

**FORMULATION AND POTENTIAL OF PURPLE CABBAGE (BRASSICA  
OLERECEAL.) AS A NUTRACEUTICAL PRODUCT IN MAINTAINING  
CARDIOVASCULAR HEALTH**

**SKRIPSI**

**Oleh :**

**SALSABILA EKA SETIA NINGRUM  
NIM. 200703110028**



**PROGRAM STUDI FARMASI  
FAKULTAS KEDOKTERAN DAN ILMU KESEHATAN  
UNIVERSITAS ISLAM NEGERI  
MAULANA MALIK IBRAHIM MALANG  
2023**

**FORMULATION AND POTENTIAL OF PURPLE CABBAGE (BRASSICA  
OLERECEAL.) AS A NUTRACEUTICAL PRODUCT IN  
MAINTAINING CARDIOVASCULAR HEALTH**

**SKRIPSI**

**Diajukan Kepada :**

**Fakultas Kedokteran dan Ilmu Kesehatan**

**Universitas Islam Negeri (UIN) Maulana Malik Ibrahim Malang**

**Untuk Memenuhi Salah Satu Persyaratan dalam**

**Memperoleh Gelar Sarjana Farmasi (S.Farm)**

**PROGRAM STUDI FARMASI  
FAKULTAS KEDOKTERAN DAN ILMU KESEHATAN  
UNIVERSITAS ISLAM NEGERI  
MAULANA MALIK IBRAHIM MALANG  
2023**

**FORMULATION AND POTENTIAL OF PURPLE CABBAGE (BRASSICA  
OLERECEAL.) AS A NUTRACEUTICAL PRODUCT IN  
MAINTAINING CARDIOVASCULAR HEALTH**

**SKRIPSI**

**Oleh :  
SALSABILA EKA SETIA NINGRUM  
NIM. 200703110028**

**Telah diperiksa dan disetujui untuk diuji :  
Tanggal : 18 Desember 2023**

Dosen Pembimbing



apt. Mayu Rahmayanti, S.Farm.,M.Sc.  
NIP. 19920531 20191120 2 256

Mengetahui,

Ketua Program Studi Farmasi



### **PERNYATAAN KEASLIAN TULISAN**

Saya yang bertandatangan dibawah ini:

Nama : Salsabila Eka Setia Ningrum

NIM : 200703110028

Program Studi : Farmasi

FakultaS : Kedokteran dan Ilmu Kesehatan

Judul Penelitian : “Formulation and potential of purple cabbage (Brassica oleraceaL.) as a nutraceutical product in maintaining cardiovascular health”

Menyatakan dengan sebenarnya bahwa skripsi yang saya tulis ini benar-benar merupakan hasil karya sendiri, bukan merupakan pengambilalihan data, tulisan, atau pikiran orang lain yang saya akui sebagai tulisan atau pikiran saya sendiri, kecuali dengan mencantumkan sumber cuplikan pada daftar pustaka. Apabila dikemudian hari terbukti atau dapat dibuktikan skripsi ini hasil jiplakan, maka saya bersedia menerima sanksi atas perbuatan tersebut.

Malang, 18 Desember 2023

Yang membuat pernyataan



Salsabila Eka Setia Ningrum  
NIM. 200703110028

## **MOTTO**

يَا أَيُّهَا الَّذِينَ آمَنُوا اسْتَعِينُوا بِالصَّبْرِ وَالصَّلَاةِ إِنَّ اللَّهَ مَعَ الصَّابِرِينَ

"Wahai orang-orang yang beriman! Mohonlah pertolongan (Kepada Allah) dengan sabar dan salat. Sungguh, Allah beserta orang-orang yang sabar" (Q.S.Al-Baqarah: 153)

## **LEMBAR PERSEMBAHAN**

### **Alhamdulillah rabbil 'alamin...**

Sembah sujud serta syukur kepada Allah SWT. Taburan cinta dan kasih sayang- Nya telah memberikanku kekuatan, melimpahkan ilmu serta memperkenalkanku dengan cinta. Atas karunia serta kemudahan yang Engkau berikan akhirnya skripsi yang sederhana ini dapat terselesaikan. Shalawat dan salam selalu terlimpahkan keharibaan Rasulallah Muhammad SAW. Sehingga penulis dapat diberikan kemudahan untuk melaksanakan kewajiban mencari ilmu. Kupersembahkan karya sederhana ini kepada orang yang sangat kukasihi dan kusayangi.

### **Ayah dan Ibu**

Sebagai tanda bukti, hormat dan rasa terima kasih kepada orang tua penulis bapak Solikhin dan ibu Lidia Pangestingsasi. Orang tua hebat yang selalu menjadi penyemangat penulis sebagai sandaran terkuat dari kerasnya dunia. Yang tidak henti-hentinya memberikan kasih sayang dengan penuh cinta dan selalu memberikan motivasi. Yang telah memberikan semangat, dukungan material dan mendo'akan serta ikhlasnya demi pendidikan anaknya untuk menuntut ilmu setinggi-tingginya. Terima kasih selalu berjuang untuk kehidupan saya. Terimakasih untuk semua berkat do'a dan dukungannya saya bisa berada di titik ini.

### **Adik serta seluruh keluarga besar**

Sebagai tanda terima kasih, aku persembahkan karya ini untuk Adik Samsu Falaq Dwi Cahyo serta seluruh keluarga penulis. Terimakasih telah atas segala doa dan support yang telah diberikan. Semoga doa dan semua hal yang terbaik yang engkau berikan kembali kepada kalian serta menjadikan ku orang yang baik pula.

### **Sahabat dan Teman-teman**

Teruntuk kalian yang selalu memberikan motivasi, nasihat, dukungan moral yang selalu membuatku semangat untuk menyelesaikan skripsi ini. Teman kontrakan (Cindy Natasya, Ludy Wiji Lestari, Fitriyani, Alma Nur Afifah), anggota kelompok TBL 29, dan teman-teman Zonula (Angkatan 2020), Furaidah Aulia, Zahroou Rihhadatut Taqiyah. Terima kasih atas kebersamaan dan kontribusi kalian yang telah menjadi bagian berharga dari perjalanan akademis ini.

