Chitin and Chitosan from Green Shell (*Perna Viridis*): Utilization Fisheries Wastes from Traditional Market in Jakarta

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Abstract. Many advantages of burden wastes which adversely impact to the environment in the form of solid waste. Green shellfish wastes are used for resources of chitosan. The aim of this works is to identify the effectiveness of chitosan application into 2 kinds of moist foods; wet noodles and meatballs. The concentration of chitosan are 0%, 0.5%, 1%, 1.5%, and 2%. The samples are immersed for 0,15, 30, 45, and 60 minutes. The study has found the water content of chitin is 8.31% and chitosan is 6.83%. The degree of deacetylation of chitin is 37.81% and chitosan is 82%. The best concentration of chitosan for wet noodle is 1.5% -2% with the immersion of 45 -60 minutes, and for meatballs is 1.5%-2% with the immersion of 15 minutes. The organoleptic test, on day-3 noodle and meatball, is still in good condition. If no chitosan added the noodles sample is day-1 is in fair condition, while meatball should be consumed directly because in day-1 is becoming chewy with a sour taste, and on day-2 are overgrown with mushrooms.

1 Introduction

Indonesia is referred to as a country with the largest archipelago. Fisheries is a major source of marine resources for food, industry, and other reliable sources of income. Besides the benefits, it also generates wastes. Green shellfish is the other type of wastes generated from the fisheries sector. The global annual estimates the shellfish processing discarded is around 5.118 x 106 metric ton [1]. The abandoned of the shell is severe with the limit process of wastes which creates damage to the environment, it needs proper management [2]. Exploring its value as an effort of reducing wastes has increased its economic outcome. The mollusk containing chitin can be processed to a broad range of industrial application [3]. The non-toxic and easily degradable of chitin in nature has encouraged the modification of chitin with the aim of optimizing the usefulness as well as expanding the field of chitin application [4].
Chitosan is one of the derivatives of chitin, it is the product of deacetylation. It can be produced in the form of powders, pastes, films, and fibers [5]. The bio-degradable property of the chitosan [6] 6so is certain safely to be consumed.
The property of it's in acidic media provides an antibacterial activity which makes it an ideal polymer for food science [7]. The presence of hydroxyl and amino groups along the chain of

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polymers in chitosan are effectively adsorbed the cations of organic substances such as proteins and fats. Based on this facts, the chitosan can perform as food preservatives which can inhibit fermentation, acidification or other forms of damages by damaging cell membranes of microorganisms [8].

Chitin and chitosan of Green Shellfish

Green shellfish (*Perna viridis*) lives in tropical seas, especially in coastal waters. The common name of green shellfish in Indonesia is kaung-kaung, kedaung and etc. Chitin of green shellfish is a linear polymer [9]. Chitin is an amorphous or crystalline solid, white, and biodegradable [10], it is soluble in acidic solutions and then form chitosan [9].

Chitosan is a heteropolymer of N-acetyl-D-glucosamine and D-glucosamine, which can be obtained from chitin through partial deacetylation process. Commercial chitosan has deacetylation degree of 2% to 40% [11]. The more acetyl groups lost from the chitosan biopolymer, the stronger the interaction between ion and hydrogen bonding from chitosan [12-13]. The capacity to adsorb chitin and chitosan increases with the increase of free amino group [14]. The most influential factor of chitosan as a food preservative is the number of amines (NH_2) groups.

2 Experimental

The experimental flow diagram for chitosan fabrication is drawn in Figure 1.

