Empal gentong and empal asem with packaged cans: traditional foods from Cirebon

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Abstract. There has been research on traditional cuisine from Cirebon, empal gentong and empal asem. This empal is one of a variety of Soto cuisine which uses a mixture of beef, tripe, beef spleen and cow innards. The method used was to compare the results of heat adequacy measurement at 121°C for 60 minutes (starting from pushing ON button of the equipment), then the canned product can be analysed, both physical and nutritional value between 2 different variant types of empal gentong and empal asem. The result of the research obtained by empal Gentong Heat adequacy is 21.24 minutes with a net weight of 24.4%, aw 0.882, pH 5.93, water content of 83.9%, Ash 1.53%, 7.82% protein, fat 3.07%, carbohydrate 3.68%, sugar 2.39% with total energy of 220 calories. While the result of heat adequacy empal asem is 20.36 minutes with a net weight of 25.9%, aw 0.884, pH 5.42, water content 86.5%, Ash 1.66%, protein 6.89%, fat 0.84, carbohydrate 4.11%, sugar 2.21% with a total energy of 150 calories. Based on Regulation of the Head of the Food and Drug Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of the year 2016 concerning Commercial Sterile Food Requirements, Chapter III Requirements for Sterile Commercial Foods Article 3, paragraph 2 that sterility value (F0) is at least 3.0 minutes calculated against Clostridium botulinum spores. Thus, canned empal gentong and empal asem can be declared safe for consumption by consumers.

1. Introduction

Empal in the native language of Cirebon means meat that is cooked with gravy. There are 2 types of empal, empal gentong and empal asem. The difference between the two is type of sauce used. Empal gentong used coconut milk as a soup base, whereas empal asem only used water with added tamarind. Besides empal gentong cooked using gentong or barrel made from clay. Empal gentong is more towards curry and tasteful while empal asem is more towards soto (traditional food from Indonesia made from broth and meat) and tastes fresh. In general, the two foods do not have a long shelf life; after being cooked they are ready to be served and only have 24 or 48 hours of shelflife by reheating. One of the technologies that can extend the storability of empal gentong and empal asem is canning.

Canning is a way of preserving food in hermetically sealed containers and hot-disposed. This way of preservation is the most common way to do it because it is kill spoilage bacteria, and can maintain nutritional value, taste and attractiveness [1] because hermetically sealed canned foods can be protected against rot for 1 year while changes in water content, oxidation damage or taste can be prevented [2]. Several studies on the effect of heat treatment on nutrient reduction [3] namely the
heating process affects the decrease in vitamins, protein and color of many foods. This decrease in nutrients varies depending on the type and food product [4].

The food canning process consists of the first several stages, namely the preparation of ingredients including washing, cutting and processing before canning. The next step is beef processing and the process of blanching vegetables which aims to remove air from the tissues, soften the ingredients and facilitate filling in cans and activate enzymes. Blanching is usually done at a temperature of 90-100°C [5]. The process of filling the ingredients in the can is done quickly and uniformly. Material that is ready must be filled immediately in the can so that it is not contaminated. Filling in cans is done regularly and uniformly in order to maintain uniformity of the air cavity (Headspace). The function of the headspace is as a spare room for product development during sterilization so as not to press the can. the next process is air venting or exhausting. Exhausting is the process of expelling air in the package so that the pressure in the can is reduced during heating. The next process is the process of closing cans by using a double seaming machine [5].

The next process is sterilization which is the most important process in canning. The purpose of sterilization is to destroy spoilage and pathogenic bacteria and make products more mature. The temperature and time of product sterilization depend on the ingredients of the product. The main seafood product uses 240°F for 15-30 minutes [6].

The research objective is to determine the optimization of packaging empal gentong and empal asem with cans through the value of sterility, chemical and physical properties, metal contamination and bacterial contamination.

2. Materials and methods
The research materials used quality beef, and vegetables such as onion leaves, kucai leaves, frying onion and spices. The research tools used include two pieces can size of high 300 mm and diameter 215 mm, digital balance, seamer, autoclave, data loggers and thermocouples.

