

CHAPTER I

INTRODUCTION

1.1 Research Background

Garlic (*Allium sativum* L.) is a type of plant that has been known since the time of the Prophet and continues to be recognized today, as mentioned in the word of Allah SWT, (QS: Al-Baqarah: 61).

وَإِذْ قُلْتُمْ يُوسَىٰ لَنْ نَصْبِرَ عَلَىٰ طَعَامٍ وَاحِدٍ فَادْعُ لَنَا رَبَّكَ يُخْرِجْ لَنَا مِمَّا تُنْبِتُ الْأَرْضُ مِنْ بَقْلِهَا وَقِثَّائِهَا وَفُومِهَا وَعَدَسِهَا وَبَصِلِهَا قَالَ اتَّسَبِدُونِ الَّذِي هُوَ أَذْنَىٰ بِالَّذِي هُوَ خَيْرٌ اهْبِطُوا مِصْرًا فَإِنَّ لَكُمْ مَّا سَأَلْتُمْ وَصُرِبَتْ عَلَيْهِمُ الذَّلَّةُ وَالْمَسْكَنَةُ وَبَاءُوا بِغَضَبٍ مِّنَ اللَّهِ ذَٰلِكَ بِأَنَّهُمْ كَانُوا يَكْفُرُونَ بِآيَاتِ اللَّهِ وَيَقْتُلُونَ النَّبِيِّنَ بِغَيْرِ الْحَقِّ ذَٰلِكَ بِمَا عَصَوْا وَكَانُوا يَعْتَدُونَ ﴿٦١﴾

Remember when you said, 'O Musa, we cannot endure eating only one kind of food. So, ask your Lord to provide us with what the earth grows, such as vegetable, cucumber, garlic, fennel, and shallots'. He (Musa) answered: "Are you asking for something bad in exchange for something good? go to a city, and you will surely get what you ask for." Then, they were afflicted with disgrace and poverty, and they (once again) incurred the wrath of Allah. This happened because they constantly rejected the signs of Allah and killed the prophets without any just cause. This punishment was inflicted upon them because they disobeyed and transgressed all bounds (QS: Al-Baqarah:61).¹

Indonesian people use garlic as an essential ingredient in culinary and health sectors.² In 2023, garlic production in Indonesia reached 40.000 tonnes, representing

¹ Al-Qur'an Al-Karim, QS: Al-Baqarah:61

² Sunarto, *Kuliner Bergizi Berbasis Budaya*, (Yogyakarta: CV. Absolute Media, 2022, p. 205)

an increase of 28.26% compared to the previous year.³ Garlic contains more than 33 bioactive compounds with various pharmacological activities.⁴ The primary compounds in garlic are organosulfur compounds (sulfur-containing compounds), such as diallyl disulfide, S-allylcysteine, diallyl trisulfide, and allicin.⁵ Allicin (*diallyl thiosulfinate*) is the primary bioactive compound in garlic after it is crushed or chopped.⁶ Characteristic of allicin in garlic is its unique taste and distinctive garlic aroma.⁷

Allicin is an unstable and thermolabile compound (sensitive to heat).⁸ At temperatures above 40°C, allicin degrades rapidly into other compounds, such as diallyl disulfide, diallyl trisulfide and ajoene.⁹ Therefore, an appropriate method is required for the extraction and analysis of allicin levels in garlic. Based on the research by Singh et al. (2020), the qualitative analysis of organosulfur compounds in garlic extract obtained through cold pressing showed positive results, indicating the presence of organosulfur compounds. The concentration of allicin in the cold press extract was analyzed using HPLC, and it was found to be 81.37%.¹⁰

Based on these descriptions, this research will involve the maceration extraction and fractionation of garlic, followed by qualitative analysis using complexometric titration and Thin Layer Chromatography (TLC), then the quantitative analysis of allicin levels in extracts and fractions was conducted using HPLC instruments.

