UTILIZATION OF CRAB SHELLS FOR FOOD

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ABSTRACT

Crab shells are waste generated from the crab meat freezing and canning industry. This article aims to review the use of crab shells into food products carried out in Indonesia either directly or indirectly. Based on the results of literature studies , crab shells can be used as food products either directly or indirectly. The use of crab shells as food ingredients directly, namely for the manufacture of petis, flavoring powder and crab shell flour for fortification of food products such as crackers and noodles. The use of crab shells as food ingredients is indirectly made as a natural coloring of food, for example in sausages.

Keywords : Petis, flavoring powder, natural dyes, crackers, fortification

INTRODUCTION

The crab (*Portunus pelagicus*) belongs to the basic meat-eating animals belonging to the family portunidae. Crab on the economic side is a fishery product with a high selling value so that it becomes an export commodity. Indonesia is a crab exporting country to various countries such as Singapore, Malaysia, China, Japan, and several countries in Europe, especially America. Every year almost 90% of Indonesia's crab meat production enters the American market. Currently, crab is a leading export commodity for Indonesian fishery products, especially for exports to Japan, the European Union, and the United States (Agustina, 2014).

According to the Indonesian Ministry of Fisheries and Maritime Affairs, in 2022 fishery exports will increase compared to the previous year. Crab commodities – kepeting ranks fourth largest in Indonesia's fishery export commodities. The export value of crab-kepeting amounted to USD 295.19 million, contributing 9.65% of the total fishery export value.

Export of crabs to America in the form of frozen crab meat or canned crab meat. The activities of the crab meat freezing and canning industry produce waste including crab shells. The more crab exports increase , the more crab shell waste will be generated. The increase in crab shell waste will have an impact on environmental pollution if left untreated.

Crab shells are poorly utilized potensial waste, even though the crab shells contain proteins, minerals, pigments and polysaccharides (chitin) that can benefit humans. According to Hapsoro *et al*. (2017), the nutritional content contained in crab waste has great potential when processed into food additives. About 40% – 60% of crabs are waste in the form of shells, which are rich in amino acids and disodium 5 ribonucleotides which are classified as umami source compounds (Tu *et al*. 2020). This article aims to review the use of crab shells into food products carried out in Indonesia either directly or indirectly.

Utilization of Crab Shells into Petis Making Materials

Petis is a processed paste-shaped product that resembles a thick, clayy and elastic pulp. Petis are generally black or brown depending on the type of raw material, additives and fillers. Petis is classified as a semi-solid textured food product (intermediate moisture food) (Isnaeni et al. 2014).

Petis in Indonesia, especially on the island of Java, is used as a spice for certain dishes such as rojak and kupat tahu. The basic ingredients of this petis are fish essence, shrimp, or part of fish and shrimp. Crab shells dapat used for the manufacture of petis (Novita, 2017 and Al-Faruqi, 2020)

The procedure for making petis from crab shells is as follows (Al-Faruqi, 2020) :

1. The crab shells are cleaned with water then boiled for 2 hours while stirring constantly.
2. Boiling is carried out in a ratio of water and shell 2:1 (volume/weight).
3. After boiling, then filtering is carried out to separate between the shell and the resulting broth.
4. The broth is then weighed and reheated.
5. The broth is then added palm sugar as much as 25% of the weight of the broth.
6. The broth that has been mixed with palm sugar is stirred while heated. After 1 hour of heating, the mixture is added tapioca flour by 10%, salt by 1% and sugar by 1% by weight of the broth. Stirring and heating continue to be carried out until a viscous mixture is formed.

Petis from crab shell juice has a sweet taste that is not excessive, with a thick slightly rough texture typical of palm sugar and a strong crab aroma (Al-Faruqi, 2020). According to Novita 2017, thecharacteristics of a good petis are brightly colored (not dull), generally blackish brown, smell good, viscous but slightly diluted from margarine. Too clayy petis can be suspected of containing too much starch. Thetexture is smooth and easy to apply.

The quality of petis in Indonesia is regulated based on the Indonesian National Standard (SNI) Number 2326:2010. These standards include sensory, ash, microbial contamination, metal contamination, and chemistry as shown in Table 1.

Table 1. Petis Quality Standards Based on SNI No. 2326:2010.