The first step in the canning process was preparation. Preparation began with boiling the beef with all the herbs and spices to make the broth, preheating (blanching) of vegetable cuts taking the cooked beef from the broth and dicing the cooked beef into 1.5 to 2 cm cubes.

The second step was to put the ingredients in the can. The ingredients added into the cans were 50 grams diced cooked beef, blanched vegetables (3 grams each), and the broth until each can reached weight of 300 grams (usually with a headspace average of 0.5 cm).

The third stage was to carry out the process of exhausting or vacuuming the filled can at 90°C for 20 minutes, after that the cans were immediately closed and sterilized used autoclave at 121°C for 20 minutes then the cooling process was carried out. After that the product was placed in room temperature and hygiene room for 14 days. Sterility value analysis was carried out during the sterilization process to determine the adequacy of heat to the product. Other analyzes conducted on the final product include physical, chemical, metal and microbial contamination. The standards used for parameter analysis were displayed as table 1.

| Parameter                     | Reference                          |
|-------------------------------|------------------------------------|
| Net weight                    | SNI 01-2891-1992 (point 2)         |
| Nitrite (NO₂⁻)                | SNI 01-2894-1992                   |
| Metal contamination           |                                    |
| Plumbum (Pb) dan Cadmium (Cd) | MU/MO/10 (AAS)                     |
| Cuprum (Cu) dan Seng (Zn)     | AOAC 999.11 (9.1.09.2005)          |
| Lead (Sn)                     | SNI 01.2896-1996 (point 5)        |
| Mercury (Hg)                  | MU/MO/12 (Cold Vapor AAS)         |
| Arsen (As)                    | MU/MO/13 (AAS)                     |
| Microbial contamination       |                                    |
| Total plate count (30°C 72 hour) | ISO 4833.2003 (E), ISO 7218.2012  |
3. Results and discussions

Sterilization is the most important operation in the food canning process. This process aims to destroy the decomposing microbes and pathogens, to make the product sufficiently ripe, texture and taste as desired. The sterilization process must be carried out at a temperature high enough to destroy microbes, but it should not be too high to make the product overcooked [7-9]. If the heating is too high, the organoleptic value and nutritional value of food will be damaged so that food cannot be accepted by consumers [4]. The degree of sterility is usually represented as an F value, which is the time in minutes at 121°C that is needed to destroy microbes. This F value depends on the process temperature and Z value (temperature change) where the microbes are destroyed by 1 log or 10^n [10, 11].

Along with the times, the term commercial sterility is known as the destruction which is intended only for pathogenic microbes, forming toxins and decomposition only. Some heat-resistant spores are still alive but cannot multiply and spoil food [11]. Sterilize value of canned empal gentong and empal asem were displayed as Figure 1.

Based on the Regulation of the Head of the Drug and Food Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Commercial Sterile Food Requirements, chapter iii commercial sterilize food requirements Article 3, paragraph 2 that the F0 value of at least 3.0 minutes is calculated against the Clostridium botulinum spores [11]. Thus the product tested under the above process conditions was declared commercially safe or sterile because it had a sterility value of 21.24 minutes for canned empal gentong and 20.36 minutes for canned empal asem.

Basically, not all foods need the same temperature and time for sterilization. To avoid undesirable changes, an appropriate and safe sterilization process is developed and can reduce product quality degradation to a minimum. For that we need careful determination temperature and sterilization time to produce commercial sterility right to order durable product without reducing nutritional value, taste and texture [1]. If a food packaged in a can is paced in a retort, then the temperature of the product will not immediately reach the temperature of the process in a accordance with the desired retort, but will transfer slowly to the inside. Before penetration into inside, heat will be distributed throughout the retort room, then heat will be transmitted to the can and to the inside [12].

Results of physical and chemical analysis, and metal and microbial contamination of canned empal gentong dan empal asem were displayed at table 2.
**Figure 1.** Sterilize value of canned empal gentong at 21.24 minutes.

