# Isolation Of Chitosan From Dogol Shrimp Skin (*Parapenaeopsis Sculptilis*)

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***Abstract***
*In Indonesia, shrimp underwent a "cold storage" process where the heads, tails, and shells were discarded as waste. This shrimp waste could pollute the environment around the factory so it needed to be utilized. So far, shrimp shells had only been used as ingredients for making crackers, shrimp paste, and animal feed supplements. The remaining shrimp shells that had been separated were made into chitosan which was then subjected to characterization tests. The three steps of the chitosan isolation process were deproteinization, demineralization, and deacetylation. The analytical tests carried out were testing the water content, ash content, and functional groups contained in chitosan which were identified using the Fourier Transform Infra Red (FT-IR) Spectrophotometer. Based on the test results, there was a moisture content of 9.27% and an ash content of 1.69% in the chitosan samples made from shrimp shells. Functional groups of shrimp shell chitosan were identified using FT-IR characteristics. The -NH- group, which was represented by the N-H and O-H stretching groups, could be seen in the absorption band 1456.26 in the wave range 3000–30500. The conclusion of this study was that chitosan could be extracted from shrimp shells and meet the characterization criteria.*

***Keywords:*** *Chitosan, shrimp shell, characterization and FT-IR.*

## I. INTRODUCTION

Shrimp is one of the most abundant crustaceans in Indonesian waters which contains protein (21%), fat (0.2%), vitamins A and B1, calcium, and phosphorus which are also sources of food [1]. In Indonesia, shrimp undergo a "cold storage" process where the heads, tails, and shells are discarded as waste. This shrimp waste can pollute the environment around the factory so it needs to be utilized. So far, shrimp shells have only been used as ingredients for making crackers, shrimp paste, and animal feed supplements. Even though 20-30% of the waste contains chitin compounds which can be converted into chitosan [2]. Chitin is a natural polymer found in shelled marine animals. Chitin can be processed into chitosan through a deacetylation process where chitosan has antibacterial and biocompatible properties. Indonesia as a maritime country has a high amount of aquatic product waste, one of which is shrimp shell waste [3].

Chitosan is a natural polysaccharide with the characteristics of biodegradable, biocompatible, non-toxic, and capable of forming films [4].Chitosan is a compound derived from chitin, a compound that makes up the exoskeleton of many-legged animals such as crabs, small crabs, shrimp, and insects [5]. Chitin is insoluble in water so its use is limited. One of the chitin derivatives is chitosan, a compound with the chemical formula β-(1,4)-2-amino-2-dioxy-D-gluc the acetyl group in chitin is converted by hydrogen into an amine group by adding a high concentration of a strong base solution. The main advantage of chitosan compared to cellulose and chitin is its versatility, because the deacetylation process releases an amine group ($NH_2$), resulting in chitosan with a very basic character. In chitosan, the availability of reactive sites allows collateral bonding and the formation of aldimines and ketamine with aldehydes and ketones. For example, chitosan and aldehydes by hydrogenation are derived from N-alkyl chitosan, leading to the formation of a film [5].

## II. METHODS

The method used in this study was an experimental method using raw shrimp shells (*Parapenaeopsis sculptilis*) for the manufacture of reagents, chitosan isolation, characterization of the chemical content of chitosan (testing moisture content, ash content, and analysis of functional groups using the Fourier tool), and Infrared Transform Spectrophotometer (FTIR).

### 2.1 Sample

The material used was shrimp shells obtained from fish shelters at Tanjung Leidong port, Batu Labuhan Utara.

### 2.2 Isolation of Chitosan from Dogol Shrimp Skin

Using an infrared spectrophotometer, functional groups present in standard chitosan and shrimp shell chitosan were identified to characterize chitosan qualitatively. In the range of wave numbers 3000-30500, the isolated chitosan showed a bending vibration of -NH-amine in the absorption band 1456.26. This absorption was 3464.15 cm-1, which was expressed as the N-H and O-H stretching groups. The NH absorption peak was the main feature of the chitosan structure. The absorption peak of 1172.74 indicated the presence of -CO- groups, which from the results of the absorption peaks of chitosan and the groups observed from the isolation results could be expressed as chitosan compounds. The -CH (methylene) stretching group was seen at the peak of 2921.03 [6].