## KATA PENGANTAR

Alhamdulillah, puji dan syukur penulis panjatkan kehadirat Allah SWT, karena atas rahmat, hidayah, dan karunia-Nya sehingga penulis dapat menyelesaikan penyusunan skripsi dengan judul **“Formulation and potential of purple cabbage (Brassica oleraceaL.) as a nutraceutical product in maintaining cardiovascular health”** dengan baik sebagai salah satu syarat untuk memperoleh gelar sarjana Farmasi Fakultas kedokteran dan Ilmu Kesehatan Universitas Islam Maulana Malik Ibrahim Malang. Shalawat serta salam semoga senantiasa tercurahkan kepada junjungan kita Nabi Muhammad SAW.

Selanjutnya penulis haturkan ucapan terima kasih seiring do'a dan harapan *jazakumullah ahsanal jaza'* kepada semua pihak yang telah membantu terselesaikannya skripsi ini. Ucapan terima kasih ini penulis sampaikan kepada:

1. Prof. Dr. H. M. Zainuddin, M.A. selaku rektor Universitas Islam Negeri Maulana Malik Ibrahim Malang
2. Prof. Dr. dr. Yuyun Yueniwati PW, M.Kes., Sp.Rad (K). selaku Dekan Fakultas Kedokteran dan Ilmu Kesehatan Universitas Islam Negeri Maulana Malik Ibrahim Malang
3. Apt. Abdul Hakim, M.P.I., M.Farm. selaku Ketua Program Studi Farmasi Fakultas Kedokteran dan Ilmu Kesehatan Universitas Islam Negeri MaulanaMalik Ibrahim Malang
4. apt. Mayu Rahmayanti, S.Farm.,M.Sc.,selaku Pembimbing Lomba yang telah meluangkan waktu, memberikan ide serta gagasan dalam penyusunan naskah.
5. Segenap civitas akademika Fakultas Kedokteran dan Ilmu Kesehatan

Universitas Islam Negeri (UIN) Maulana Malik Ibrahim Malang terutama dosen serta staf Program Studi Farmasi yang telah memberikan banyak ilmu selama perkuliahan.

6. Keluarga tercinta, terutama orang tua penulis bapak solikhin dan ibu lidia pangestiniingsasi yang telah memberikan kasih sayang, motivasi serta do'a restu selama perkuliahan.
7. Kepada teman-teman kontrakan, teman dekat yang telah memberikan semangat, motivasi, dan masukan serta telah mendengarkan keluh kesah selama perkuliahan dan menyelesaikan skripsi ini.
8. Seluruh teman-teman Zonula yang telah berjuang bersama, memberikan informasi dan motivasi kepada penulis.

Penulis menyadari bahwa dalam penyusunan skripsi ini masih terdapat kekurangan dan penulis berharap semoga skripsi ini bisa memberikan manfaat kepada para pembaca serta dapat menambah khazanah ilmu pengetahuan bagi pembacanya.

*Wassalamu'alaikum Wr. Wb.*

Batu, Desember 2023

Penulis



## DAFTAR ISI

|                                  |      |
|----------------------------------|------|
| HALAMAN JUDUL.....               | i    |
| HALAMAN PERSETUJUAN.....         | ii   |
| PERNYATAAN KEASLIAN TULISAN..... | iii  |
| MOTTO.....                       | iv   |
| HALAMAN PERSEMBAHAN.....         | v    |
| KATA PENGANTAR.....              | vi   |
| DAFTAR ISI.....                  | viii |
| DAFTAR GAMBAR.....               | ix   |
| DAFTAR TABEL.....                | x    |
| ABSTRACT.....                    | xi   |
| CHAPTER I INTRODUCTION.....      | 1    |
| CHAPTER II METHODS.....          | 5    |
| CHAPTER III RESULTS.....         | 10   |
| CHAPTER IV CONCLUSIONS.....      | 20   |
| REFERENCES.....                  | 21   |

## DAFTAR GAMBAR

|  |    |
|--|----|
| <b>Figure 1.</b> Respondent's gender.....              | 11 |
| <b>Figure 2.</b> Respondent ages .....                 | 11 |
| <b>Figure 3.</b> Respondent's formula preference ..... | 13 |

## DAFTAR TABEL

|  |    |
|--|----|
| <b>Table 1.</b> Nutritional content in every 100 grams of purple cabbage ( <i>Brassica oleracea</i> L.)..... | 1  |
| <b>Table 2.</b> Product formulation of “Ceamond Crispy” .....  | 7  |
| <b>Table 3.</b> Organoleptic test results for “Ceamond Crispy” products .....                                | 10 |
| <b>Table 4.</b> Hedonic test results of “Almond Crispy” .....  | 12 |
| <b>Table 5.</b> Anthocyanin test results .....   | 14 |
| <b>Table 6.</b> The nutritional content of “Ceamond Crispy” products test results.....                       | 16 |

## ABSTRACT

Purple cabbage (*Brassica oleracea L.*) is one of the agricultural products that contain anthocyanins which have the potential as antioxidants. The amount of production in Indonesia is still relatively low due to a lack of consumer demand and a lack of innovation in its utilization. So it is necessary to make new innovations, one of which is by processing it into flour to make Almond Crispy which is then given the name "Ceamond Crispy". The reason Almond Crispy is made, because it is easy to process and can be consumed for a long time. This study aims to determine the anthocyanin compounds contained in processed food "Ceamond Crispy". Almond Crispy is made with a ratio of purple cabbage flour and moderate protein flour in 3 formulations namely formulation 1 (1:2), formulation 2 (1:1), and formulation 3 (2:1). This research was conducted by organoleptic test, anthocyanin, nutritional content. Therefore, it can be concluded that the organoleptic test results obtained brown color, taste like chocolate, vanilla aroma, and crunchy texture. The anthocyanin test results obtained positive results in all three formulations. The results of the nutritional content test showed that the 3 formulations contained the same protein, carbohydrates (starch), and carbohydrates (glucose), but did not contain fat. The results of the preference test showed that formulation 3 was the most preferred formulation. Thus, proving that "Ceamond Crispy" can be received with a positive response by the community and has the potential to be developed into an innovative food that is beneficial for the heart. Thus, proving that "Ceamond Crispy" is safe for consumption by the public and can be developed into innovative foods that are beneficial for heart health.