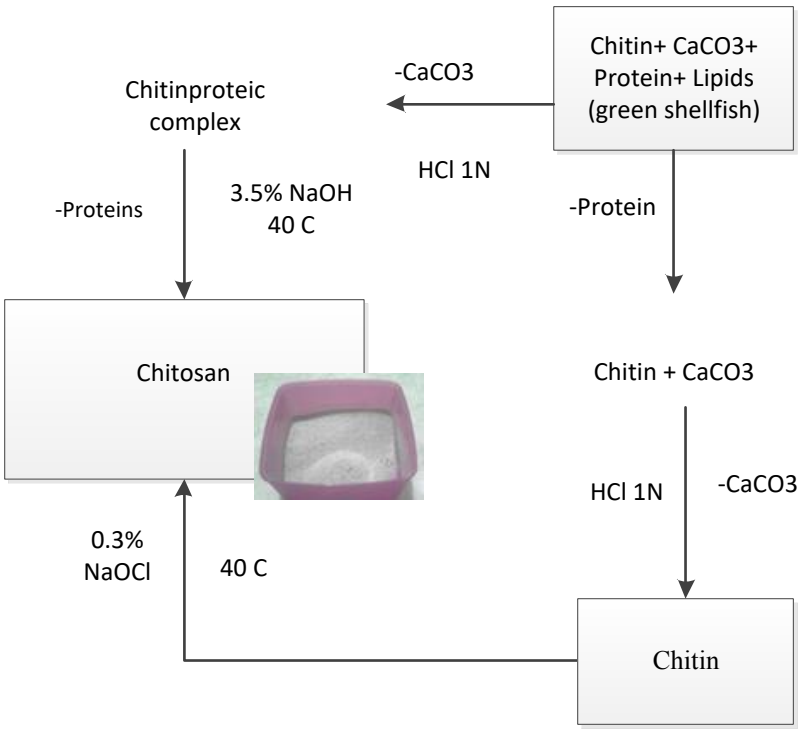

Fig1. Flow Diagram of Chitosan

2.1 Characterization of Chitosan

1.Organoleptic test. Testing includes shape, color, and odor. It performed by the appearance of shell powder, chitin, and chitosan.
2.Moisture Content. AOAC method. Weigh the empty porcelain. Weigh a sample of 1-3 grams in a porcelain. Put in the oven at 100-105^{0}C for 1-2 hours. Cooled for approximately 30 minutes and weighed. Heat again, and cooled until the weight is constant.
3. Measuring the Degree of Deacetylation (DD) by FTIR. The degree of deacetylation is the percentage of acetyl group removed during the chitin deproteination process. The chitin is treated by adding 50% NaOH which causes the hydrolysis of the acetyl group of the chitin acetamide group.

2.2 Immersion of noodles and meatballs into chitosan solution.

The chitosan solution was prepared by blending chitosan powder with acetic acid 2%. The desired chitosan concentration are 0.5%; 1%; 1.5%; and 2% (v/v). Soak the wet noodles and meatballs into chitosan solutions. Immersion is done at the desired time 15; 30; 45; and 60 minutes. Drain the wet noodles and meatballs. Let it stand for room temperature. Conducted the organoleptic test in 0,1,2, and 3 days.

3 Results and Discussion

The crushed green shell is treated by 1N HCl to removed the $CaCO_3$ salt, and continued the process to proteins and lipids removal by 3.5% NaOH, according to Remya the best concentration of NaOH is 5% [15]. The degree of deacetylation is address to differentiate between chitin and chitosan. The depigmentation into chitin has caused to forming the white chitosan powder. Chitosan is a safe ingredient to be used as an inhibitor of microbial activity. This is due to the positively charged amino groups interacting to microbes, so weaken active microbes. The limited solubility of chitosan in many solvents but perfectly soluble in acetic acid.The percentage of acetyl group removed during the extraction process by adding NaOH which causes hydrolysis of an acetyl group from acetamide group. The degree of deacetylation is determined by IR spectrum. The degree of acetylation of chitin is 37.81% which is lower than chitosan 82%, as summarizes in Table 1.

Table 1. Physical characteristics of raw materials and products

Parameter	Shellfish	Chitin	Chitosan
Form	Rough powder	Fine powder	Fine powder
Color	Greyish White	Brown	Pale white
Odor	Fishy	Little Fishy	No smell
Water (%)		8.31	6.83
Degree Deacetylation		37.81	82

The water content of chitosan is 6.83% this is possible of concurrent water molecules as well the nature as hygroscopic. The Standard of water content in chitosan is in the range of 2-10% [6]. In this study, the application of chitosan has been carried out on foods such as wet noodles and meatballs. The indicator used to know that chitosan works effectively in extending food life is from odors. The food stale because preservatives are not working properly. Some initial occurrence is from the odor, texture, and possibly of mushroom growth which is the sign of beginning of decomposition.

In wet noodles, 15 minutes of food immersion is still fair good until day 2. Overall the best concentration is in the range of 1.5-2% with immersion for 45-60 minutes, as can be seen in Figure 2.

