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THERMAL STERILIZATION AND STORAGE TIME OF CULINARY MEGONO LACTOGENIC SAFETY

Abstract: The traditional culinary heat test of megono lactogenic cans has been carried out. This study aims to determine the optimal temperature, sterilization and storage time. Sterilization was carried out at 100^oC and 121^oC for 5 minutes, 10 minutes, 15 minutes and 20 minutes on two samples (A and B). The results showed that both samples had solid properties, but required different sterilization times (F^o) to achieve sufficient heat. Sample A was at 121^oC in 16 minutes and reached F^o in 7.48 minutes. In sample B the temperature was 121^oC in 18 minutes and reached F^o in 7.94 minutes. These results confirm that the two lactogenic megono products are declared to be commercially safe. Expiration test of sample A with the addition of 1% Sauropus androgynous leaf powder for 12,550 months. While sample B with the addition of 2% Sauropus androgynous leaf powder has an expiration date of 10,374 months.

Key words: Thermal; time sterilization; storage time; megono lactogenic; safety.

Language: English

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INTRODUCTION

Megono is one of the typical foods of Pekalongan, Central Java, Indonesia which is made from young jackfruit mixed into small pieces, added with grated coconut and spices, shaped like a cone of rice. Around the North Coast of Java Island, megono is an offering for Dewi Sri, so that the harvest is abundant and the people live in prosperity [1,2,3]. Since Islamic teachings entered Pekalongan City, megono rice has been one of the dishes in tahlil events at mosques [1,2,3].

Megono Lactogenic is a typical Pekalongan megono mixed with katuk leaf powder which is useful in increasing breast milk production and spurring baby growth [4]. This Megono has a short shelf life of only a few hours and a maximum of 12 hours. Due to the large number of requests from immigrants or tourists to be brought home as souvenirs and brought home to families for the people of Pekalongan who migrated, a canned lactogenic megono was made. In addition, canned packaging can increase the opportunities for small

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and medium businesses, as well as preserve local as a batik city, and is located in the middle of the distance from Jakarta to Surabaya or East Java, so that many pedestrians rest while enjoying Pekalongan specialties.

One method of food preservation is canning with thermal sterilization. This method is the most widely used and has made a real contribution to the nutritional well-being of most of the world's population [5]. Thermal processing is also a cost-effective processing and preservation technique, so that many food industries use it [6,7]. This technique is very important because it can extend shelf life, improve food quality and increase food availability, safety and affordability [8,9]. This canning technique can stop spoilage by unwanted microorganisms by heating food for a certain period of time [9].

Several studies on thermal processes have been carried out by Holdsworth and Simpson, examining theoretical and experimental evaluations of energy consumption models and practices at the laboratory scale of thermal processing. These studies include: the adequacy of the sterilization process for edible mushrooms [10]; Effect of Temperature Bonding and Sterilization on Fo Value and Physical Condition of Gudeg Cans [11]; Empal gentong and empal tamarind cans are typical Cirebon food packaging [12].

The tools used in the heat adequacy test refer to research conducted by [13], namely: 1) TOMMY Brand Retort S=325 with a voltage specification of 220V 50/60 Hz, 10 A, maximum pressure 2.3 kgf/cm^2, capacity of 0.053 m^3; 2) data storage for the ELLABCTF9004 brand with a maximum temperature specification of 350^{0}C, accuracy 0.1^{0}C,

T-121.1^{0}C; 3) universal testing machine (UTM) brand Zwick model Z005; 4) AMD Atthlon TM IIX260 specification 3.20 GH processor, 2 GB RAM, 32-bit Operating system; 5) The software used to perform the simulation is MATLAB Version R2010a. Megono lactogenic cans.

METHOD

The materials used refer to previous research by [14], 1.5 kg of chopped young jackfruit mixed with spices and 1 kg of grated coconut. Then mixed until smooth and cooked until half cooked. All ingredients are put into cans, (each can contains 200 grams of megono), two pieces cans, the size is 300 x 205 cm. With enamel (lacquer) specifications, the outer can body is transparent (clear lacquer) and the inner can is aluminum; easy open end (EOE) can lid. Canning process with a sterilization temperature of 121°C with a sterilization time of 15 minutes.