Paremeter	Unit	Persyratan
Sensory	Numbers (1-9)	Minimum 7
Microbial Contamination :		
- Total microbes	Colony/g	Max 5.0 x 10^3
- Escheria coli	APM/g	< 3
- Salmonella	Per 25 g	Negative
- Staphylococcus aureus	Colony/g	Max 1 x 10^3
- Vibrio cholerae	Per 25 g	Negative
- Mold	Colony/g	Max 5.0 x 10^1
Metal Contamination		
- Cadmium (Cd)	mg/Kg	Max 1.0
- Lead (Pb)	mg/Kg	Max 0.5
- Mercury (Hg)	mg/Kg	Max 1.0
- Arsenic (USA)	mg/Kg	Max 1.0
- Tin (Sn)	mg/Kg	Max 40.0
Chemistry		
- Moisture content	%	30 – 50
- Salt content	%	Max 5
- Protein content	%	Sun 15

Source : Novita (2017).

Petis has the opportunity to be a substitute for shrimp paste besides that the use of petis as a flavoring ingredient in cooking will reduce the use of monosodium glutamate (MSG) which is not good for health. Therefore, this petis has a potential domestic market opportunity.

Utilization of Crab Shells into Flavoring Powder Materials

Perisa is defined as a food additive in the form of concentrated preparations, with or without flavoring adjuncts used to give flavor, with the exception of salty, sweet and sour flavors. Another definition of food flavoring is a food additive that can provide, add or emphasize the taste of food. Perisa is classified into 2 groups, namely synthetic flavors and natural flavors.

According to Hastuti et al (2012), centetic flavoring is a concern for various groups, due to the solvents and basic materials used. The solvents used typically use chemicals (alcohol and propylene glycol) to produce aromas. The use of alcohol solvents in Indonesia is not allowed, because the resulting flavors fall into the category of non-halal for Muslims

According to Mulyadi et al (2013), crab shells can be used as a natural flavoring powder material. This crab shell flavor can have the aroma and taste of seafood which is currently still rarely found in the commercial market.

The manufacture of flavoring powder from crab shells is as follows (Mulyadi et al, 2013): Ccrab shells are cleaned with running water, then dic Shrink its size (crushed) to increase the surface area, and water is added with the ratio of the shell : water that is 1 : 2. After that it is heated to a temperature of 100 ^{o} C for 60 minutes, then filtered and the pulp is removed, a filtrate is obtained which is then concentrated until the volume becomes half (1

hour 45 minutes), so that a concentrated filtrate is produced. After that, the concentrated filtrate is added dextrin as much as 10% of the weight of the filtrate, garlic, sugar, salt, and mixed using a blender until evenly distributed (2 minutes). After that, it is poured on a baking sheet (30 x 25 cm) with a plastic base and dried using a vacuum dryer with a temperature of 60 ^{o} C with a time of 8 hours, then crushed diblender and sifted (60 mesh), and produced flavoring powder.

Based on the results of research by Hastuti et al (2012), the level of panelists' acceptance of crab shell flavoring on average panelists like flavoring products based on aroma and taste. The flavoring aroma of crab shells is almost the same as that of crab meat. Mulyadi et al (2013) informed that hasilanoleptic org test in the manufacture of natural flavoring powder from crab shells obtained a taste value of 2.6 (neutral), aroma 3 (neutral), color 3.6 (like), texture 3.8 (like), and for physical parameters namely water content 6%; solubility 74.67%; and absorbency of 10.34%. The flavoring powder from crab shells can be applied as a flavor enhancer to foods such as meatballs, noodles, soup, soup, and so on.

Utilization of Crab Shells into Natural Dyes Materials

In today's modern era , food coloring agents are inseparable from various types of processed food and beverages. Producers are also competing to attract the attention of consumers by adding coloring to food and beverages (Nasriani, 2018). The coloring agents used in food are colored compounds that have a chemical affinity for the objects they color. Color in food or beverage products is an important factor that is usually an attraction for consumers. Color is a basic factor in determining the quality of a food (Nurdianti et.al. 2017).