**Keywords:** *purple cabbage cookies, nutraceutical, cardiovascular health, anthocyanin*

## CHAPTER I

### INTRODUCTION

Purple cabbage (*Brassica oleracea L.*) belongs to the Brassicaceae family which contains lots of vitamin A, B, and C. In the antioxidant potential of cabbage varieties, the highest antioxidant is obtained from purple cabbage (*Brassica oleracea L.*), and according to Wahyuni (2018) the ethanol extract of purple cabbage (*Brassica oleracea L.*) has an IC50 value of 44.64 ppm which shows very strong antioxidant activity.

Purple cabbage (*Brassica oleracea L.*) is one of the agricultural products whose existence is quite well known by the public. The amount of purple cabbage production in Indonesia is relatively low, this is due to the lack of consumer demand for this commodity. The use of purple cabbage in Indonesia is only limited to making salted vegetables and as a mixture in salads (A. S. Putri et al., 2018). The nutritional content of purple cabbage can be seen in **Table 1**.

**Table 1.** Nutritional content in every 100 grams of purple cabbage (*Brassica oleracea L.*) (Amanah, 2019)

| Nutrient     | Amount  |
|--------------|---------|
| Proteins     | 1.4 g   |
| Carbohydrate | 5.3 g   |
| Fat          | 0.2 g   |
| Calcium      | 46 mg   |
| Phosphor     | 31 mg   |
| Iron         | 1 mg    |
| Vitamin A    | 80 IU   |
| Vitamin B1   | 0.06 mg |
| Vitamin C    | 50 mg   |

Purple cabbage is a vegetable rich in anthocyanins. Anthocyanins in red cabbage have a good level of stability. Purple cabbage has an anthocyanin content of 113mg/100g. Along with the times, many people still do not know the benefits of purple cabbage, one of which is as an antioxidant.

Antioxidants are compounds that can withstand, eliminate, and clean up the effects of free radicals which can cause various degenerative diseases such as premature aging, heart disease, stroke, cataracts, osteoarthritis, and cancer. One type of antioxidant that can be found in purple cabbage is anthocyanin (Wuwur et al., 2021).

Anthocyanins are pigments composed of flavonoids (anthocyanidins) with an aromatic ring in ring B, a C6-C3-C6 cyclic ring, and sugar groups in different positions. Anthocyanins include water-soluble pigments found in epidermal cells in flowers or mesophyll cells in leaves. The types of anthocyanins contained in Purple cabbage are cyanidins with sugar groups either acylated with caffeic, ferulic, synapic acid, and p-coumarate or not (Lukitasari et al., 2017). Many studies have shown that anthocyanins have a positive effect on health. There is also a lot of evidence that anthocyanins are non-toxic but also have positive therapeutic and pharmacological properties (Herfayati et al., 2020).

Anthocyanins have many health benefits, namely as anti-diabetic, anticancer, anti-inflammatory, antimicrobial, anti-obesity and help prevent cardiovascular disease. In the context of cardiovascular pathology, anthocyanins have been

reported to have cardioprotective effects against isoproterenol-induced myocardial infarction damage (Wuwur et al., 2021).

Cardiovascular disease is one of the non-communicable diseases that causes the number 1 death in the world, which is around 80%. Cardiovascular disease is widely known as a disease with disorders of the heart and blood vessels.<sup>6</sup> Cardiovascular disease can develop due to hypertension, platelet aggregation, high blood Low-Density Lipoprotein (LDL), and dysfunction of endothelial cells in the blood vessels. Epidemiological studies show that consumption of vegetable and fruit-based foods can increase protection against heart disease due to the presence of bioactive compounds, one of which is anthocyanin. The mechanism of the cardioprotective effect of anthocyanins is by preventing LDL oxidation, protecting the integrity of the endothelial cells lining the blood vessel walls so that damage does not occur, and preventing platelet aggregation. One way that anthocyanins protect endothelial cells is by inhibiting the induction of tumor necrosis factor alpha (TNF $\alpha$ ) which triggers inflammation through monocytes (Ifadah et al., 2021).

Functional or nutraceutical foods are natural ingredients that are processed into food products, so they have the potential to have a higher health value than nutritious foods in general.<sup>28</sup> Development of purple cabbage nutraceutical products to become one of the foods suitable for consumption by the public. One of the snacks known by the public is Almond Crispy. Almond Crispy is a variation of cookies or pastries that are flat and have a crunchy texture (Widiyawati et al., 2021).

Crispy Almonds were chosen because they are easy to process, namely through the mixing and roasting process, the texture resembles biscuits, can be

stored in a closed container, and can be consumed for a long time.<sup>2</sup> This research obtained a cookie product namely Almond Crispy Purple cabbage (*Brassica oleracea L.*) which contains anthocyanin which can maintain heart health. This product was created to innovate purple cabbage (*Brassica oleracea L.*) food products into Crispy Almond products. The utilization of purple cabbage (*Brassica oleracea L.*) here is expected to be a snack that can provide added value and can maintain heart health. Therefore, this study was conducted to determine the presence of anthocyanins contained in purple cabbage Crispy Almonds (*Brassica oleracea L.*) using various comparisons of purple cabbage flour (*Brassica oleracea L.*) and other ingredients by setting the right drying temperature to get the taste and consistency appropriate.



## CHAPTER II

### METHODS

#### **Research design**

The research design used was a qualitative analysis method by observing the presence of anthocyanins and nutritional content (protein, carbohydrates, and fats) in purple cabbage flour (*Brassica oleracea L.*) and “*Ceamond Crispy*” products.

