Statistical analysis
This study has an experimental design type Central Composite Design (CCD), with two factors. The first factor is the concentration of maltodextrin (gram/liter or g/L) with the lowest value of 50 g / L and the highest 200 g / L. The second factor is the temperature of the spray dryer (°C) with the lowest value of 120°C and the highest value of 140°C. Response Surface Methodology using for optimization. Table 1 shows the optimization design used in this research. Data processed using Design Expert 7.1.5 software.

| Optimization parameters | Response |
|-------------------------|----------|
| Maltodextrin concentration (g/L) | Inlet spray dryer temperature (°C) | Color | Aroma | Taste | Texture |
| 18,93 | 130,00 | | | | |
| 50,00 | 120,00 | | | | |
| 50,00 | 140,00 | | | | |
| 125,00 | 115,86 | | | | |
| 125,00 | 130,00 | | | | |
| 125,00 | 130,00 | | | | |
| 125,00 | 130,00 | | | | |
| 125,00 | 130,00 | | | | |
| 125,00 | 144,14 | | | | |
| 200,00 | 120,00 | | | | |
| 200,00 | 140,00 | | | | |
| 231,07 | 130,00 | | | | |

3. Results and Discussion
3.1. Physical properties and sensory attributes evaluation
Optimization of variables in the production of edamame milk powder showed that the optimum concentration of maltodextrin was 129.91 mg/L, and inlet spray dryer temperature was 130.84°C, and it rounded to 131°C during verification. The analysis was carried out on the chemical and physical characteristics of the final product. The results of the analysis compared to commercial instant beverage products “New Mandala Instant Powder Soybean 525” taste was chosen as the control aiming to determine the position of sugarless edamame powder milk for products that have been circulating in the market in terms of physical and chemical.
Physical properties and sensory attributes evaluation of edamame milk powder and edamame milk shown in Table 2. The results of water content analysis in edamame milk powder at optimum condition were 2.31%, while the control sample had a moisture content of 2.07%. The results of the paired t-test (α = 0.05) in both samples produced a p-value of 0.001 (p < 0.05) so that the water content values between the two samples were significantly different. According to SNI [3], the water content of milk powder is 5% w/w maximum. So, the standard water content of edamame powdered milk, which is optimal based on sensory attributes have met Indonesian National Standards.

The results of the statistical analysis of the test stated that the four responses namely color, aroma, taste, and texture between predictions and verification were not significantly different because it has a p-value of more than 0.05, which is color 0.443, aroma 0.263, taste 0.374, and texture 0.145. The results stated that the results of the design expert software optimization were appropriate to be applied. Total solids in units of °Brix represent solids dissolved in a solution or the like. Solids in edamame milk in this study came from edamame and additives, namely maltodextrin and salt. Edamame has solids that contribute to the analysis of total solids, namely protein, carbohydrates, and other nutrients. The results of the analysis of total solids in steeping edamame powdered milk with controls were 19.89% and 24.87%, respectively. The paired-t analysis shows that both are significantly different from those indicated by the p-value of 0.000 (p-value <0.05). It is allegedly caused by the composition and composition of the two different types so that the ability to dissolve the solids is different due to the total solids detected by the tool from the two samples showing different results.

### Table 2. Physical properties and sensory attributes evaluation of edamame milk and soybean powder

| Parameters          | Edamame Milk Powder | Instant Soymilk Powder | Notation |
|---------------------|---------------------|------------------------|----------|
| Water content (%)   | 2.31 ± 0.04         | 2.07 ± 0.05            | s        |
| Total Solid (%) brix| 19.89 ± 0.02        | 24.87 ± 0.10           | s        |
| Solubility (%)      | 95.23 ± 0.38        | 98.52 ± 0.59           | s        |
| Color               | L : 94.26±0.03      | L : 98.73 ± 0.04       | s        |
|                     | a : -58.48 ±0.46    | a : 1.95 ± 0.07        | s        |
|                     | b : 81.51 ± 0.52    | b : 15.00 ± 0.04       | s        |
| Sensory evaluation  |                     |                        |          |
| Color               | 8.50 ± 0.69         | 8.35 ± 0.59            | ns       |
| Aroma               | 8.25 ± 0.79         | 8.40 ± 0.75            | ns       |
| Taste               | 7.80 ± 0.83         | 8.0 ± 0.86             | ns       |
| Texture             | 8.35 ± 0.75         | 8.6 ± 0.50             | ns       |

Notes: s: significant; ns: not significant; α: 0.05

Solubility defined as the ability of a product in the form of powder, flour, or seeds to dissolve with solvents. The results of the analysis of solubility of edamame powder milk with maltodextrin concentration and spray dryer temperature were 95.23%, while the control sample had a higher solubility of 98.52% (Table 2). According to [20], the higher the solubility, the better the quality products. The results of paired t-test (α = 0.05) in both sample resulted in a p-value of 0.023 (p <0.05) so that the solubility between edamame powdered milk samples with control was significantly different, this was thought to be caused by the composition of different ingredients so that the ingredients the compilers of the two samples are different until the solubility becomes different. The composition of the Mandala 525 soybean milk powder sample (control) in the packaging labeled soybean powder while the edamame powdered milk of this study contained edamame powder, salt, and maltodextrin.