Megono that has been half cooked, then put into cans containing 200 grams of megono per can. The can that already contains the megono is empty by the exhausting process, then closed. The can that already contains the megono is inserted into the retort and connects the thermocouple to the terminal according to the sequence. The retort was closed and set at 111^{0}C for 15 minutes. The retort and data logger are turned on, waiting for the sterilization operation to complete. Repeat procedure 1 to 4 for all temperature variations (111^{0}C, 121^{0}C, 131^{0}C), setting time (10 minutes, 20 minutes and 30 minutes). The temperature increase for every 1 sample with 1 minute intervals will be printed on the print out paper by the data logger, as well as the sample sterility value (F value) at a certain time.
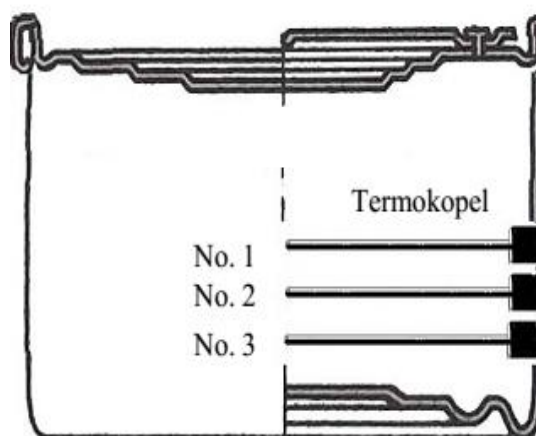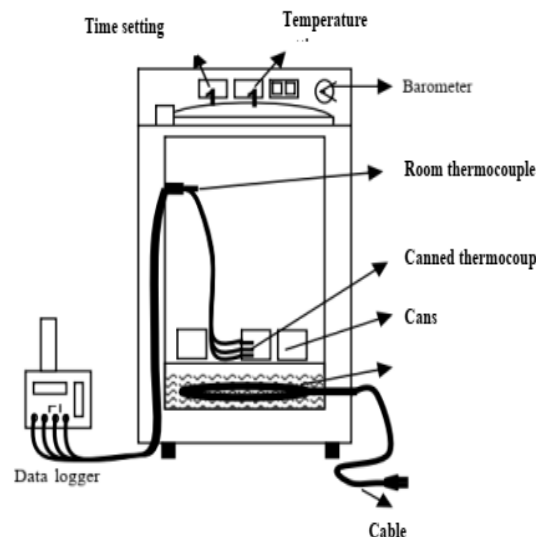

Fig.1. The terminal architecture of a thermocouple on a can
Source: Asep, et al (2014)

Fig 2. Hematic of the can position on the retort
Source: Asep et.al, 2014

Model Simulation (Mathematical modeling) methods with differential equations are used in computer simulations. One of them is a type of soft computing algorithm, calculating with the help of numerical computing [14]

Matrix Laboratory (MATLAB), is one of the most widely used finite difference engineering programs in the use of numerical computational discretization models [13, 16]. Stability is determined based on a number of assumptions, namely the temperature outside the cans remains constant [13,17], heat reaction is neglected [13,18], heat capacity between ambient temperature and the can wall is neglected, so T wall = T environment [13,19].

RESULTS AND DISCUSSION

The results of the study on megono latogenic with 2 (two) variants adding 1% in sample A and 2% Sauropus androgynous leaf powder in sample B which were packaged using cans:

Heat adequacy test

The results of the heat adequacy test when the product is sterilized during the canning process for both samples are shown in Figures 4 and 5

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                              GET STARTED

   Thermophysical          Heat transfer
   model material          cylindrical        Observation temperature data
    properties             coordinates

   Proximate input                             Create a script
   (water, ash, fat,                             MATLAB              Repair script
   carbohydrate,
     protein)

                                           Determination of initial
   Thermophysical material                 conditions and boundary
   properties (α, ρ, k, c)                       conditions

                                             Model T_{i,j} = f(T,t)