#### **Time and place**

This research was conducted in the Phytochemistry Laboratory, Department of Pharmacy, Faculty of Medicine and Health Science, Maulana Malik Ibrahim State Islamic University Malang, on 8th December 2022.

#### **Tools and materials**

The tools used in the manufacture of this research are a mixer (Miyako HM-620), digital scales (SF 400), sieve, baking sheet, baking paper, spoon, and oven (Hakashima Electric Oven 23 Lt).

The tools used for testing in this study were analytical balances (Ohaus CP 214), oven (Mettler Universal Oven Original UN 30), test tubes (Herma), test tube racks, watch glass, gauze, bunsen, tripod, beaker glass 100 ml (Iwaki), 250 ml beaker glass (Iwaki), stirring rod, 5 ml measuring pipette (Iwaki), 10 ml measuring pipette (Iwaki), pushball, spatula, 100 ml measuring cup (Iwaki), spoon horn, wooden tongs, and a dropper (Pyrex).

The materials used in the manufacture of this research include purple cabbage, egg whites, powdered sugar, salt, vanilla powder, medium protein flour,

butter, almonds, and grated cheese. All ingredients are obtained from the cake ingredients shop.

The materials used for testing in this study were NaOH, HCl, Lugol's reagent, Fehling A, Fehling B, CuSO<sub>4</sub>, and KHSO<sub>4</sub>. All ingredients are obtained from pharmacy stores.

### **Research methods**

Large purple cabbage is cut into small pieces and washed thoroughly with water then drained. Slices of Purple cabbage were dried in an oven (MEMMRT Universal Oven Original UN 30) at 50°C for 24 hours. Then grind it into powder.<sup>9</sup>

The mixing of dry ingredients in the production of "*Ceamond Crispy*" includes medium protein flour, purple cabbage flour, vanilla powder, and salt, mixed using a mixer (Miyako HM-620) until well blended. The purpose of mixing the dry ingredients is to do it separately first so that the dry ingredients get even conditions so that when stirring is done, the dough will be more even and there will be no accumulation or clumping of the dough (Wibowo et al., 2018)

The product "*Ceamond Crispy*" is made by weighing all the ingredients first. Next, mix the egg whites and sugar using a mixer (Miyako HM-620) until stiff peaks (swell). Sift the dry ingredients that have been mixed and put them into the egg-white mixture in three stages, stirring until evenly distributed. Pour in the melted butter and stir again until smooth. Prepare a baking sheet lined with baking paper. Take enough dough, about ¼ tsp, put it on baking paper, and flatten it with the back of a spoon to form a circle. Sprinkle with almond chips and grated cheese

on top of the dough. In the oven (Hakashima Electric Oven 23 Lt) at 50°C for 1 hour. In the last step, Ceamond Crispy is weighed as much as 20 grams and put into the package. The product formulation can be seen in **Table 2**.

**Table 2.** Product formulation of “Ceamond Crispy”

| Ingredients           | F1 (%)  | F2 (%)  | F3 (%)  |
|-----------------------|---------|---------|---------|
| Purple Cabbage Flour  | 20 g    | 30 g    | 40 g    |
| Medium protein flour  | 40 g    | 30 g    | 20 g    |
| Egg whites            | 2       | 2       | 2       |
| Fine granulated sugar | 50 g    | 50 g    | 50 g    |
| Salt                  | 1/8 tsp | 1/8 tsp | 1/8 tsp |
| Powdered vanilla      | 1/4 tsp | 1/4 tsp | 1/4 tsp |
| Butter                | 45 g    | 45 g    | 45 g    |
| Almond Chips          | qs      | qs      | qs      |
| Grated cheese         | qs      | qs      | qs      |

### **Organoleptic test**

Organoleptic is a food ingredient test based on preferences and desires for a product. Organoleptic test, also known as sensory test or sensory test, is a method of testing using the human senses as the main tool for measuring product acceptance (Gusnadi et al., 2021). The product “Ceamond Crispy” which was tested organoleptic consisted of 3 formulations added with Purple cabbage flour (*Brassica oleracea* L.) according to the formulation of the addition of flour respectively (20 grams, 30 grams and 40 grams). Organoleptic testing of "Ceamond Crispy" includes color, taste, aroma, and texture. The senses used in this test are sight, taste, smell,

and touch. Organoleptic testing was carried out simultaneously with hedonic testing, involving 35 panelists living in the Malang districts.

### **Hedonic test**

The hedonic test is a test in organoleptic sensory analysis which is used to determine the magnitude of the difference in quality between several similar products by providing an assessment or score of certain properties of a product and to determine the level of preference of a product (Tarwendah et al., 2017). The parameters of the "Ceamond Crispy" hedonic test included color, aroma, taste, texture, and overall. The selected panellists were untrained panellists who were randomly selected according to the age group of 35 panellists who live in Malang district.

### **Anthocyanin test**

The anthocyanin test was carried out to determine the anthocyanin content in purple cabbage and "Almond Crispy" products. The first step, the sample is put into a test tube, then the sample is heated above Bunsen with a drop of 2M HCl solution for 2 minutes using a temperature of 100 °C, the color of the sample is observed. If the red color in the sample does not change (constant), it indicates a positive anthocyanin. In the second stage, the samples were mixed by adding 2M NaOH drop by drop. If the sample from red turns to blue-green and fades slowly, it indicates that the sample is positive for anthocyanin (Anggriani et al., 2017).

### **Nutritional content test**

#### **Carbohydrate test**

1. Put the sample solution into 2 test tubes, 2 military each.

2. Test tube 1 added 2-3 drops of Lugol's reagent, and a positive reaction for starch shows a blue or purple-black color.

3. In test tube 2, 2 mL of Fehling A and Fehling B solutions are added each, then add 4 drops of 10% NaOH solution. Positive for glucose if there is a brick-red precipitate.

### **Protein test**

1. Make a 2% sample solution in distilled water, then take 1 mL to put it in a test tube.

2. Add 1 mL of 10% NaOH, and 1 mL of 0.1% CuSO<sub>4</sub> solution and shake. The positive reaction of the protein occurs purplish-blue.

