Quality characteristic of dried anchovy (*Stollephorus* sp) produced by using solar dryer equipment as the traditional method development

I K E Saviti 1,2* and R B D Sormin 1

1 Department of Fish Processing Technology, Faculty of Fishery and Marine Science, Pattimura University, Jl. Mr. Chr. Soplani, Poka, Ambon. 97233
2 Maritime and Marine Science Center of Excellence, Pattimura University, Jl. Ir. M. Putuhena, Kampus Poka, Ambon

*Email: endahsavitri@gamil.com

Abstract. Dried anchovy is a prospecting product from Buru Island Maluku which is produced traditionally by spreading on the ground under the sun with a used net as a base. Effort to develop that method is needed to meet the increasingly stringent standard of sanitation and hygiene food products, especially for modern and export markets. Three types of solar drying equipment as the traditional method development were applied to produce dried anchovy and the product characteristic was investigated. The two enclosed solar dryers walled and roofed using plastic with multilevel racks and drying space forms a tunnel dryer system. One of them using transparent plastic and another using blue plastic. The third equipment is “para-para” (local called for bamboo or wood arranged side by side horizontally with an altitude roughly 1.25 meter above the ground) roofed using blue tarpaulin plastic. The characteristics of dried anchovy produced by using solar dryer equipment are better than traditional drying method product, especially organoleptic, insoluble acid ash content and total bacterial. Dried anchovy with the better quality characteristic will be reach the wider distribution and higher segment market.

1. Introduction

Dried anchovy is one of the popular traditional preservation fish product, as well as dried anchovy from Buru Island which is one of the prominent fish product. Dried anchovy from Buru is not popular yet as well as dried anchovy from Medan, in fact Buru’ dried anchovy has a good feasibility business and a good quality [1]. Drying method traditionally is done by spread the fish on the ground under the sun with a used net as a base. During process the product potentially exposed to the contaminant that influences the final quality of the product. This method is not sanitation and hygiene guaranteed, especially for modern and export markets requirements. Effort to develop that method is needed to meet the increasingly stringent standard of sanitation and hygiene food products.

Three types of solar drying equipment as the traditional method development were applied to produce dried anchovy. The two enclosed solar dryers walled and roofed using plastic with multilevel racks and drying space forms a tunnel dryer system. One of them using transparent plastic and another using blue terpauliene plastic. The third equipment is “para-para” (local called for bamboo or wood arranged side by side horizontally with an altitude roughly 1 meter above the ground) roofed using blue plastic. “Para-para” is common to use in drying many kinds of product in the community in villages but “para-para” roofed by using plastic is slightly a new idea and uncommon to apply in the village. Those drying equipments prevent the product exposed to the contaminant (animal pass on and eat it, dust and other impurity, flies and other infectious insects) directly and also get wet when raining suddenly during process. The delayed drying process is highly potential for initial microbial
investment. The better process will produce the better quality characteristic which has implication for the wider distribution and higher segment market.

Based on the background, this study was done to investigate the characteristic indicators of quality of the dried anchovy produced by using different types of solar dryer equipment as the development of traditional drying method. The experiment was conducted in Saliang-Batuboi village at the coastal of Kayeli bay in Buru district as the central production of dried anchovy.

2. Materials and Method

2.1. Sample Preparation

Fresh anchovy harvested from Bagan (floating object equipped with lamp to attract the fish) setted on the water of Kayeli bay. The fresh and clean harvested anchovy directly spread on the racks of the enclosed solar dryer and the floor of the para-para. The drying process is held for 25 hours effective time in 3 days and the dried anchovy packed in sealed polyethylene sack and keep in the lab for laboratory analysis. The dried anchovy sample was prepared with 2 replications.

2.2. Design of solar dryer equipment

The design of solar dryer equipment is presented in Figure 1.

*Kasa = wire net
Material for the base of the rack is wire netting covered with anchovy net
The framework made of wood block 7 cm x 5 cm x 3 cm and wood block 5 cm x 5 cm x 3 m
The material for the wall and the roof of enclosed solar dryer is transparent plastik and blue terpaulin plastic

Figure 1. Design of Solar Dryer Equipment
2.3. Procedure Analysis of Quality Parameters

2.3.1. Organoleptic test. This test aimed to know the quality of dried anchovy by observing the appearance, smell, consistency and presence or absence of mold growth. Organoleptic test was done according to Indonesia National Standardization (1991) [2] involved 15 panelists by using score sheet organoleptic dried (salted) anchovy with the highest scale of 9 and the lowest 1.

2.3.2. Total Plate Count (Total Microbial). Total Plate Count (TPC), according to Indonesia National Standardization (SNI) [3]. Pipetting 1 ml homogenized 25 grams dried anchovy in 225 ml Butterfield Phosphate (BFP) into a tube filled 9 ml BFP (10⁻³ dilution) then pipetting 1 ml 10⁻³ dilution into other tube filled 9 ml BFP (10⁻⁶ dilution) and further up to dilution 10⁻⁹. Pipetting 1 ml from every dilution tube into sterilized petri-disc then 12-15 ml Plate Count Agar (PCA) (T 45 °C) poured into the petri-disc then shaken generously until homogenous and let it solidified. Furthermore all of the petri-disc was put into incubator (T 37 °C) for 24-48 hours. Colony counting was done on the petri-disc 25-250 colony.