                                                Input data
                                          (T_{i,j}, T_s, ∅, h)(r,z)

                                            Prediction temperature
                                               T_{i,j} = f(T,t)

                                                Stable ?          No

                                                   Yes

                      Prediction                              Filling data
                      temperature                            observation and
                     T_{i,j} = f(T,t)                          predictions

                                                                  Finish
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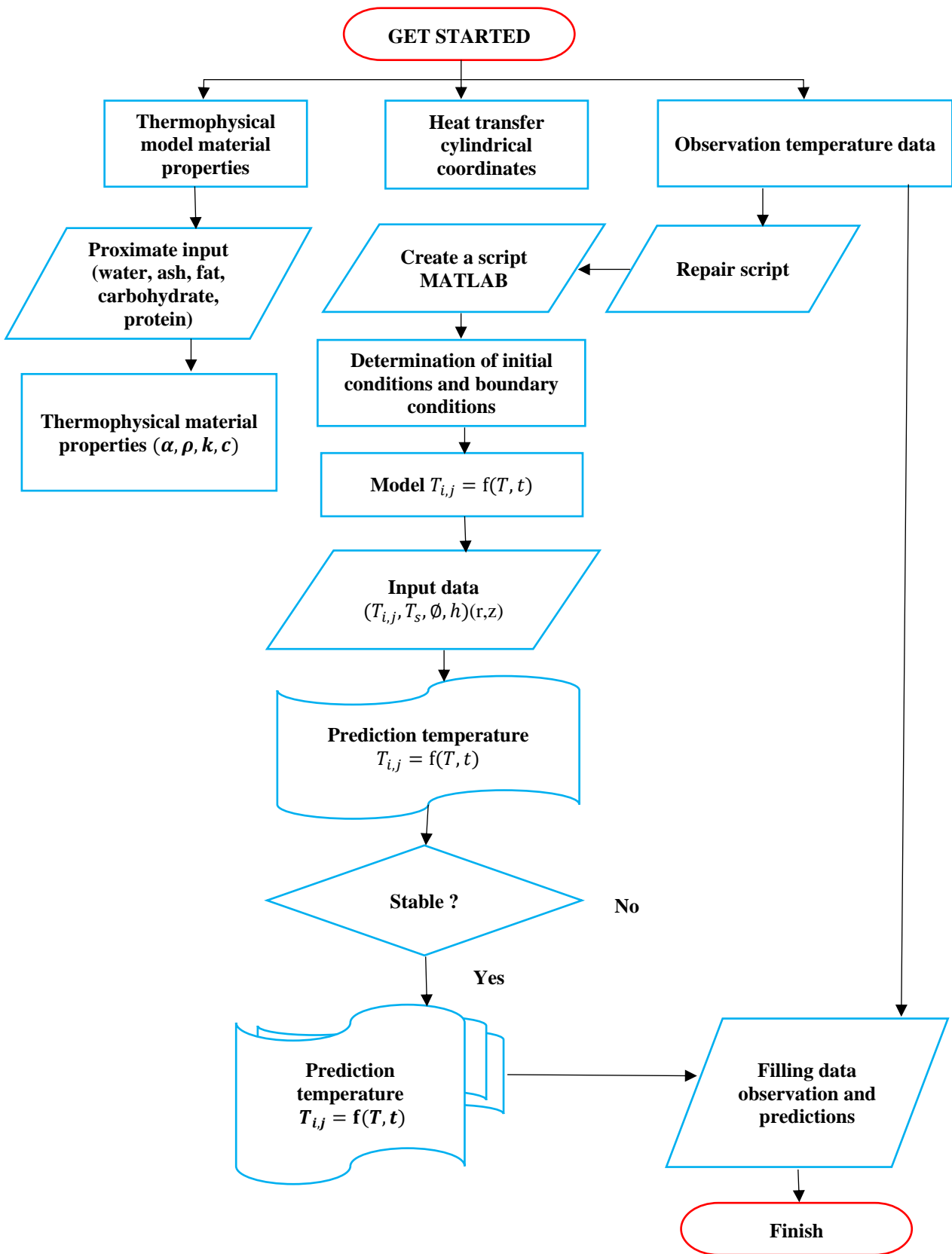
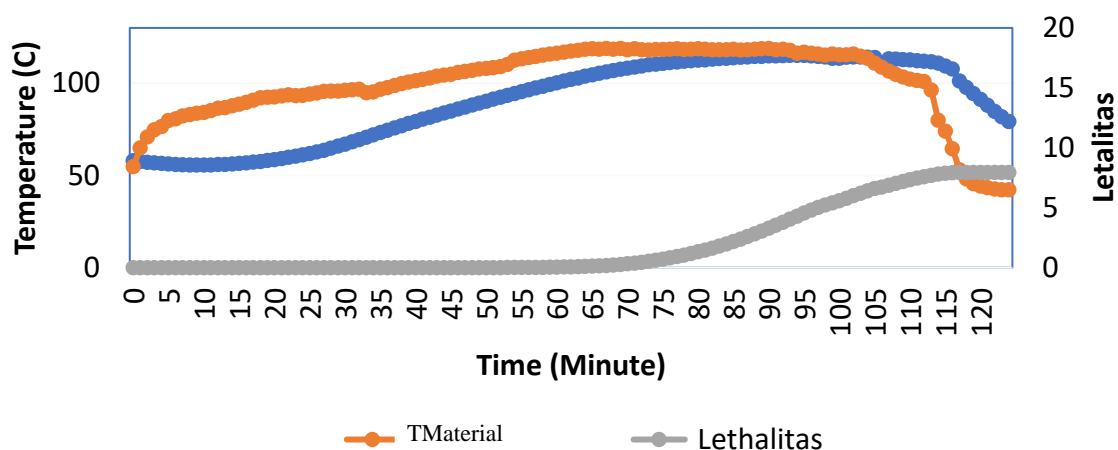**Fig 3. Flowchart of MATLAB simulation; Source: Nurhikmat, A., et al. 2014**