### **Fat test**

1. Put 3 drops of the sample solution into the test tube.

2. Add 1 tablespoon of KHSO<sub>4</sub> and then heat it. A positive reaction of grease has the smell of burnt fat with white smoke.

## CHAPTER III

### RESULTS

#### Organoleptic test results

An organoleptic test is used to see how the appearance of the product "*Ceamond Crispy*" is assessed by the five senses. Organoleptic results can be seen in **Table 3**.

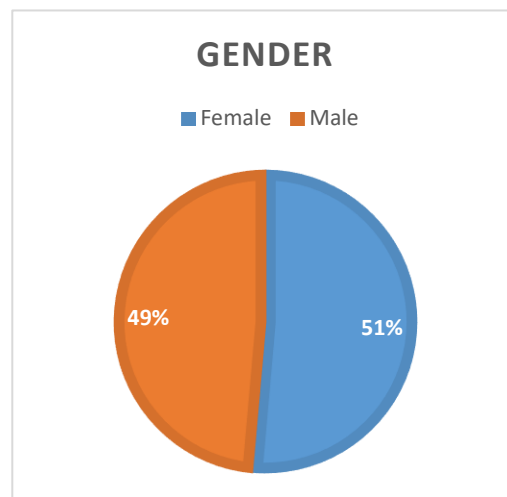
**Table 3.** Organoleptic test results for “Ceamond Crispy” products

| Parameter | F1             | F2             | F3                                 |
|-----------|----------------|----------------|------------------------------------|
| Color     | Chocolate      | Chocolate      | Purplish brown                     |
| Flavor    | Like chocolate | Like chocolate | Like chocolate and slightly bitter |
| Aroma     | vanilla        | vanilla        | vanilla                            |
| Texture   | crispy         | crispy         | crispy                             |

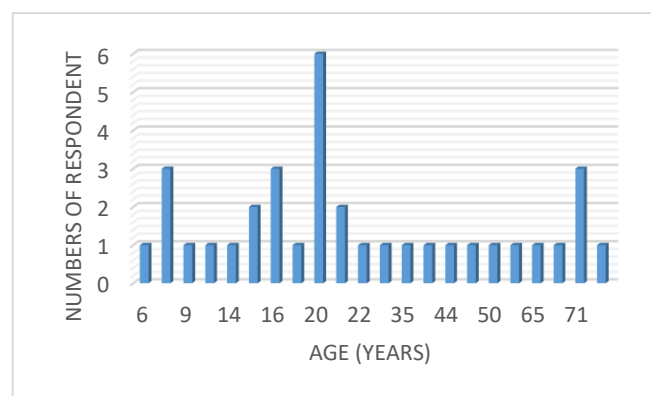
This "*Ceamond Crispy*" product has the same texture in the three formulations because in the manufacture it is formed flat and thin. In addition, the aroma is the same because when making the dough, vanilla powder is added. This "*Ceamond Crispy*" product is made with powdered sugar which makes it taste slightly sweeter than the original taste of purple cabbage flour (*Brassica oleracea L.*). The color of the product “*Ceamond Crispy*” is influenced by the presence of anthocyanin which is a color pigment in Purple cabbage (*Brassica oleracea L.*) and can act as a natural dye.

### Hedonic test results

The hedonic test is a test used to determine panelist preferences for the "Ceamond Crispy" product. The population in this hedonic test were men and women ranging in age from children around 6 years to parents aged 72 years with a total of 35 untrained panellists. The percentage of male panellists was 49% and 51% female. Data on the number of panellists by age and gender can be seen in **Figure 1** and **Figure 2**.



**Figure 1.** Respondent's gender



**Figure 2.** Respondent ages

The hedonic test was conducted to assess the level of preference for the "Ceamond Crispy" product in the people of Greater Malang with a total of 35

panellists of various ages with hedonic test parameters including texture, color, smell, taste, and an overall assessment of the "Ceamond Crispy" product with a score 1-5 through a questionnaire using the google form media. The hedonic test results are shown in **Table 4**.

**Table 4.** Hedonic test results of "Almond Crispy"

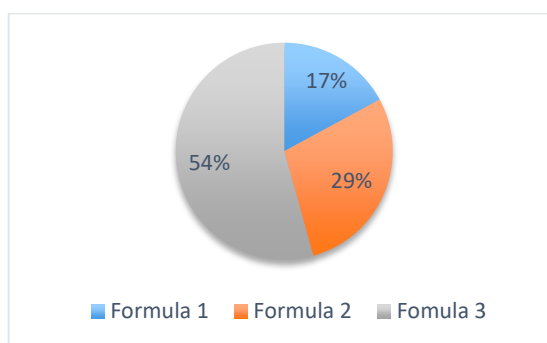
| Question   | 1 | 2         | 3          | 4          | 5          |
|--|---|-----------|------------|------------|------------|
| Do you like the texture of Crispy Almond products? | 0 | 0 (0%)    | 2 (5.7%)   | 11 (31.4%) | 22 (62.9%) |
| Do you like the smell of Crispy Almond products?   | 0 | 5 (14.3%) | 14 (40%)   | 11 (31.4%) | 5 (14.3%)  |
| Do you like the color of Crispy Almond products?   | 0 | 2 (5.7%)  | 12 (34.3%) | 12 (34.3%) | 9 (25.7%)  |
| Do you like the taste of Almond Crispy products?   | 0 | 0 (0%)    | 0 (0%)     | 13 (37.1%) | 22 (62.9%) |

Based on the results of testing the filling out of the questionnaire on question number 1, there were 22 panellists who chose option 5 which means they really like the texture of "Ceamond Crispy", 11 panellists who chose option 4 which means they like it, and 2 panellists who chose option 3 which means neutral. The results of test number 2 on the questionnaire, 5 panellists chose option number 2 which means dislike, 14 panellists chose option 3 which means neutral, 11 panellists chose option number 4 which means like, and 5 panellists chose number 5 which means really like the smell of "Ceamond Crispy" product. The results of test number 3 on



the questionnaire, 2 panellists chose option 2 which means they don't like it, 12 panellists chose option 3 which is neutral, 12 panellists chose option 4 which means they like it, and 9 panellists chose option 5 which means they really like the smell of the product "Ceamond Crispy". The results of test number 4 on the questionnaire, 13 panellists who chose option 3, namely neutral, and 22 panellists who chose option 5, which means they really like the taste of the "Ceamond Crispy" product.

