Characteristic of *acan*: a traditional shrimp paste of Maduranese, Indonesia

Mahrus Ali¹,³, Yunianta¹, Aulanni’am² and Joni Kusnadi¹

¹Faculty of Agricultural Technology, University of Brawijaya, Malang, Indonesia  
²Faculty of Veterinary, University of Brawijaya, Malang, Indonesia  
³Fisheries and Marine Sciences Department, University of Lampung, Indonesia

E-mail: mahrus.ali@fp.unila.ac.id

Abstract. *Acan* is a typical fermented product from Maduranese, Indonesia. The product made from small shrimp called *odhang acan* or *geraguh* (*Acetes* sp.). *Acan* is a traditional condiment and has a distinctive aroma and flavor. This study aim is to identify the characteristics of Maduranese *acan* including raw material, fishing gears, manufacturing process, physical properties, chemical, and microbial profiles of the product. This research conducted by survey and interview technique, following by laboratory checking of the quality profile of the product. The results of the study indicate that *acan* produced by SMEs in Madura. The production of *acan* is quite simple through fermentation technology which added with 5-10% solar salt. Product properties have different characteristics depended on processing steps and fermentation period. Generally, the quality of *acan* has a convenient to the Indonesian shrimp paste standard product (SNI).

1. Introduction
The ethnic of Maduranese is one of the largest tribes in Indonesia, nearly to 7 million in population. Most of them inhabited in Madura island located in East Java province which an area of 5,168 km². Madura Island divided into four regencies, Bangkalan, Sampang, Pamekasan and Sumenep regencies also many small islands reached 127 in number [1].

Madura island has some resources that economically important and potential to be developed. Besides known as a producer of solar salt, and local cattle, the island also provided some marine resources and their derivative products. One of the important marine resources is a small-pelagic shrimp which is known locally as *odeng acan* or *gereguh*, which scientifically named *Acetes* sp. (Decapoda: Sergestidae). According to Mantiri et al. [2], the shrimp was caught by local fishermen using push-net, scoop-net and boat-seine. These shrimp usually sold freshly, or in dried form, but most of them processed into fermented shrimp paste known as *acan*.

*Acan* is an inherited food ingredient and daily consumed as raw material for making traditional condiment of Maduranese. It had a distinctive aroma and taste and consumed a long time ago. There are some advantages of consuming fermented food, i.e., improving the nutritional value, distinctive
odor and taste, and more appearance form. Besides, it has an extended expiration period, low-cost production, simple technology, and potential to develop as a functional food.

Thus far, there is no comprehensive reported on acan product from Madura Island, whether in processing technology and product quality. The research aimed to identify the characteristics of Maduranese acan which includes the manufacturing process and the characteristic of the product. This research is essential in developing acan product and can provide basic information in the future research.

2. Materials and methods

2.1. Sampling

Freshly acan obtained from six SME producers in Madura (Figure 1), consisting of three samples from Bangkalan Regency: West Kwanyar sub-district (station 1), Lajing, Arosbaya (sta. 2), and Macajeh, Tanjung Bumi (sta. 3). While sample 4 obtained from Tamberru Alet, Pamekasan Regency (sta. 4), and two samples from Sumenep Regency, whereas both of them obtained from Ambunten Timur sub-district (sta. 5, 6). No acan producers were found in Sampang Regency.

2.2. Research method

This study used the descriptive research with observational and survey methods followed by interview [3]. The survey performed including fishing gears, pre-treatment for raw material, and processing technology. The interview conducted by using questioner to tabulate the equipment, raw material, and procedure in producing acan, fermentation period, price, and selling method.

2.3. Product characteristics analysis

The characteristic observations performed by sensorial, chemical properties, and microbial profiles. The sensory analysis was carried out by hedonic and determined according to the Indonesian National Standard method [4]. Four types of analysis (i.e. appearance, smell, taste, and texture) were compared with a score sheet by 20 semi-trained panelists for sensory evaluation.

The microbial analysis carried out by the total acan microbes on the nutrient agar medium based on SNI [5]. The chemical properties consisted of water activity (a_w) measured using a_w meter, the pH profile measured by homogenized the acan sample with 10 volume of aquadest, and pH value detected by a pH meter, moisture, protein, fat, and ash content determined according to SNI methods [5].

Figure 1. Sampling location of acan producers in Madura Island, Indonesia.
3. Results and Discussion

3.1. Fishing gears

**Odhang acan or geraguh** (*Acetes* sp.) is a small-pelagic shrimp that live in groups and usually caught at the beginning of rainy season. These shrimps captured by seine net called *bering* in Madura or by push-net called *pondet* and scoop-net called *soddu*. The different types of fishing gear depend on the bottom condition of the seawater, current strength, and the easy way in operating the gear (Mr. Iskandar Zulkarnaen, personal communication).

