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Submission date: 06-Apr-2023 11:33AM (UTC+0700)
Submission ID: 2057271029
File name: golden_apple_snail.pdf (231.5K)
Word count: 2389
Character count: 12800

International Journal of Eco-Innovation in Science and Engineering (IJEISE) Vol 3 (2), 2022 (45-48)
https://ijeise.upnjatim.ac.id/ E-ISSN: 2721-8775

IJEISE

Article

Physical Characteristics of Golden Apple Snail (*Pomacea Canaliculata*) Sauce Using Bromelain and Calotropin Enzym

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Received: 11th October 2022; Revised: 21st November 2022; Accepted : 29th November 2022;
Available online: 30 November 2022. Published regularly: May and November.

Abstract

A golden snail (*Pomacea Canaliculata*) is a mollusca group known as a pest that is quite disturbing for the growth of rice plants. Judging from its high protein content, a golden apple snail can be considered a source of protein for food, one of which is soy sauce. The process of making soy sauce can use a protein hydrolysis technique with the help of protease enzymes, namely bromelain enzymes and bidari enzymes. This study aims to determine the effect of the type and concentration of protease enzymes on the physical properties of golden apple snail sauce. This study uses a factorial experimental design with two factors, where factor I is the type of protease enzyme used consisting of three types (bromelain enzyme, bidari enzyme, and a combination (bromelain: bidari) and factor II is the total concentration of the enzyme consisting of three levels. (8%, 10%, 12%). The best treatment was sauce with a combination of bromelain and bidari enzymes at a concentration of 12%, with physical characteristics of 31.05% yield, total soluble solids 70.3°brix and viscosity 3293.20 cP.

Keywords: bidari[3], bromelain [1], golden apple snail[2], soy sauce[4]

1. Introduction

Soy sauce is a fermented food ingredient that is added to food to strengthen the taste. This product is in the form of a liquid, dark brown, and tastes relatively sweet, salty, or between the two with a distinctive aroma [7]. Generally, some spices are added to the taste of sauce in making sauce. Sauce is usually made from both vegetable and animal protein sources by acid hydrolysis or enzymatic. Some research results on the hydrolysis are soy sauce from water snail [1], snakehead fish sauce [5], eucah fish sauce [3] and lobsian fish sauce [9]. The manufacture of sauce can utilize various protein sources, one of which is a golden apple snail (*Pomacea canaliculata*).

Golden apple snails are a class of *Mollusa* that have been known as pests that are quite disturbing for the growth of rice plants and pose a threat to farmers. Rice damage due to golden apple snail pests can reach 10-40%, so the golden apple snail needs to be removed or managed further [4]. Golden apple snails generally have a higher protein content, ranging from 12.2 to 14.04%, so they can be considered a source of protein for food and feed [4]. The golden apple snail

hydrolyzate has several amino acid components where glutamic acid is the amino acid component with the highest content of 9.05% that make up the umami flavor so that it can be used as a flavor enhancer product, one of which is soy sauce [9].

Traditional soy sauce making takes a long time in the fermentation process. It can be accelerated by protein hydrolysis technique using proteolytic enzymes from the endopeptidase group, namely bromelain, and the exopeptidase group, bidari gum. The combination of endopeptidase and exopeptidase is known to have good synergism to produce short-chain peptides and high amino acids [12].

Therefore, this study aimed to determine the effect of the type and concentration of bromelain and bidari enzymes on the physical characteristics of golden apple snail sauce.

2. Material and Method

2.1. Materials preparation

The material used is golden apple snails (*Pomacea canaliculata Lamarck*) obtained from aquaculture ponds in Punggul village, Gedangan, Sidoarjo. While the manufacture of bromelain enzymes includes crude extract of pineapple obtained from the Gedangan market. The sap of the bidari plant (*Calotropis gigantea*) was obtained in Kepetih, Surabaya, and other ingredients, such as brown sugar, sucrose, and deaf, were obtained from the Gedangan market. The tools include blenders, beakers, measuring cups, test tubes, filters, stoves, pans, digital scales, centrifuges, incubators, analytical balances, ovens, weighing bottles, pH meters, viscometers, refractometers.

2.2. Research Methods

Processing protein hydrolyzate of golden apple snails

The cleaned gold snail meat will be mashed using a blender with the addition of aquadest (2: 1), then the hydrolysis stage is carried out with the addition type of protease enzyme are bromelain enzyme, bidari enzyme, and a combination (bromelain: bidari) and concentration of the enzyme are 8, 10, and 12 percent (%). Hydrolysis was carried out at 55°C for 3 hours. The enzyme was inactivated at 100°C for 10 minutes and centrifuged at 3000 rpm for 30 minutes. The resulting supernatant was used as a hydrolyzate.

2.2.1. The process of making Golden apple snail sauce

The hydrolyzate was added with aqua dest in the ratio (1:4) and added 1% deafness and 10% sucrose, stirred, and then filtered. The filter results are added with a 30% brown sugar thickener and heated to boiling for 20 minutes. Boiling results are allowed to stand until a temperature of 37°C and filtered again. The second filtering result is the result of golden apple snail soy sauce.

2.2.2. Yield Analysis

The results of the soy sauce are then weighed to determine the weight. Yield calculation using the formula:

$$\text{Yield} = \frac{\text{final weight of soy sauce}}{\text{initial weight}} \times 100\%$$

2.2.3. Total Dissolved Solids Analysis

Total dissolved solids were tested using a hand-refractometer. The refractometer prism was first rinsed with distilled water and wiped with a soft cloth. The sample is dropped into the refractometer prism, and the degree of Brix is measured.