Figure 4. The heat adequacy graph of the sample A. Source: CV. Uniform Tester Lab Bandung, 2020
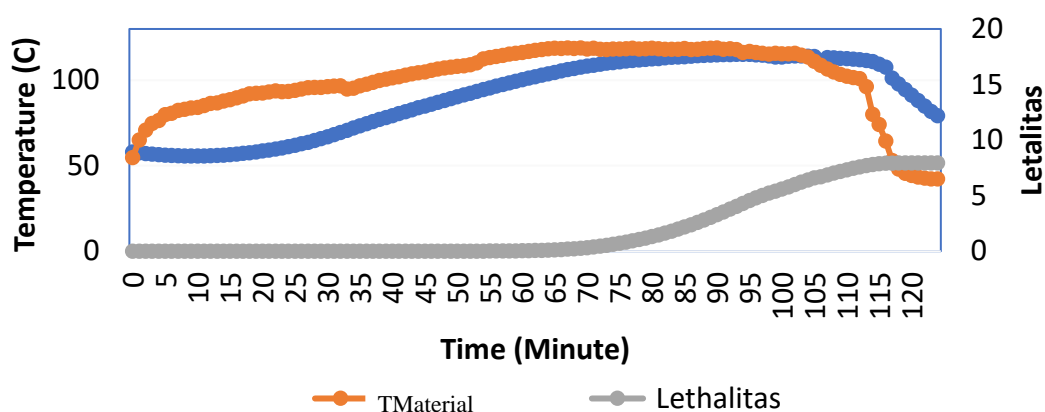

Figure 5. The heat adequacy graph of the sample B. Source: CV. Uniform Tester Lab Bandung, 2020

It can be seen in Table 1. that both samples have solid properties, it can be seen in the first heating (to reach a temperature of 100ºC) it takes a long time, namely 61 and 60 minutes. after that to reach the sterilization temperature (121ºC) it takes 27 and 26 minutes.