Processed product of Red Cabbage (*Brassica oleracea* L.) "Ceamond Crispy" has good properties in terms of texture, smell, color and taste so that the product can be accepted and enjoyed by people of all ages. Based on the questionnaire that has been given, the community tends to prefer formula 3 with a percentage of 54% (**Figure 3**).



**Figure 3.** Respondent's formula preference

This proves that the product "Ceamond Crispy" is received with a positive response by the public and can be developed into an innovative food that is beneficial for cardiovascular health.

#### Anthocyanin test results

This test was carried out to identify anthocyanin compounds in the form of a color test using 2M NaOH and 2M HCl reagents. The results of the anthocyanin

test on purple cabbage Flour and "*Ceamond Crispy*" Products can be seen in Table 5.

**Table 5.** Anthocyanin test results

| Sample               | Results      |                | Color          |            |
|----------------------|--------------|----------------|----------------|------------|
|                      | 2M HCl       | 2M NaOH        | 2M HCl         | 2M NaOH    |
| Purple Cabbage Flour | Positive (+) | Red Green Blue | Red Green Blue | Blue-green |
| F1                   | Positive (+) | Red Green Blue | Red Green Blue | Blue-green |
| F2                   | Positive (+) | Red Green Blue | Red Green Blue | Blue-green |
| F3                   | Positive (+) | Red Green Blue | Red Green Blue | Blue-green |

This test was conducted to determine the presence of anthocyanins in purple cabbage Flour (*Brassica oleracea L.*) and the product "*Ceamond Crispy*". The results of the anthocyanin test on all samples were positive (+) indicated when the sample solution was dropped with 2M HCl it produced a constant red color and when 2M NaOH was dropped the red color changed to blue-green and faded slowly. These results indicate the characteristics of anthocyanins, where the color change is caused by changes in the anthocyanin structure caused by the influence of H<sup>+</sup> and OH<sup>-</sup> ions (Surianti et al., 2019).

Anthocyanins belong to phenolic substances which are widely found in plants and give them blue, red, or purple colors (Wuwur et al., 2021). One of the factors

that affect the color of anthocyanin is a change in pH (Lukitasari et al., 2017). In acidic media, anthocyanins are red, purple in neutral solutions, and green-blue in alkaline solutions (Wuwur et al., 2021). Apart from changes in pH, pigment concentration, presence of mixtures with other compounds, the number of hydroxy and methoxy groups also affect the color of anthocyanins. The dominant hydroxy group causes the color to tend to be blue and is relatively unstable, while the dominant methoxy group causes a red color and is relatively more stable (N. K. M. Putri et al., 2015).

Purple cabbage (*Brassica oleracea L.*) anthocyanins are preferred because of their good solubility and easy extraction (Herfayati et al., 2020). Anthocyanin is a natural pigment in purple cabbage which is water soluble and has antioxidant properties (Susanti et al., 2019). The antioxidant activity of purple cabbage (*Brassica oleracea L.*) extract powder was 84.69%. These results are to the research of Karoui et al. (30) which stated that the antioxidant activity of purple cabbage extract powder ranged from 80-93.89%. The antioxidant activity of purple cabbage (*Brassica oleracea L.*) extract powder can be derived from phenolic compounds,  $\alpha$ -tocopherol, ascorbic acid, and carotenoids present in purple cabbage. In addition, the anthocyanins in purple cabbage are also quite high, ranging from 40.53-76.16 mg/100 g of purple cabbage (*Brassica oleracea L.*) (Wuwur et al., 2021).

Anthocyanin is a plant pigment that has a wide range of colors, namely purple, blue, orange, and red to slightly greenish blue (Ondagan et al., 2018). Anthocyanins can be used as alternative dyes in food and medicinal products (He et al., 2015). Anthocyanin stability is strongly influenced by temperature, both during processing

and storage. The higher the temperature, the greater the possibility of anthocyanin color degradation (He et al., 2015). Much evidence shows that anthocyanins are not only non-toxic but also have positive pharmacological and therapeutic properties. Therefore, this pigment can be consumed without showing negative effects on health (Yusuf et al., 2018).

### Nutritional content test results

The nutritional content test was carried out to determine the levels of protein, carbohydrates, and fat in the product "*Ceamond Crispy*" Formula 1, Formula 2, and Formula 3. The results can be seen in **Table 8**.

**Table 6.** The nutritional content of "Ceamond Crispy" products test results

| Sample | Test                    | Smell | Color                      | Result |
|--------|-------------------------|-------|----------------------------|--------|
| F1     | Proteins                | -     | Purple                     | +      |
|        | Carbohydrates (starch)  | -     | Purple                     | +      |
|        | Carbohydrates (glucose) | -     | Brick Red<br>Precipitation | +      |
|        | Fat                     | -     | -                          | -      |
| F2     | Proteins                | -     | Purple                     | +      |
|        | Carbohydrates (starch)  | -     | Purple                     | +      |
|        | Carbohydrates (glucose) | -     | Brick Red<br>Precipitation | +      |
|        | Fat                     | -     | -                          | -      |
| F3     | Proteins                | -     | Purple                     | +      |
|        | Carbohydrates (starch)  | -     | Purple                     | +      |
|        | Carbohydrates (glucose) | -     | Brick Red<br>Precipitation | +      |
|        | Fat                     | -     | -                          | -      |

### Carbohydrate test results

Carbohydrates are the main source of calories for almost the entire population in the world. Although the number of calories that can be produced by 1 gram of carbohydrates is only 4 kcal when compared to protein and fat, carbohydrates are a cheap source of calories. In the body, carbohydrates are useful for preventing

ketosis, excessive breakdown of body protein, and loss of minerals, and are useful for helping fat and protein metabolism.<sup>20</sup>