*Bering* is a long net that tied with buoys on a side (top side) and operated by a boat around the shoreline. According to Mantiri et al. [2], *bering* was used at 10–20 m depths. The nets dropped into seawater followed by boat moved forward until both of the net edges interlocked in a circular line. The bottom of the net then pulled in and the shrimp trapped inside the baring circle. The fisherman was capturing *gereguh* for twelve hours (04.00 a.m to 04.00 p.m) with a fishing ground 1–2 miles in coastal line.

*Sottal* operated by a small boat around the seashore. The net pushed into the surface of seawater against the flow of tides to collect the shrimps, while *soddu* is a scoop-net with a mesh size of 1 mm and used in the shoreline manually by pulling or pushing using the handle. Mantiri et al. [2], reported that some *soddu* also used in Java, Bali, and Madura.

### Table 1. Data survey on Maduranese *acan* from Madura Island.

| Characteristic | Acan product from Madura |
|---------------|-------------------------|
|               | 1 | 2 | 3 | 4 | 5 | 6 |
| a. Production |   |   |   |   |   |   |
| - shrimp gear | *soddu*, *pondet* | *soddu*, *pondet* | *soddu*, *pondet* | *pondet*, *bering* | *pondet*, *bering* | *pondet*, *bering* |
| - peak harvest| Apr-May | Aug, | Aug, | Jan, | Jan-Mar | Jan-Mar |
| - pre-treatment | draining | Oct-Des | 6 h drying | Freshly | 3 h drying | 3 h drying |
| - salt (%) | 10 | 10 | 10 | 10 | 5 | 5 |
| - coloring agent | Yes | no | no | No | Yes | Yes |
| - fermentation II (d) | 3-7 | 3-4 | 3-4 | 2 | 2 | 2 |
| b. Selling |   |   |   |   |   |   |
| - *acan* prod. (ton/d) | 10 | 0.2 | 0.25 | 0.5 | 0.5-1 | 1 |
| - price/ kg (IDR) | 60,000 | 45,000 | 45,000 | 35,000; 40,000 | 35,000; 40,000 |
| - selling area | locally, Nusa | locally, Java | locally, Java | locally, Java, Borneo | locally, Java, Borneo | locally, Java, Borneo |

Peak season of harvesting *geraguh* (Table 1) in each station is in a different period. In Ambunten, Sumenep (sta. 5, 6) occurred in January-March with daily catch reached to 2-3 tons per fishing gear. Famine season cones when April-Juni in every year. *Acen* producers have to buy raw material from other regions or islands, such as Kwanyar, Pekalongan, Tegal, and Semarang.

In Tamberru (sta. 4), peak harvest occurred in January, and April-June with a maximum catching up to 1-2 tons per fishing gear. In Arossbaya and Tanjung Bumi (sta. 2, 3) the peak season comes around August and October-December, while in Kwanyar (sta. 1) occurred in April-May with daily catch reached 2 tons.
3.2. Acan production

The processing of *acan* is quite simple through fermentation combined with sun drying. The manufacture of *acan* preceded by pre-treatment of *gereguh* to reduce the moisture content of the raw material. In Kwanyar and Arosbaya (sta. 1 and 2) the pre-treatment carried out by draining wet shrimp for 1 hour to get a semi-dried shrimp. In Tanjung Bumi (sta. 3), the *gereguh* are sun drying up to 6 hours while in Tamberru (sta. 4) used freshly and processed immediately. In Ambunten (sta. 5 and 6) both were sun-dried for 3 hours.

The shrimp ground into a fine-cut followed by adding solar salt based on the dosage (Table 1). Then the mixture was re-grind to ensure the shrimp meat and shell well-crushed. At stations 1, 5 and 6 added a food grade coloring agent (erythrosin®). Then following by fermentation overnight and grounded the *acan* pasta by a meat grinding. The pasta then lumped into 1 kg and re-dried (II) following by fermentation step for 2, 3, 4 or even 7 days depending on the daily weather to form a desired-smooth texture of the product (Table 1). The last step in producing *acan* is packaging on 1 kg polypropylene plastic (Fig. 2). In improving more distinctive aroma and taste, some producers extended the fermentation period for 3-5 days for aging before being sold.

Based on the *acan* manufacturing process, the product has similarities procedures with the making of *terasi* which is well-known as Indonesian shrimp paste. *Terasi* is made using the spontaneous fermentation of lactic acid bacteria (LAB) which utilizes some indigenous microbes [6]. The process of making *terasi* varied among regions in Indonesia, but in general, the process includes raw material preparation, drying, grinding, salt concentration, fermentation, drying, and packaging [7].

Fermentation of *terasi* occurs as a result of hydrolytic enzymes from raw materials and endogenous microbes degrading the complex compound from raw material into simpler ones [8]. During *terasi* fermentation several hydrolytic enzymes play a crucial role, especially: protease [9], fibrinase [10], lipase [7], chitinase and chitosanase [11].