With a sterilization time of 16 and 18 minutes, the resulting heat adequacy value (Fo value) for samples A and B were 7.48 minutes and 7.94

The development of a food product, the product must be specific, namely: having advantages, not being limited to new products and alternative processes, the results of selection and meeting consumer safety factors. The idea and concept of product development must be really mature so that research, regulation, and legal aspects from the government must be supported [20]. The latest development of the food production process is the availability of ready-to-eat food that is safe and has a long shelf life [21]. One technology that can be used is packaging with cans. minutes, respectively. Based on the 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 Commercial Sterile Food Requirements Article 3, paragraph 2 that the Fo value of at least 3.0 minutes is calculated against Clostridium spores botulinum [22].

Food canning is a method of preserving food that is packaged hermetically and then sterilized. Hermetic means that the closure is done very tightly, so that it cannot be penetrated by air, water and microbes. Thus canned food is protected from spoilage, changes in water content, oxidation and changes in taste.

Another advantage, this method can be applied to almost all types of food such as vegetables, fruit, meat, fish, poultry, milk, eggs, and various types of beverages [23]. The application of technology to maintain product quality and safety in the development of traditional foods needs to be improved so that the resulting products are guaranteed quality and safety. Applications carried out at high temperatures will extend the shelf life of a product, because high temperatures can inactivate microbes that cause damage [24].

The process that is quite important in canning is sterilization, because at that temperature the microbes become inactive and even destroyed, but

the other effect is a decrease in nutritional value and organoleptic properties. Therefore, it is necessary to optimize the use of heat with a temperature high enough to destroy microbes but not high enough to reduce nutrition and organoleptic properties. Canning technology is not a new technology but there are still many things that have not been mastered, especially the stages of the process on various raw materials. One of them is the optimization of the use of sufficient heat to kill microbes but still maintain the quality of the resulting product [21]. Heat sterilization is the most effective preservation method but has a detrimental effect on nutrients and food quality [24].

Heat adequacy test

The sterilization process aims to destroy spoilage microbes and pathogens, to make the product cooked enough, texture and taste as desired. Therefore, the sterilization process must be carried out at a temperature high enough to destroy microbes, but not too high to overcook the product. If the heating is too high, the organoleptic value and nutritional value of the food will be damaged so that the food cannot be accepted by consumers [24, 25].

The concept of temperature measurement is the temperature distribution that occurs inside the packaging of a material determined as a function of position and time [23]. The amount of heat required for adequate sterilization depends on several factors,

namely: The size of the can (the larger the dimensions of the can, the longer the sterilization), The type of material (the denser the material, the slower the heat penetration), The type of microbe (Commercial sterilization is designed to kill Clostridium botulinum and spores), Heat source (Water vapor is pure water vapor so the heat transfer process runs quickly).

Expiration test (shelf time)

It can be seen in Table 2. that the results of the expiration test using the Accelerated Shelf Life Test (ALST) method, Fanelis prefers sample A with the addition of 1% Sauropus androgynous leaf powder so that the resulting expiration period is 12,550 months or more than 1 (one) year. Meanwhile, sample B with the addition of 2% expiration date resulted in 10,374 months or less than 1 (one) year.

Storage temperature is directly related to the shelf life of the product. If the temperature of 10°C is considered as the desired storage temperature, then increasing the temperature to 20°C causes the shelf life of the material to decrease by half. If the color of the material is damaged at a temperature of 10°C then at a temperature of 30°C the damage will be accelerated 4 times until the same level of damage is achieved. Chemical reactions that occur during canned food storage will affect the taste, color, texture and nutritional value of the food [26,27].

Tables 1: The results of the heat adequacy test of samples A & B

Stages	Sample	
	A (Minutes)	B (Minutes)
heating I	61	60
heating II	27	26
Sterilization time	16	18
Cooling	19	19
F0 Value	7.48	7.94

Source: CV. Uniform Tester Lab Bandung, 2020

Table 2: Expiration test results for samples A & B

Attribute	Unit	Sample	
		A	B
Color	Month	14,880	10,469
Scent	Month	13,764	11542
Texture	Month	12,976	11.018
Taste	Month	12,550	10.374
Whole	Month	14,191	11.433

Source: CV. Uniform Testerlab Bandung, 2020

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