### 2.3 Characteristics of Chitosan from Dogol Shrimp Skin

The characteristics of chitosan from dogol shrimp skin tested were analysis of water content, analysis of ash content, and characteristics of chitosan using Fourier Transform Infra-Red (FTIR) Spectrophotometry.

## III. RESULT AND DISCUSSION

The Yield of Chitosan Isolation Results from Dogol Shrimp Shells, after the shrimp shells were cleaned, they were weighed 360 gr. After being mashed into powder and sieved, the weight was recovered, which was 178 gr. The yield obtained was 82.5%.

Chitosan isolation results at the processing stage:

### 3.1 Deproteination

In shrimp shell flour, the deproteination procedure tried to release the protein bonds. To separate proteins covalently bound to the functional groups of the powder, the deproteination process of the shrimp shell powder was reacted with dilute NaOH so that the protein dissolved in the base. Complete protein breakdown and protein deposition were facilitated by stirring and heating procedures which accelerated the binding of the protein chain ends to NaOH [7].

### 3.2 Deacetylation

Chitin was converted into chitosan during the deacetylation process by hydrolyzing the acetyl group (-NH-COCH3) using a certain solution. Strong NaOH solution was one that had been used. Chitosan could still be ground to a certain size at this point, although it was still in the form of coarse granules [8]. The acetyl group (-NH-COCH3) of chitin was intended to be converted into an amine group (-NH2) in chitosan through a chitin deacetylation procedure using concentrated NaOH solvent. By examining changes in the infrared spectrum of chitin and the deacetylation results determined at certain wavelengths, these changes could be identified [9]. The number of free amino groups in a polysaccharide was determined by the degree of deacetylation [10]. The acetyl group on the chitin molecule was removed during the deacetylation process, resulting in chitosan with a high level of chemical reactivity from the amino group. An infrared spectrophotometer was used to evaluate the dry powder produced by the deacetylation procedure to determine the active group presented in a yield of 27.8%.This study used raw material in the form of cuttlefish bones. To determine (protein content, moisture content, and ash content), chitosan from shrimp shells was characterized. Table 1 shows the results of the chitosan characterization of shrimp shells [11].

**Table 1.** Characterization of shrimp shell chitosan

| No. | Parameter | Isolated chitosan content (%) | Standard level of chitosan (EGRA,2010) |
|---|---|---|---|
| **1.** | Mousterizer content | 9,27 | ≤ 10 |
| **2.** | Ash content | 1,69 | ≤ 3 |

The metric used as a benchmark for the quality of chitosan was the typical result of chitosan having a water content. The extent to which chitosan could withstand the presence of microbes depended on how much water it contains[12]. The method used to dry the chitosan, the length of the drying process, the amount of chitosan dried, and the surface area on which the chitosan was dried all had an impact on the moisture content of the chitosan [13]. The metric used as a benchmark for the quality of chitosan was the typical result of chitosan having a water content. The extent to which chitosan could withstand the presence of microbes depended on how much water it contains . The method used to dry the chitosan, the length of the drying process, the amount of chitosan dried, and the surface area on which the chitosan was dried all had an impact on the moisture content of the chitosan [14].

In the results of the study, chitosan had an ash percentage of 1.69%, indicating a lower overall mineral composition. This showed that the demineralization procedure used to make chitosan was effective because there was not much mineral left. An important factor was the ash content of chitosan. Viscosity could be reduced and solubility could be affected by high ash content [14], [15]. The ash content reflected the success rate of demineralization, so a low ash value indicated the purity of chitosan. The purpose of the ash content analysis was to determine the amount of minerals present in the blood of the clams. In addition, the amount of ash in a substance could be used to measure how soluble chitosan was in certain solvents [16].Based on the results of analysis using the FTIR spectrophotometer [15], chitin isolated from shrimp shells had been successfully synthesized into chitosan. Figure 1 shows the results of the analysis of the characterization of the chitosan functional groups. Then Figure 2 shows the results of the characteristics analysis of the chitosan functional groups from shrimp shells.