Color is the first parameter seen by consumers in terms of receipt of food products. Edamame powdered milk has a color that is not significantly different, according to panelists’ observations based on their level of preference. The sample color of steeping edamame powdered milk is non-transparent light green, which is influenced by the pigments of edamame, namely chlorophyll b and steeping white yellow and not transparent control samples. The results of the statistical analysis of the paired t-test showed that the level of preference of panelists for the color of steeping edamame powdered milk with
a control sample (p-value > 0.05). The color formed in edamame and steamed milk powder still represents green when fresh. The panelists already know edamame is a type of soybeans and also is not ordinary with edamame color so that compared to soybean products does not differ significantly in their level of pleasure. According to the results of the research, panelists preferred the color of steeping edamame powdered milk compared to control products, but the difference was not significantly different from the p-value of 0.419.

Edamame milk powder, which brewed, has a color that is significantly different when observed using a colorimeter. The brightness of edamame powdered milk was lower than that of the controls because the \( L^* \) (brightness) value of steeping edamame powdered milk was 94.26, while the controls were 98.73. The results of the analysis of redness (\( a^* \)) showed that steeping edamame powdered milk tended greenish color with values of \( a^* -58.48 \) while controls had a slightly reddish color with \( a^* 1.95 \). The results of the yellowish analysis (\( b^* \)) showed that steeping yellowish edamame milk powder was higher with a value of \( b^* 81.51 \) while the control value of \( b^* \) was only 15.00. A paired t-test (\( \alpha = 0.05 \)) in both samples in the parameters \( L^* \), \( a^* \), and \( b^* \) produced the third p-value of 0.000 (\( p < 0.05 \)) so that the brightness, redness, and yellowness values between edamame milk powder samples and the controls are significantly different. It is because the types of soybeans used are different. The control uses white soybeans, while in this study, uses edamame, which is green because it contains chlorophyll pigment b [6]. The preferred color according to this study, is the color of steeping edamame powdered milk compared to controls.

The aroma of food or drink is a derivative of some components of food detected by the human sense of smell. The results of the statistical analysis of the paired t-test showed that the level of preference of panelists on the aroma of steeping edamame powder milk was not significantly different from the control sample (p-value > 0.05). The chemical components that contribute to the distinctive taste of edamame are analyzed using HPLC and show that the source is amino acids in edamame (Valine, Tryptophan, Treoin, Methionine, Lysine, Leucine, Isoleucine, Histidine and Arginine) and natural sugar edamame. Amino acids contribute to the savory flavor when smelled by the human sense of smell [15].

Taste is essential for consumer acceptance of food. Food products must fulfill the requirements of nutritional value, price, and safety. However, if consumers are not accepted the taste, the product is rejected (Fennema, 1996). The results of the statistical analysis Pair ed t-test showed that the level of preference of the panelists for the taste of steamed edamame milk powder with the control sample (p-value > 0.05) was 0.163. The results of the analysis stated that the two samples had a taste with a level of preference that was not significantly different. Beverages’ taste influenced by the content of the ingredients. The main ingredients used from the two samples are different but still in the same type, namely soybeans, amino acids that contribute to savory taste [15]. Soymilk, although the type of edamame is not yet on the market in the form of milk. Maltodextrin in the steeping sample of edamame powdered milk contributes a little to sweetness because it is a carbohydrate derivative [12].

The texture is a sensory attribute that can be recognized by the tongue papilla that meets the components in the mouth. Milk texture in the form of softness or roughness of particles contained in the emulsion. The size and shape of solids contribute to the texture felt by the senses when consumed (Kong et al., 2008). Statistical analysis of the Paired t-test showed that the level of preference of panelists for the taste of steamed edamame milk powder with a control sample (p-value > 0.05) was 0.262. The results of the analysis stated that the two samples had a taste with a level of preference that was not significantly different.