The carbohydrate test was carried out using two test tubes for each formulation, where the Lugol test was carried out in the first tube and the Fehling test in the second tube. Lugol's test or iodine test is a qualitative test of carbohydrates to determine the presence of complex carbohydrates. The iodine test is one of the test methods used to differentiate polysaccharides from disaccharides and monosaccharides. The color change of the solution occurs because, in the starch solution, there are glucose units that form. The principle of the iodine test is that starch or starch which reacts with iodine will form a blue color, dextrin will form a purplish-red color, and glycogen will form a brownish-red color (Mustakin & Tahir, 2019). This research was conducted by dripping 2 ml of the sample with 2-3 drops of Lugol's solution, samples containing complex carbohydrates will cause a discoloration to blue or dark purple. The Lugol carbohydrate test experiment using "*Ceamond Crispy*" showed positive test results for each formulation marked by the formation of a purple color.

Fehling's test is used to test the reduced sugar content in a sample. This test is based on the presence of a free aldehyde or ketone group. Fehling's reagent is divided into two, namely Fehling A (copper (II) sulfate) and Fehling B (KOH and sodium potassium tartrate). Fehling's test is used to show the special properties of carbohydrates in the presence of reducing carbohydrates. The test results show that glucose and sucrose are sugars that can reduce Fehling's solution and as reducing carbohydrates. Fehling's reagent plus carbohydrates are then heated, then a brick-

red precipitate will form in the final result (Fitri et al., 2020). In this “Ceamond Crispy” carbohydrate test experiment, positive test results were indicated for each formulation marked by the formation of a brick red precipitate.

### **Protein test results**

Proteins are polymers of amino acid monomers connected by peptide bonds. A peptide bond is formed between the carboxyl groups or the amino groups of adjacent amino acids. Protein is needed for growth and an ideal protein must have an amino acid arrangement that suits the needs of humans and animals (Afkar et al., 2020).

Qualitative protein analysis is an analysis that aims to determine the presence or absence of protein in a food ingredient. In the protein content test study using copper sulfate ( $\text{CuSO}_4$ ) reagent which produces  $\text{Cu}^{2+}$  ions that in alkaline conditions will react with polypeptides or peptide bonds that form proteins to form purple complex compounds and use sodium hydroxide ( $\text{NaOH}$ ) as a base medium.<sup>24</sup> In this “*Ceamond Crispy*” protein content test experiment, positive test results were indicated by the dormation of purple color in each “*Ceamond Crispy*” product formulation.

### **Fat test results**

Fats and oils are triglycerides or triacylglycerols, both of which mean “triesters (of) glycerol”. The difference between a fat and an oil is arbitrary: at room temperature fats are solid and oils are liquid. Most of the glyceride in animals is in the form of fat, while the glyceride in plants tends to be oil. Fats are classified based on the saturation of bonds in their fatty acids. The classification is saturated and

unsaturated fatty acids. Fats contain saturated fatty acids, namely fatty acids that do not have double bonds (Sobari, 2014). Due to the relationship between intake of saturated fatty acids and HDL cholesterol levels in CHD patients, this study uses very little fat so that it does not affect heart health.

As for this study, 3 drops of the solution were put into a test tube, the sample was added with 1 spoon of  $\text{KHSO}_4$ , and samples containing fat would smell burnt fat and cause white smoke. The fat test experiment using "*Ceamond Crispy*," showed negative test results for each formulation, which was indicated by the absence of a burnt fat odor and the absence of white smoke appearing in each formulation.

The addition of purple cabbage extract powder to the "*Ceamond Crispy*" product causes the fat content of the product to tend to decrease with increasing concentration of the extract powder. This could be because the purple cabbage extract powder does not contain fat, so the addition of purple cabbage extract powder to the "*Ceamond Crispy*" dough will cause the weight of the dough to increase. However, this does not increase the fat content of the product, so the "*Ceamond Crispy*" fat content will be lower with the addition of purple cabbage extract powder (Wuwur et al., 2021).

## **CHAPTER IV**

### **CONCLUSIONS**

Based on the research that has been done, it can be concluded that the results of laboratory tests showed that the Ceamond Crispy product positively contained anthocyanins, protein, carbohydrates, and negative results for fat. The product "Ceamond Cripny" has a taste like chocolate on F1, F2 and a slightly bitter chocolate taste on F3, and smells like vanilla. The product "Ceamond Crispy" is brown on F1, F2 and purplish brown on F3, and has a crunchy texture. Based on the results of the preference test conducted on 35 panellists for each formula. The most preferred "Ceamond Crispy" product is Formula 3 with a percentage of 54%. The results of the panelist questionnaire stated that they liked the product "Ceamond Crispy". This proves that the product "Ceamond Crispy" is safe for consumption by people of all ages and has the potential to be a healthy food for cardiovascular health.



## REFERENCES

- Afkar, M., Nisah, K., & Sa'diah, H. 2020. Analisis Kadar Protein Pada Tepung Jagung, Tepung Ubi, Kayu dan Tepung Labu Kuning dengan Metode Kjeldhal. *Amina*, 1(3), 108–113.
- Amanah, W. 2019. Biokonversi Antosianin Menjadi Antosianidin dan Uji Aktivitas Antioksidan dari Kubis Ungu (*Brassica oleracea* var. *capitata* L.) Melalui Fermentasi Ragi Tempe (*Rhizopus oligosporus*). Universitas Islam Indonesia.
- Anggriani, R., Ain, N., & Adnan, S. 2017. Identifikasi Fitokimia Dan Karakterisasi Antosianin Dari Sabut Kelapa Hijau (*Cocos nucifera* L Var *Varidis*). *Jurnal Teknologi Pertanian*, 18(3).
- Dirga, Asyhari, N., & Djayanti, A. D. 2018. Analisis Protein Pada Tepung Kecambah Kacang Hijau (*Phaseolus aureus* L.) Yang Dikecambahkan Menggunakan Media Air, Air Cucian Beras Dan Air Kelapa. *Journal of Science and Applicative Technology*, 2(1), 27–33.
- Fathurohman, M., Aprillia, A. Y., Pratita, A. T. K., & Tenderly, V. F. 2020. Diversifikasi Produksi Susu Kedelai Berbasis Mikroalga Autotrofik Guna Meningkatkan Indeks Nutrasetikal. *Jurnal Aplikasi Teknologi Pangan*, 9(2), 70–76.
- Fitri, A. S., Arinda, Y., & Fitriana, N. 2020. Analisis Senyawa Kimia pada Karbohidrat Analysis of Chemical Compounds on Carbohydrates. 17(1).
- Gusnadi, D., Taufiq, R., & Baharta, E. 2021. Uji Oranoleptik dan Daya Terima Pada Produk Mousse Berbasis Tapiel Singkong Sebagai Komoditi

