Effect of processing conditions on fish quality

Processing of minced fish meat is by separating the edible flesh from waste. Additional steps are applied to the minced fish meat to produce surimi. Surimi is originated from Japanese word, intend to mimic the texture and colour of other shellfish. Common fish used in production of surimi is cold water white fish. This experiment is aimed to monitor the effect of processing conditions on physicochemical properties and sensory properties of minced fish meat. The whole fish was cleaned and debone which will then be washed, decanted, and pressed, in which analysis is done after each decanting process, the third washing, and pressing process. Besides, sensory evaluation is also done on the fish meat for colour and odour. The weight and the moisture content of the fish meat after processing are expected to decrease. It is expected that the processed minced fish meat to be low in fat content and have acceptable white flesh with mild fishy odour.

Keywords: Minced fish meat, surimi, processing, sensory properties, physicochemical properties

Introduction

Minced fish the common way of separating the edible flesh from waste is produced by filleting. The fish flesh is separated from skin, scales, fine and bone in a bone separator and coarse mince is recovered. These minced fish meat can undergo additional steps to produce many other minced meat based formulated products such as surimi, fish balls, sausages, nuggets. In this experiment, the minced fish meat will be processed to produce surimi.

Surimi is originated from Japanese word which refers to a fish-based food product intended to mimic the texture and color of the meat of lobster, crab

and other shellfish. It is a very good source of proteins. The fish that commonly used for the production of surimi is cold water white fish such as Alaska Pollock (Theragra chalcogramma) and Threadfin Bream (Nemipterus spp.). The most suitable species for surimi processing are those with white flesh and low fat content. Alaska Pollock still represent the largest fishery biomass used for surimi production (Park, 2005).

There are a few major steps in processing the surimi. Firstly, the fishes are cleaned, deboned and minced. The minced fish meat is then washed with chilled water repeatedly to remove the undesirable pigments, fats, flavours and water soluble proteins, primarily sarcroplasmic proteins which are thought to impede the gel-forming ability of surimi. This process is called leaching. Myofibrillar is the primary components in surimi that possess the ability to form three dimensional gel network which responsible for gel formation in surimi based product (Park and Lanier, 2000). Hence, the removal of water soluble proteins will concentrates the myofibrillar proteins and enhances the functional properties of surimi (Park, 2005). The last step is the dewatering process where the water in the minced fish meat is removed by pressing. Next, food additives such as gel enhancers and cryoprotectants are added to enhance the quality of surimi. The surimi is will then undergo further process to produce imitation meat product.

The fish that used in this experiment is Threadfin bream (Nemipterus japonicas) or locally known as Kerisi. It is a fish which has color of upper body pinkish and silvery below. This fish can be found on sand or mud bottoms. There are abundant in coastal waters. Larger fish feed mainly on crustaceans, fish and cephalopods. Young fish (< 12 cm) eat copepods,

ostracods and amphipods (Russell, 1990). Threadfin is a white flesh and lean (low fat content) fish which is suitable in the surimi processing.

The objective of this experiment is to monitor the effect of processing conditions and sweetener addition on physicochemical properties and sensory properties of minced fish meat. The processing conditions which is an extrinsic factors such as time and temperature of processing, washing cycle and wash water ratio and the pH, hardness or salinity of the water used will also affect the quality of the surimi.

Materials and Methods

2. 1. Samples

The fishes Nemipterus japonicus was collected from Pasar Borong Selangor during July, 2010. The average length, breath and weight of degutted Nemipterus japonicus were 22. 34 cm, 2. 31 cm, 0. 120 kg respectively where as the number of individuals taken was six.

2. 2. Sample Preparation

The fishes were undergone deboning process using a deboner forming minced fish. It is followed with the washing process whereby the minced fish were washed with ice slush in 1: 3 fish to slush ratio. The minced fish were filtered using filter gauze. 0. 2% of NaCl were added beginning from 2nd washing of the fish. The washing processes were repeated for 3 times before undergoing pressing using a decanter. The process conducted is similar to process described by Park (2000). Analyses were done on each washing process.

2. 3. Sample Analysis

The analysis includes colour using the Hunter Lab Colorimeter; moisture using both Infrared Drying (IR method) and Oven Drying method (AOAC Method 945. 15); pH using calibrated pH meter; fat using Soxhlet method (AOAC Method 960. 39 for Meat Fat) and Percentage of Yield (% Yield)

Result and Discussion

3. 1. Discussion

Surimi is a stabilized myofibrillar protein of fish muscle. Therefore, the quality of surimi is affected by several intrinsic parameters. The qualities are affected by the effects of the species, seasonality, sexual maturity, freshness and other factors affecting surimi quality. (Park and Lanier, 2000)

The proximate value obtained from this experiment is quite similar when compared to the standard value of proximate composition of minced fish. The standard moisture content of minced fish is 78. 4% while the moisture content obtained from this experiment is 83. 65%. As for the fat content of minced fish, standard value is 1. 7% while experimental value is 1. 04% after the fourth washing. The standard pH range of minced fish is a wide range of pH 6- 8 while the pH value obtained from this experiment is pH 6. 8 after the fourth washing (Sen, 2005).