### 3.2. Proximate analysis and vitamin content

Results of proximate analysis and vitamin content of Edamame milk and Edamame milk powder shown in Table 3. The average of the protein content of edamame milk powder was 26.66 g/100g. It has met the minimum requirements for the standard of the soymilk protein content of a minimum 2 % w/w. The average fat content of all experiments ranged from 6.49% w/w, the level in the soy milk standard is acceptable because it must reach minimum 1% w/w [1], while the standard quality of milk powder with an average fat content from this study classified as low-fat milk [3].

Undetectable vitamin B1, B2, B9, and B12 (Table 3) in edamame milk powder or edamame milk due to the vitamin content is below the limit of detection of the equipment. On the other hand, the spray
drying process, raw material storage, and cooking of edamame milk using hot water might cause decreasing in quality during and. The condition of the production of food products influences the changes in nutrients content. Vitamin degradation is affected by heat temperature, duration of exposure to heat, light, presence of oxygen, acidity, and humidity. The most unstable vitamins are retinol (boiling vegetables, reduced by 33%), vitamin C (the most significant damage factor is cooking and oxidation), folate (water-soluble cooking, less than 40%), and thiamine (cooking, decreasing 20-80%). Niacin, biotin, pantothenic acid are types of vitamins that are quite stable [22].

Table 3. Proximate analysis and vitamin content of edamame milk powder and edamame milk

| Parameters                  | Edamame Milk | Edamame Milk Powder |
|-----------------------------|--------------|---------------------|
| **Proximate Analysis**      |              |                     |
| Protein (g/100 g)           | 3.6[^23]     | 26.66               |
| Total Carbohydrate (g/100 g) | 6.16[^23]    | 38.98               |
| Total Fat (g/100 g)         | 2.51[^23]    | 6.49                |
| **Nutritional Analysis**    |              |                     |
| Vitamin A (mcg/100 mL)      | ND (LOD=4.76) | ND (LOD=4.76)       |
| Vitamin C (mg/100 mL)       | 0.42         | 3.8                 |
| Vitamin D (mcg/100 mL)      | 0.67         | 16.075              |
| Vitamin E (mg/100 mL)       | 0.13         | 0.93                |
| Vitamin K (mcg/100 mL)      | 2.545        | 64.205              |
| Vitamin B1 (mg/100 mL)      | ND (LOD=0.15) | ND (LOD=0.15)       |
| Vitamin B2 (mg/100 mL)      | ND (LOD=0.03) | ND (LOD=0.03)       |
| Vitamin B9 (mcg/100 mL)     | ND (LOD=27)  | ND (LOD=27)         |
| Vitamin B12 (mcg/100 mL)    | ND (LOD=0.08) | ND (LOD=0.08)       |

Notes: ND: not detected, LOD: limit of detection

The number of microorganisms in food products needs to determined to fulfill food safety standards. The standard used for comparison in this study is the Indonesian National Standard (SNI). Based on the result (Table 4), the number of microorganisms in edamame milk powder meets the standards for milk powder and soybean powder. The number of microorganisms is below the threshold of SNI [3]. Therefore, the spray drying method is appropriate for producing edamame milk powder with the result a small number of microorganisms. Consequently, edamame milk powder produced in this study can categorize as safely consumed in terms of contamination of microorganisms.

Table 4. The microbial content of edamame milk powder and soymilk powder

| Parameters       | Edamame Milk Powder | Soymilk Powder [2] | Soymilk [1]          |
|------------------|---------------------|---------------------|----------------------|
| TPC (colony/g)   | 2.1x10^2            | 4x10^4              | Max. 2x10^2 (colony/mL) |
| Mold (colony/g)  | <10                 | 2.1x10^4            | Max. 50 (colony/mL)   |
| Salmonella sp. (/25 g) | Negative         | -                   | Negative             |
| Coliform (MPN / g) | 0                  | -                   | Max. 20              |

4. Conclusion
The optimum condition in producing edamame milk powder was maltodextrin concentration 129.91 g/L and inlet spray dryer temperature 131°C. Storage of raw material, grinding edamame with hot water, and spray drying are factors that cause low vitamin content in edamame milk and milk powder. The spray drying method is appropriate for producing edamame milk powder with the result a small number of microorganisms. It fulfills the requirement of standard quality soymilk powder or milk powder. It will be important that future research investigate nutritional changes during the production of edamame milk powder.
References

[1] SNI 1995 Indonesian National Standard for Soymilk (SNI 01-3830-1995) National Standard Agency [in Indonesian]

[2] Adebayo-Tayo B C, Adegoke A A, and Akinjogunla O J 2009 Microbial and Physico-chemical quality of powdered soymilk samples in Akwa Ibom, South Southern Nigeria African Journal of Biotechnology 8 13 pp. 3066-3071