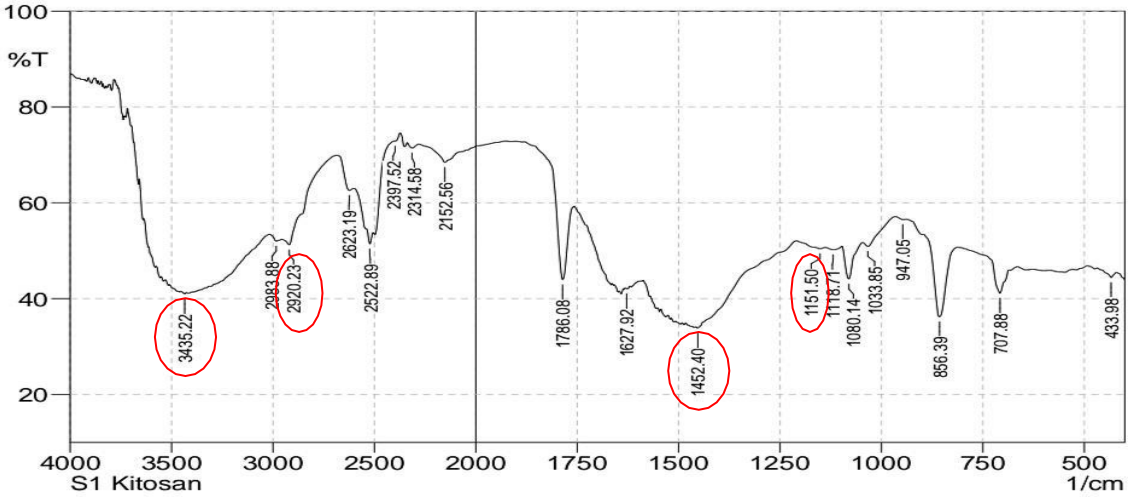


**Fig 1.** Spectrum of the analysis of the standard functional group of chitosan

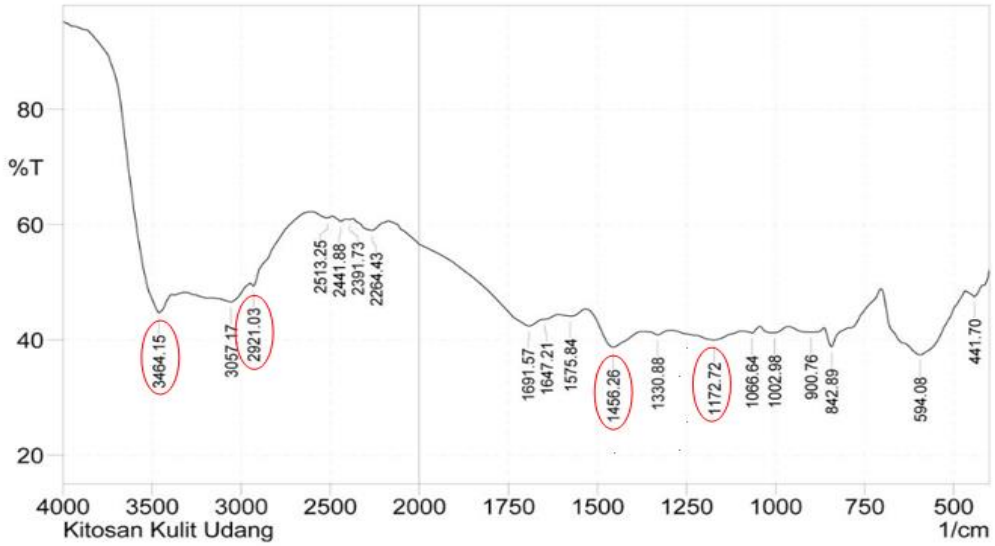


**Fig 2.** Spectrum of the analysis of the functional group of Shrimp shells chitosan

Using an infrared spectrophotometer, functional groups presented in standard chitosan and dogfish shell chitosan were identified to qualitatively characterize chitosan. In the range of wave numbers 3000-30500, the isolated chitosan showed a bending vibration of -NH-amine in the absorption band 1456.26. This absorption was 3464.15 cm-1, which was expressed as the N-H and O-H stretching groups.The NH absorption peak was the main feature of the chitosan structure. The absorption peak of 1172.74 indicated the presence of -CO- groups, which from the results of the absorption peaks of chitosan and the groups observed from the isolation results could be expressed as chitosan compounds. The -CH (methylene) stretching group was seen at the peak of 2921.03.

## IV. CONCLUSION

Chitosan can be isolated from shrimp shells, as evidenced by the results of the characterization tests carried out, showing results that are in accordance with the literature or previous studies.

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