**Figure 2.** Sterilize value of canned empal asem at 20.36 minutes.
Table 2. Result of physical and chemical analysis, and metal and microbial contamination of canned empal gentong and empal asem.

| Parameter            | Unit     | Result Empal gentong | Result Empal asem |
|----------------------|----------|-----------------------|-------------------|
| Can condition        | -        | Normal                | Normal            |
| Water activity       | -        | 0.882                 | 0.884             |
| Net weight           | %        | 24.4                  | 25.9              |
| pH                   | -        | 5.93                  | 5.42              |
| Natrium Nitrite      | mg/kg    | 4.92                  | 5.09              |
| Metal contamination  |          |                       |                   |
| Plumbum (Pb)         | mg/kg    | 0.06                  | 0.10              |
| Cadmium (Cd)         | mg/kg    | <0.004                | <0.004            |
| Cuprum (Cu)          | mg/kg    | 0.51                  | 0.26              |
| Seng (Zn)            | mg/kg    | 11.3                  | 10.6              |
| lead (Sn)            | mg/kg    | <0.8                  | <0.8              |
| Mercury (Hg)         | mg/kg    | <0.005                | <0.005            |
| Arsen (As)           | mg/kg    | <0.013                | <0.013            |
| Microbial contamination |    |                       |                   |
| Total plate count 30°C 72 hour | colony/gram | <10                | <10              |
| Thermophilic aerobic bacteria forming spores | colony/gram | <10                | <10              |
| Coliform             | APM/gram | <3                    | <3                |
| Clostridium perfringens | colony/gram | 0               | 0                |
| Salmonella           | /25gram | Negative              | Negative          |
| Staphylococcus aureus | colony/gram | 0                | 0                |
| Thermophilic anaerobic bacteria | colony/gram | <10                | <10              |

Table 3. Nutritional fact of canned empal gentong and empal asem.

| Parameter          | NUTRITIONAL FACT | Empal gentong | Empal asem |
|--------------------|------------------|---------------|------------|
| Serving size       | 300 grams        | 300 grams     |            |
| Number of servings | 1                | 1             |            |
| Total energy       | 220 Calorie      | 150 Calorie   |            |
| Fat energy         | 60 Calorie       | 20 Calorie    |            |
| % AKG              |                  | % AKG         |            |
| Total fat          | 9 g 13 %         | 2.5 g 4 %     |            |
| Protein            | 23 g 10 %        | 21 g 35 %     |            |
| Total carbohydrate | 11 g 4 %         | 12 g 4 %      |            |
| sugar              | 7 g -            | 7 g -         |            |
| Natrium            | 1180 mg 79 %     | 1190 mg 79 %  |            |

It appears that the product has enough nutritional composition, metal contamination under the provisions and negatives of pathogenic bacteria (table 2). This proves that empal gentong and empal asem which are packed in cans are suitable for consumption [12].

Table 3 shows the difference in calorific value of the two types of product, where the largest calorie is provided by empal gentong with 220 calories, compared to empal asem which is 150 calories. This is due to the empal gentong used coconut milk as the main component of soup so that the fat from coconut milk provides the largest contribution to calories.
In general, canned food can be accepted by consumers, but some things that need to be considered are the selection of right process technology so that the foodstuff cannot experience a significant decrease in nutrition [12].

4. Conclusion
The canning of empal gentong showed heat adequacy of 21.24 minutes with a net weight of 24.4%, aw 0.882, pH 5.93, water content of 83.9%, ash 1.53%, 7.82% protein, fat 3.07%, carbohydrate 3.68%, sugar 2.39% with total energy of 220 calories. While the heat adequacy of empal asem was 20.36 minutes with a net weight of 25.9%, aw 0.884, pH 5.42, water content 86.5%, ash 1.66%, protein 6.89%, fat 0.84, carbohydrate 4.11%, sugar 2.21% with a total energy of 150 calories. Based on Regulation of the Head of the Food and Drug Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Commercial Sterile Food Requirements, Chapter III Requirements for Sterile Commercial Foods Article 3, paragraph 2 that sterility value (F0) is at least 3.0 minutes calculated against Clostridium botulinum spores. Thus, canned empal gentong and empal asem can be declared safe for consumption by consumers.

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