- UMKM di Kabupaten Bandung. *Jurnal Inovasi Penelitian*, 1(12).
- He, X. L., Li, X. L., Lv, Y. P., & He, Q. 2015. Composition and color stability of anthocyanin-based extract from purple sweet potato. *Food Science and Technology (Brazil)*, 35(3), 468–473.
- Herfayati, P., Pandia, S., & Nasution, H. 2020. Karakteristik Antosianin dari Kulit Buah Nipah (*Nypa fruticans*) sebagai Pewarna Alami dengan Metode Soxhletasi. *Jurnal Teknik Kimia USU*, 09(1), 26–33.
- Ifadah, R. A., Wiratara, P. R. W., & Afgani, C. A. 2021. Ulasan Ilmiah: Antosianin dan Manfaatnya untuk Kesehatan. *Jurnal Teknologi Pengolahan Pertanian*, 3(2), 11–21.
- Karoui, I. J., Jalloul, B. A., Jihene, A., Abderrabba, M., & Jalloul, A. Ben. 2018. Characterization of Bioactive Compounds, Antioxidant Properties and Antimicrobial Activity of Red And White Cabbage Leaves Extracts. *Journal of Chemistry: Education Research and Practice*, 2(1), 1–8.
- Lukitasari, D. M., Indrawati, R., Chandra, R. D., Heriyanto, H., & Limantara, L. 2017. Mikroenkapsulasi Pigmen Dari Kubis Merah: Studi Intensitas Warna dan Aktivitas Antioksidan. *Jurnal Teknologi Dan Industri Pangan*, 28(1), 1–9.
- Mustakin, F., & Tahir, M. M. 2019. Analisis Kandungan Glikogen Pada Hati, Otot, dan Otak Hewan. *CANREA Journal*, 2(2)
- Ondagau, D. C., Ridhay, A., & Nurakhirawati. 2018. Karakterisasi Pigmen Hasil Ekstraksi Air-Etanol dari Buah Senggani (*Melastoma malabathricum*). *KOVALEN*, 4(3), 228–236.

- Putri, A. S., Kristiani, B., & Haryati, S. 2018. Kandungan Antioksidan pada Kubis Merah (*Brassica oleracea* L.) dan Aplikasinya Pada Pembuatan Kerupuk. *Media Komunikasi Rekayasa Proses dan Teknologi Tepat Guna*, 14(1), 1–6.
- Putri, N. K. M., Gunawan, I. W. G., & Suarsa, I. W. 2015. Aktivitas Antioksidan Antosianin Dalam Ekstrak Etanol Kulit Buah Naga Super Merah (*Hylocereus costaricensis*) dan Analisis Kadar Totalnya. *Jurnal Kimia*, 9(2), 243–251.
- Sobari, R. N. 2014. Hubungan Asupan Asam Lemak Jenuh dan Tak Jenuh dengan Kadar Kolesterol HDL Pada Pasien Penyakit Jantung Koroner di RSUD DR. Moewardi.
- Surianti, Husain, H., & Sulfikar. 2019. Uji Stabilitas Pigmen Merah Antosianin dari Daun Jati Muda (*Tectona hrandis* Linn f) terhadap pH sebagai Pewarna Alami. *Jurnal Ilmiah Kimia Dan Pendidikan Kimia*, 20(1), 94–101.
- Susanti, R. E. E., Nurjanah, A., Safitri, R. E., & A'yun, Q. 2019. Pemanfaatan Ekstrak Kubis Ungu (*Brassica Oleraceae*) Sebagai Indikator Warna Pada Analisis Hidrokuinon. *Akta Kimia Indonesia*, 4(2), 95.
- Tarwendah, I. P., Teknologi, J., Pertanian, H., Universitas, F., Malang, B., Veteran, J., & Korespondensi, P. 2017. Comparative Study of Sensory Attributes and Brand Awareness in Food Product : A Review (Vol. 5, Issue 2).
- Wahyuni, D. I. 2018. Aktivitas Ekstrak Etanol dan Ekstrak Etil Asetat Kubis Ungu (*Brassica oleracea* L.) dalam Menurunkan Kadar Gula Darah Mencit Jantan.

- Wibowo, S. T., Yudhistira, B., & Parnanto, N. H. R. 2018. Proses Produksi Almond Crispy Ubi Jalar. *Jurnal Kewirausahaan Dan Bisnis*, 23(11).
- Widiyawati, E., Ratnaningsih, N., & Lastariwati, B. 2021. Daya terima dan zat gizi almond crispy coklat sebagai camilan alternatif berserat tinggi. *Jurnal Teknologi & Industri Hasil Pertanian*, 26(2), 91–98.
- Wuwur, R. N., Swasti, Y. R., & Pranata, F. S. 2021. Penambahan Bubuk Ekstrak kubis Merah (*Brassica oleraceae* Var. *Capitata* F. *Rubra*) Sebagai Sumber Antioksidan dan Pewarna Alami Pada Cheesecake. *Jurnal Teknologi Pertanian*, 22(3), 221–236.
- Yusuf, M., Indriati, S., & Attahmid, N. F. U. 2018. Karakteristik Antosianin Kubis Merah Sebagai Indikator Pada Kemasan Cerdas. *Jurnal Galung Tropika*, 7(1), 46–55.