Extraction of arotenoid k pigment on crab shells using a type of maceration extraction. According to Mukhriani (2014) the maceration method has several advantages such as how to work and the tool units used are simple, operational costs are relatively low, and can avoid damage to compound compounds that are thermolabile.given bulk ice. The use of dark-colored buckets and bulk ice is intended to avoid the occurrence of contamination from the light and temperature of the environment. The working procedure of the extraction of the pigment karotenoid on the crab shell by maceration method is as follows:

1. Weigh crab shells. Then Put in a measuring cup a volume of 2 liters.
2. Add acetone in a ratio of 2 : 1 with the shell and stir for 5 minutes then strain using filter paper number 1.
3. Rinse the pulp from the sieve with acetone.
4. Filter the extraction results then evaporate them under vacuum conditions at a temperature of 40oC using a rotary evaporator.
5. Recover pigment using cooking oil as much as 5 ml.
6. Transfer the pigment-containing oil into a dark bottle (sample bottle).
7. Store in the freezer at a temperature – 20oC.

The resulting natural dyes will be applied to food products in the form of sausages, and onde-onde. The natural dye will be mixed into food until it is homogeneous (Nasriani, 2018).

Processing of Crab Shells in the Form of Flour and Its Use as Calcium Fortification Materials in Food Products

Crab shell flour has a high calcium content and can meet the daily needs of human calcium. Calcium is needed by the body around 800-1200 mg / day. The function of calcium, among others, is for the formation of bones and teeth, plays an important role in growth and as an auxiliary factor and regulator of biochemical reactions in the body.

The manufacture of crab shell flour (*Portunus pelagicus*) is carried out using two methods, namely the wet method and the dry method. The stages of making crab shell flour (*Portunus pelagicus*) by the wet method consist in cleaning, reducing the size, boiling, washing, boiling with an autoclave , drying with the oven, and grinding. Making crab shell flour (*Portunus pelagicus*) by the dry method consists of several stages, namely cleaning, reducing size, boiling, washing, drying with oven, and grinding. The following is the process of making crab shell flour ((Khasanah and Hartati 2014):

1. Cangkang crab iscleaned with running water then boiled with water until boiling and leave for 30 minutes. After that it is drained and cooled.
2. The next stage is carried out the drying process, which is dried in a Cabinet Dryer with a temperature of 60ºC for 4 hours (the product becomes half dry).
3. The next process is scavenging, which is grinding using a blender, and continued enrichment using a sieve with a size of 80-100 mesh, then crab shell flour is formed which is ready to be used as a calcium fortification material.

The manufacture of crab shell flour in Indonesia has been widely carried out on a research scale. Yanuar et al (2009) inform the physical and chemical properties of crab shell flour as contained in Table 2.

Table 2. Physical and Chemical Properties of Crab Shell Flour

Parameters	Unit	Value
Physical properties		
- White degree	%	62.88 ± 0.21
- Water absorption	%	65.96 ± 4.56
- Kamba density	g/ml	0.69 ± 0.01
Chemical properties		
- Moisture content	%	3.32 ± 0.55
- Ash content	%	72.87 ± 0.36
- Calcium levels	mg/g (bk)	300.90 ± 10.15
- Phosphorus levels	mg/g (bk)	12:01 PM ± 0.98
- Ph		9.64 ± 0.05

Source : Yanuar et al (2009).

According to Yanuar (2013) one of the alternative efforts to utilize crab shell waste to have the value and usability of crab waste into products of high economic value is processing into crab shell flour which can then be processed as substitution and fortification of foodstuffs.

Fortification of crab shell flour has been carried out on noodle products. Khasanah and Hartati, (2014) stated that the noodle products preferred by the panelists were obtained from the ratio of wheat flour and crab shell flour (90:10)%. The Proximate content of the comparison is water content 0.51%, ash content 0.44%, protein 6.60%, fat 2.7%, and carbohydrates 89.75%. Yanuar et al (2009) have also conducted research on the addition of crab flour to crackers products. The most preferred crackers product is the crackers product obtained from the addition of 3% crab flour. The chemical composition of the crackers is as follows: water content 3.03%, protein content 9.78%, fat content 22.89%, carbohydrate content 60.57%, ash content 3.73%, calcium content 3.76 mg / kg (bk), and levels phosphor 1.99 mg/Kg (bk).

CONCLUSION

Basedon the results of the study of crab shell literature, it can be used as an ingredient in food products either directly or indirectly. The use of crab shells as food ingredients directly, namely for the manufacture of petis, flavoring powder and crab shell flour for fortification of food products such as crackers and noodles. The use of crab shells as food ingredients is indirectly made as a natural coloring of food, for example in sausages.

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