From the result obtained, the moisture content increases for each washing before the pressing process. The increase of moisture content is affected by several factors. One of the factors is the fish used. Based on data in Table 1, Kerisi (Nemipterus japonicas) used was measured at the average of 22. 34 cm in length, 2. 33 cm in breath and 0. 120 kg in weight after degutted. The

average length of matured kerisi was measured 25 cm (Samuel, 1986) and weigh 0. 596 kg (Lee, 1975). After comparison, the fish used are matured fish and may have undergone spawning as July is the peak of the spawning season (Vladimir et. al. 2004). The pH of the fish harvested during and just after spawning season produces lowest quality of surimi as pH is relatively higher compare to non-spawning season. The high pH causing the leached muscles tends to retain more water making water removal more difficult. Thus, increases the moisture content of the sample for each stage of analysis as shown in the first 2 washes in Table 2. Lee (1986) suggested that by lowering the pH or increasing the salinity of the final wash can alleviate the water retained. Another factor would be the process of decanting. In the process of decanting, screening was done manually and the force exerted was not as constant as pump screening to remove the excess water. Thus, this also contributes to the increase of moisture content.

From Table 2, there are differences between the readings obtained in the Infrared Drying Technique (IR method) with the Oven Method. Infrared drying accuracy is affected by factors like the distance of the infrared source and also the thickness of the sample. (Bradley, 2003) The difference of the reading between IR method and Oven method is different due to the accuracy factor of Infrared method as the sample may be too thick for the analysis.

In the same table shows that the initial crude fat content of the minced fish before washing process is 0. 61%. After the first washing and decanting, the crude fat content decreased to 0. 40%. For the second analysis of crude fat, the percentage of crude fat increased to 0. 76%. The crude fat content of

minced fish increased to 0. 95% and 1. 04% for the third and forth analysis respectively. Washing is one of the most critical steps in surimi manufacturing used to remove the sarcolpasmic proteins, blood, fat, and other nitrogenous compounds from the minced fish flesh. Texture, color and odour of the final products were greatly improved when these impurities are removed by washing (Park, 2005).

Theorectically, the fat content of minced fish decreases significantly after the first wash and decreases slightly after two or three washes. Accordingly, protein and carbohydrate significantly increased after one wash and slightly increased after two or three washes. This result was attributed to the increased concentration of protein and carbohydrate due to leaching of the fat from the mince by washing with water (Lim and Sessa, 1995).

The Hunter Lab colorimeter is used to test and evaluate the colour intensity of the sample. The colour data and spectral data was displayed numerically in spreadsheet form or graphically as colour plots, spectral plots, trend plots and control charts. The three coordinates represent the lightness of the colour (L = 0 yields black, L = 100 indicates diffuse white), its position between red/magenta (a = positive values) and green (a = negative values), and its position between yellow (b = positive values) and blue (b = negative values). The colour of minced fish becomes lighter after every wash. This is in order to achieve the desirable colour according to market preference. Based on the data, the L value decreased from till second washing but the L value increased from second washing onwards till the fourth washing. This indicates that the whiteness of the minced fish meat increased after washing. (Park, 2005)

The deviation in results obtained is due to experimental error and inconsistency during the experiment. The ratio of water content of minced fish meat to the weight of sample (minced fish meat) is increased after subsequent washing, meaning that the water content is low, whereas the weight of minced fish meat is high for a particular fixed sample weight. Water content is low due to the addition of salt and pressing. Hence, when the fixed sample weight is needed to be achieved, higher amount of the sample (minced fish meat) is required. When more of the sample is used, the crude fat content obtained is higher.

From the sensory evaluation, 20 people were randomly selected to evaluate the colour, odour and overall acceptability of the minced fish meat. The evaluation for the first wash was not accepted and the feedback gradually increases to slightly acceptable level as the stages proceeded. This is because the minced fish has lost its strong odour and its colour.

Conclusion

Kerisi (Nemipterus japonicus) braces as a good subject for surimi production as it is a low fat content (lean) fish because high fat content fish lowers the shelf life of the minced fish due to fat oxidation. From the results obtained, Kerisi exhibits increase in whiteness in colour besides maintaining its moisture and pH. Kerisi has the potential to be developed as minced fish or surimi product as this fish is still categorized as underutilized fish in the Asia Pacific region. Production of surimi from this underutilized fish would boost the fishery industry in the region.