Colony forming unit = total colony x 1/solution factor.

2.3.3. Water content. The water content of dried anchovy was determined by gravimetric method [4]. Water content was determined by the difference between of sample weight before and after drying. The porcelain cup used firstly dried at temperature 105°C then cooled in a desiccator for 30 minutes. The porcelain cup then weighed by using digital balancing (A). Approximately 2 g of dried fish sample was poured in porcelain cup (B) and dried in an oven at a temperature of 100-105°C for 5 hours or the weighed is stable (C). Following is the equation of moisture content:

\[
\text{Water content} (\%) = \left( \frac{A + B}{B} \right) - C \times 100\%
\]

2.3.4. Insoluble Acid Ash. Dried sample cup by using oven at 100°C - 150°C for an hour, cool in the desiccator for 15 minutes and weighed (W0). 5-10 grams sample weighed in a cup (W1) then dried by using oven for 24 hours at 105°C, cool in desiccator for 15 minutes and weighed as cup + ash (W2). Added 25 ml HCl 10% into the cup close the top of the cup then boiled for 5 minutes. Sample through on the filter paper while rinsed by using hot distilled water few times. Filter paper was dried by using oven then furnace again at least 30 minutes. The furnace sample weighed (W3) and identified as insoluble acid ash. Ash was determined using formula:

\[
\text{Insoluble acid ash} = \frac{W3}{W1} \times 100\% [5].
\]

3. Result and Discussion

Characteristic dried anchovy is a quality indicators of dried anchovy. Organoleptic as well as the other characteristics namely total microbial and insoluble acid ash of dried anchovy produced by using solar dryer is better than the product of traditionally drying as shown on Tabel 1.

The appearance of solar dryer and traditional drying is shown in Figure 2. Solar dryer prevent the product exposed to the contaminant, animal, flies and other insects resulted the final product with total microbial relatively low. That indicates the low initial microbial investment reveals the good appearance, smell, texture and consistency as the component of organoleptic. The lower the initial microbial investment in the dried anchovy, the longer the shelf life will be on the right storage condition that imply to the wider distribution and higher segment market.

The low insoluble acid indicates the low imurities or low contaminated by inorganic material [5] in dried anchovy produced by using solar dryer. The clean dried anchovy related to the good
organoleptic. Organoleptic parameter is a subjective measurement of the quality express of the objective characteristic. According to the Indonesia National Standarditation, the quality of dried anchovy produced by using three types of solar dryer is very good.

| Quality Parameter                  | Dried by using solar dryer 1 | Dried by using solar dryer 2 | Dried by using solar dryer 3 | Dried traditionally |
|-----------------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------|
| Organoleptic                      | 8.3                         | 7.9                         | 8.4                         | 7.7                 |
| Total microbial (TPC) (colony/gram) | 6.9 x 10^1                 | 2.7 x 10^1                 | 2.61 x 10^1                 | 1.16 x 10^3         |
| Water content (%)                 | 17.5                        | 16.5                        | 16.6                        | 16.9                |
| Insoluble acid ash (%)            | 0.3                         | 0.28                        | 0.28                        | 0.65                |

There are 2 kinds of plastic material for wall and roof of the solar dryer, based on the consideration of availability and convenience in obtaining the material at the local market. Sometimes the transparent plastic is sold out at the local market. All of the materials for the solar dryer equipment can be found easily and relatively cheap. The experiment of drying anchovy by using solar dryer
equipment also an application of the cheap and appropriate technology improving quality of local fish products with a good market opportunities which ultimately has implication improving the welfare of the local community.

**Table 2.** Indonesia National Standard dried salted anchovy (SNI 01-2708-1992)

| Parameters                              | Standard value |
|-----------------------------------------|----------------|
| Organoleptic                            | 7              |
| Maximum total microbial (TPC) (colony/gram) | $5 \times 10^5$ |
| Maximum water content (5)               | 40             |
| Insoluble acid ash (5)                  | 0.3            |

Compared to the previous studies, the dried anchovy produced by using solar dryer in this study have a very good quality especially a relatively low total microbial. The special aspect of the dried anchovy in this study is an unsalted dried fish product with a relatively low total microbial which indicates the good sanitation and hygiene producing process. Immaculate et al. (2013) [6] reported the dried *Stolephorus commersonii* produced by drying process has 18% water content and Total microbial 1.5x10^2. Agustini et al. (2009) [7] reported water content of the few kinds of dried salted fish in Indonesia 8.28%-37.28%. Moreover, Rahmani et al. (2007) [8] reported the few dried salted fish have 19.71-25.30% water content and total bacterial 2.3x10^4 – 2.9x10^5.

**4. Conclusion**

Dried anchovy produced by using enclosed solar dryer and “para-para” have a good quality in accordance with the Indonesia National Standard SNI 01-2708-1992. Dried anchovy produced by using solar dryer equipment have a much better quality than traditional drying product especially in the characteristic of total microbial and insoluble acid ash.

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