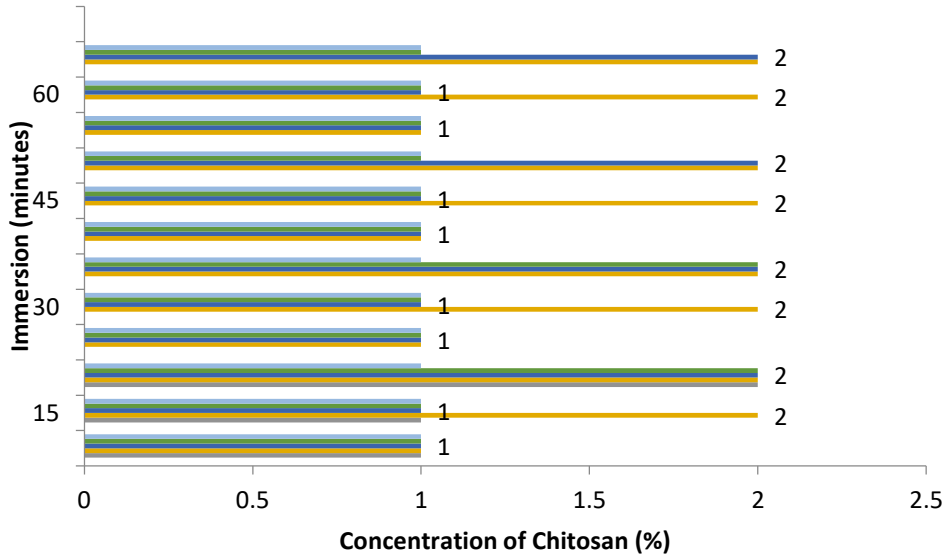

Fig 2. The concentration of chitosan to shelflife of noodle
1: smell flour 2: smell sour

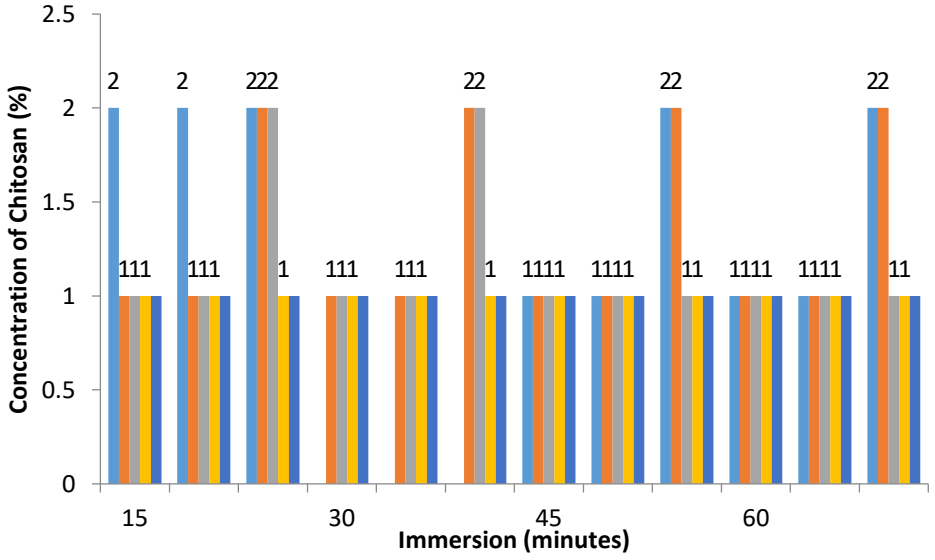

Fig 3. The concentration of Chitosan to Shelflife of meatball
1: smell typical meat 2: smell sour

The sour aroma of meatball will smell on average on the day-3. Meatballs on the immersion day 0.5% - 1% have not effectively preserved and shelflife during storage. Until day-2 the sample still has in the physical characteristics; the chewy and distinctive smell of meat and

with no mushroom. The best concentration is 1.5% - 2% in 15 minutes, as can be seen in Figure 3.

4 Conclusions

This study can be concluded :
1. From resource of green shellfish, the degree of deacetylation for Chitin is 37.81% and Chitosan is 82%.
2. The best immersion of noodle in chitosan solution 1.5 % - 2% with 45 – 60 immersion. . From the organoleptic parameters all samples are in good condition until 3 days, with physical characteristics; smells of flour, chewy and not yet encountered moldy.
3. The best immersion of meatballs in chitosan solution best is 1.5% - 2% in 15 minutes. Until day-3 the sample still has the physical characteristics; the chewy and distinctive smell of meat and the sample with no moldy.

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