![Figure 2. The processing of *acan* (a) draining, (b) grinding, (c) lumping, (d) drying, (e) packaging.](image)

3.3. Characteristics of product

Sensorial analysis of the *acan* indicated that the product has appropriate characteristics to the Indonesian shrimp paste standard [4], including appearance, smell, taste, and texture properties with the exception samples from Tamberru (sta. 4). It caused there was no draining step during pre-treatment procedure. So it would create higher moisture which affected to the sensory characteristics, i.e., less preferred, the color of the product was blackish-brown and a less distinctive in the aroma.

Generally, shrimp paste products are brownish red to dark brown [12]. The differences in the color in shrimp paste caused by different types of raw materials, different processing steps and additives used.
The total amount of microbes resulted in *acan* product was relatively varied (Table 2) depended on raw material condition, salt concentration, and moisture content. LAB and halobacteria played a crucial role in shrimp fermentation, such as Bacillus, Kurthia, Micrococcus, Pseudomonas, Sporolactobacillus, and Tetragenococcus [6, 13].

The protein content of *acan* was ranging from 24.20% to 48.43%. This difference value attributed to the different moisture content of product from each station. Binsan [15], reported *mongong* from the Philippines containing 24.24% of protein. The moisture content of fermented shrimp products varied due to differences in pre-treatment, fermentation period and drying step of the product. According to [12], *kapi* from Thailand has moisture content at range 33.95-52.19%.

The fat content in *acan* is relatively high compared to SNI [5], but not much different with *mongong* at 6.83% [15]. The pH value of *acan* was in accordant to [12], they stated that the shrimp paste product generally at 7.02-8.31.

Generally, *acan* has a similar characteristics with some Asian shrimp paste products, i.e., *ngapi* in Bangladesh, *ngapi seinsa* in Myanmar, *kapi* in Cambodia and Thailand, *saeu-jeot* in Korea, *belacan* in Malaysia and Brunei, *bangong alamong* in Philippines, *mam ruoc* in Vietnam, *xia jiang* in China, and *shiokara* in Japan [12, 14].

Locally, *acan* product is mostly wrapped using a plastic bag, or banana or teak leaves to improve a distinctive aroma and avoid contamination. In general, *acan* products from Madura have no brands, the brand added by the wholesalers in Surabaya or another location. The production quantity depended on the raw material availability and peak season.

*Acanes* products from Madura are not only sold to the local market but also to wholesalers and consumers from Kalimantan and Nusa Tenggara and Java, including Surabaya, Banyuwangi, Jember, Lumajang, Sitobondo, Bondowoso, Probolinggo and Tuban (Table 1).

4. Conclusion

*Acane* is a traditional shrimp paste product and consumed for generations by Maduranese, Indonesia. The producing of *acane* is quite simple through fermentation technology using *odeng acan* or *gereguh* (*Acetes* sp.) as the primary raw material which added with 5-10% solar salt. The characteristics and the quality of the product were convenient to the Indonesian shrimp paste standard product (SNI).

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**Table 2. The characteristic of *acane* from Madura.**

| Characteristic | *Acetes* | 1 | 2 | 3 | 4 | 5 | 6 | SNI 2016 |
|---------------|---------|---|---|---|---|---|---|---------|
| a. Sensorial  |         |   |   |   |   |   |   |         |
| Appearance    | -       | 8.7 | 9 | 9 | 6.5 | 8.9 | 9 | Min. 7  |
| Smell         | -       | 8.7 | 9 | 9 | 6.8 | 8.9 | 9 | Min. 7  |
| Taste         | -       | 8.8 | 9 | 9 | 6.8 | 9  | 9 | Min. 7  |
| Texture       | -       | 8.7 | 9 | 9 | 6.8 | 8.9 | 9 | Min. 7  |
| b. Microb.    |         |   |   |   |   |   |   |         |
| total (cfu.ml⁻¹)| -       | 2.2x10³ | 3.3x10³ | 6.8x10³ | 1.9x10⁴ | 1.3x10⁴ | 1.0x10⁴ | -       |
| c. Chemical   |         |   |   |   |   |   |   |         |
| Protein (%)   | 20.89   | 47.48 | 46.44 | 41.90 | 24.10 | 35.56 | 48.43 | Min. 15 |
| Moisture (%)  | 65.45   | 22.81 | 24.91 | 22.89 | 48.39 | 34.61 | 20.35 | 30-50 |
| Fat (%)       | 5.83    | 4.39  | 5.93  | 5.78  | 3.43  | 5.25  | 5.91  | Max. 2  |
| Ash (%)       | 4.66    | 29.69 | 28.57 | 28.37 | 23.67 | 23.25 | 21.27 | Max. 1.5|
| pH            | 7       | 8    | 7    | 7    | 8    | 7    | 7    | -       |
| awc           | -       | 0.73 | 0.77 | 0.78 | 0.80 | 0.77 | 0.74 | -       |

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