2.2.4. Viscosity Testing (Brookfield Viscometer)

The sample is put in a 500 mL glass beaker. Attach the spindle to the tool. The spindle number is selected according to need. Then turn the revolver to lower the spindle until it is completely submerged in the liquid. Select the RPM speed for the rotation. Observe the visible scale. If the speed is <10, increase the RPM. Meanwhile, if the speed is > 100, replace the spindle with a number more significant than before. Observe the speed on the scale every three revolutions. When finished, remove the material from the container, then clean the viscometer spindle.

3. Results and Discussion

3.1. Yield

Based on the analysis of variance, it can be seen that there is a significant interaction ($p \leq 0.05$) between the type and concentration of the enzyme. The graph of the relationship between type and enzyme concentration is shown in Figure 1.

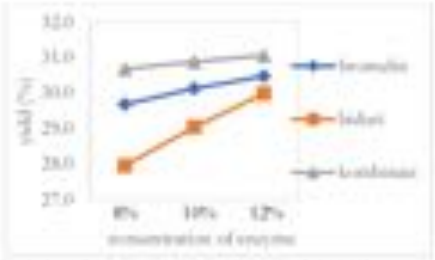

Figure 1. Concentration of enzyme (yield)

The average yield of *Golden apple snail sauce* ranges from 27.94-31.05%. The highest yield was in the combination enzyme treatment (bromelain: biduri) with a concentration of 12% with an average value of 31.05%, while the biduri enzyme treatment with a concentration of 8% had the lowest average of 27.94%.

The higher the enzyme concentration given, the higher the yield. This is due to the high yield of gold snail protein hydrolysate, which affects the percentage of added ingredients. The study of [7] on protein hydrolysis of rice field conch shell produced the best treatment on bromelain enzymes 10% and 15% with yields snail hydrolysate 13.50-13.86%. According of [6], the higher the protease activity of the protease enzyme, the more protein is broken down into smaller peptides during hydrolysis so that the yield increases.

3.2 Total Dissolved Solids

Based on the analysis of variance, it can be seen that there is a significant interaction ($p \leq 0.05$) between the type and concentration of the enzyme. The graph of the relationship between type and enzyme concentration is shown in Figure 2.

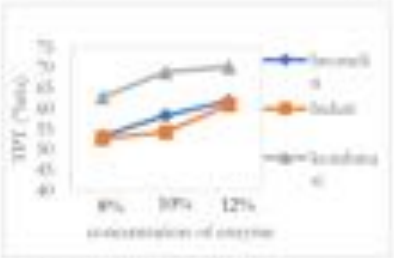

Figure 2. Concentration of enzyme (TPT)

The average value of total dissolved solids of sweet soy sauce from the hydrolyzate of golden apple snails ranged from 52.70-70.3°Brix. The highest TPT was in the combination enzyme treatment (bromelain: biduri) with an enzyme concentration of 12% with an average value of 70.3 °Brix. The total dissolved solids value increased with the added enzyme concentration. The process of protein hydrolysis is an event of breaking organic bonds that produce amino acids that makeup proteins. The total dissolved solids analyzed showed how high the total solids extracted and dissolved in the soy sauce were. According to [2], the increase in the total dissolved solids in soy sauce products was due to the addition of spices and sugar in the cooking process. The components measured as total dissolved solids were organic acids, sucrose, reducing sugars, salts and proteins. According to [7], the measurement of total solids illustrates the total content of product components soluble in water, mainly consisting of the total amount of sugar and several other components such as proteins and acids.

3.3 Viscosity

Based on the analysis of variance, it can be seen that there is a significant interaction ($p \leq 0.05$) between the type and concentration of the enzyme. The graph of the relationship between enzyme types and concentrations is shown in Figure 3.

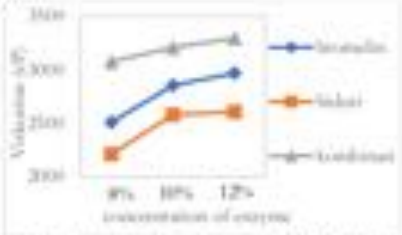

Figure 3. Concentration of enzyme (Viskositas)

Viscosity is a measure of a liquid's resistance to flow. The higher the viscosity of a liquid, the thicker the flow. The average viscosity value of Golden apple snail sauce ranged from 2211.80-3293.20 cP. The highest viscosity was in the combination enzyme treatment (bromelain : biduri) with a concentration of 12% with an average value of 3293.2 cP. The higher the enzyme concentration given, the higher the viscosity value. These results are related to the total dissolved solids value test. The viscosity value is also high if the total dissolved solids are high. A high TPT indicates a high sugar content in soy sauce. It is also similar to the variable viscosity, where the viscosity of soy sauce is influenced by the

ingredients added during the soy sauce-making process, one of which is brown sugar. According to [4] the results in an increase in viscosity along with an increase in total dissolved solids in kemaru fish sauce. Maillard reaction on protein hydolisis by heat can increase the availability of free amino groups that can react, apart from increasing the sugar concentration in the sweet soy sauce from the hydrolyzate of golden apple snails. The higher levels of components with many polar active sites (reducing sugars and sucrose) cause the solution to have hydrophilic properties, which have many effects on increasing viscosity.

4. Conclusions

Based on the results of this study, it can be concluded that there is an interaction between 2 factors, namely the type and concentration of enzymes, on the physical characteristics of Golden apple snail sauce. The best treatment based on physical characteristics was found in Golden apple snail sauce with a combination type of enzyme treatment (bromelaine biduri) with a concentration of 12%, namely; yield 31.05%, total dissolved solids 70.3°brix and viscosity 3293.20 cP.

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