[3] SNI 2006 Indonesian National Standard for Milk Powder (SNI 01-2970-2006) National Standard Agency [in Indonesian]

[4] Abdalla, A K 2017 Sensory Evaluation of Nonfat Dry Milk and Skim Milk Powder International Journal of Dairy Science 12 3 p. 190-196

[5] Antakli S, Sarkees N and Sarraf T 2015 determination of water-soluble vitamins B1, B2, B3, B6, B9, B12 and C on C18 column with particle size 3 µm in some manufactured food products by HPLC with UV-DAD/FLD detection International Journal of Pharmacy and Pharmaceutical Sciences 7 6 p. 219-224

[6] Ariyantini M D 2017 Inaktivasi Enzim Protease pada Puree Edamame (Glycine max) Menggunakan Teknik Pulsed Electric Field (PEF). Jurnal Agroteknologi 11 2 [in Indonesian]

[7] Gianfrancesco A, Turchiuli C, Flick D, and Dumoulin E 2010 CFD modeling and simulation of maltodextrin solutions spray drying to control stickiness Food Bioprocess Technol 3 p. 946–955

[8] Goulau A M and Adamopoulos K G 2008 Effect of maltodextrin addition during spray drying of tomato pulp in dehumidified air: I. Drying kinetics and product recovery Dry. Technol. 26 p. 714–725.

[9] Khotimah K 2006 Pembuatan Susu Bubuk dengan Foam-Mat Drying: Kajian Pengaruh Bahan Penstabil terhadap Kualitas Susu Bubuk. Jurnal Protein 13 1 [in Indonesian]

[10] Kong Y 2008 Emulsion Texture and Stability: Role of Surfactant Micellar Interactions in the Presence of Proteins (Illinois: Illinois Institute of Technology)

[11] Krishnan S, Bhosale R, and Singhal R S 2005 Microencapsulation of cardamom oleoresin: Evaluation of blends of gum arabic, maltodextrin, and a modified starch as wall materials Carbohydrate Polymers 61 1 p. 95–102

[12] Lao F 2017 The Effect of Pigment Matrix, Temperature and Amount of Carrier on The Yield and Final Color Properties of Spray Dried Purple Corn (Zea mays L.) Cob Anthocyanin Powders.

[13] Lee J K M, Taip F S, and Abdullah Z 2018 Effectiveness of Additives in Spray Drying Performance: a Review Food Research 2 6 p. 486 - 499

[14] Liu K S 1997 Soybeans: Chemistry, Technology, and Utilization (New York: Chapman and Hall) pp. 465-480

[15] Muaris H 2013 Khasiat Edamame untuk Kestabilan Kesehatan. (Jakarta: Gramedia Pustaka Utama) [in Indonesian]

[16] Perez-Munoz F and Flores R A 1997a. Characterization of a spray drying system for soymilk. Drying Technology 15 p. 1023–1043

[17] Perez-Munoz F and Flores R A 1997b The particle size of spray-dried soymilk Applied Engineering in Agriculture 13 p. 647–652

[18] Nawangwulan R 2014 The Effect of Red Sweet Potato (Ipomoea batatas L.) Substitution on Skim Milk as Prebiotic on Symbiotic Drink Powder Characteristic. (Surakarta: Universitas Negeri Sebelas Maret) [in Indonesian]

[19] Dibyakanta S, Mishra H N, and Deka S C 2017 Functional and reconstitution properties of spray-dried sweetened yogurt powder as influenced by processing conditions International Journal of Food Properties 20 7 p. 1603-1611

[20] AOAC 2000 Official Methods of Analysis 17th Edition (The Association of Official Analytical Chemists, Gaithersburg, MD, USA)

[21] Pentury M H, Nursyam H, Harahap N, and Soemarno 2013 Karakterisasi Maltodekstrin Dari Pati Hipokotil Mangrove (Bruguiera gymnorrhiza) Menggunakan Beberapa Metode Hidrolisis Enzim Indonesian Green Technology Journal 2 1 p. 53-60
[22] Lešková E, Kubíková J, Kováčiková E, Košická M, Porubská J, and Holčíková K 2006 Vitamin losses: Retention during heat treatment and continual changes expressed by mathematical models *Journal of Food Composition and Analysis* **19** p. 252-276

[23] Cornelia M and Lessy S T 2018 Utilization of Edamame (*Glycine max* (L.) Merr) And Red Bean (*Phaseolus vulgaris*) as a Functional Beverage *Acta. Chim. Asiana.* **1** p. 11 – 16

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