³ Badan Pusat Statistik, 2024, *Produksi Tanaman Sayuran 2021-2023*, Jakarta, diakses 20 Agustus 2024

⁴ Dejen Bikis, 2018. *Review on the Application of Biotechnology in Garlic (Allium sativum)* Improvement, International Journal of research Studies in Agricultural Sciences Vol. 4 Issue. 11., p. 23-33

⁵ Jan Borlinghaus, et.al. 2014 *Allicin: Chemistry and Biological Properties*, Molecules, Vol. 19 Issue 9, p. 12591-12618

⁶ Ibid

⁷ Ibid

⁸ Widyasari Putranti, dkk. 2018, *Formulasi Emulgel Ekstrak Bawang Putih (Allium sativum L.)*, Jurnal Sains Farmasi & Klinis, Vol. 6 No.1, p. 8

⁹ Haiping Wang, et.al. 2014, *Influence of pH, Concentration and Light on Stability of Allicin in Garlic (Allium sativum L.) Aqueous Extract as Measured by UPLC*, Journal of the Science of Food and Agriculture, Vol. 95 Issue 9, p. 1838-1844

¹⁰ Sirjan Singh, et.al. 2020. *Determination and Estimation of Allicin in Allium sativum*, Journal of Evolution of Medical and Dental Sciences, Vol. 9 Issue. 49., p. 3711-3715

1.2 Research Problems

The problem statement from this research are:

- 1 How the results of qualitative analysis of allicin in garlic extract and fractions using complexometric titration and thin-layer chromatography (TLC) methods?
- 2 How quantitative analysis of allicin in garlic extract and fractions using the HPLC instrument?

1.3 Research Objectives

The objectives of this research are:

1. This research aims to determine the results of the qualitative analysis of allicin compounds in garlic (*Allium sativum* L.) extracts and fractions using complexometric titration and thin-layer chromatography methods.
2. This research aims to determine the results of the quantitative analysis of allicin compounds in garlic (*Allium sativum* L.) extracts and fractions using HPLC instruments.

1.4 Research Benefits

1. Theoretical Benefits

The results of this research can be used as reference material for the next research on the optimal maceration extraction method to obtain allicin compounds in garlic.

2. Practical Benefits

The results of this research are expected to contribute to the body of scientific knowledge and provide insights to readers, particularly those who use herbal plants in therapeutic treatments.

1.5 Authenticity Research

Research on the analysis of allicin in garlic extract using High Performance Liquid Chromatography has been conducted by several researchers, as shown in Table 1 below.

Table 1 Authenticity Research

Research Title	Research Method	Variable	Result	Research Difference
Comparison of Allicin Decomposition Kinetics between Garlic Extracts and Phytosome ¹¹	Experimental	Dependent: Allicin decompositions kinetics. Independent: Type garlic: bulbs of garlic, garlic extract and phytosomes of garlic extract. Extraction method: Maceration. Analysis method: Spectrophotometer UV-Vis, GC-MS, Phytosome.	Analysis of allicin using spectrophotometer UV-Vis, the result obtained of allicin content in various extract was 11,287% decomposition rate allicin in garlic extract was 0,2728% week and decomposition rate of garlic in the phytosome garlic extract was 0,0185% week.	Dependent: Content of allicin compounds in garlic extracts and fractions Independent: Extraction method: maceration. fractionation method: liquid-liquid. Qualitative analysis method: complexometry titration and thin layer chromatography. Quantitative analysis method: High Performance Liquid Chromatography.
Identification of allicin in garlic (<i>Allium sativum</i> L.) using Gas Chromatography	Experimental	Dependent: Content of allicin in garlic. Independent:	The identification of allicin using gas chromatography-mass	

¹¹ Elfriyani, dkk. 2020. *Comparison of Allicin Decomposition Kinetics Between Garlic Extract and Phytosomes of Garlic Extract*, Laporan Penelitian Pengembangan Ipteks, Jakarta: Fakultas Farmasi

Research Title	Research Method	Variable	Result	Research Difference
Mass Spectrophotometry (GC-MS) ¹²		Analytical method: using Gas Chromatography Mass Spectrometry (GC-MS).	spectrometry (GC-MS) did not detect any allicin compounds in garlic with a molecular weight of 162; however, other compounds were detected 4-allyl 2-methoxyphenol (C ₁₀ H ₁₂ O ₂) and 1-methyl 2-pyrrolidiny (C ₁₀ H ₁₄ N ₂).	
Quantification of allicin by High Performance Liquid Chromatography ultraviolet analysis with effect of post ultrasonic sound and microwave radiation on fresh garlic cloves ¹³	Experimental	Dependent: Quantification of allicin Independent: Extraction method: microwave: Methods of analysis: High Performance Liquid Chromatography.	The process revealed the effect of different radiation techniques on fresh garlic retains the principle component. Allicin in its pure from and generated higher yield than the conventional way of extraction.	

¹² Junedi, 2018, *Identifikasi Allisin pada Bawang Putih Allium sativum. L) secara Kromatografi Gas Spektrofotometri Massa (GC-MS)*, Skripsi, Semarang: Fakultas Farmasi

¹³ Bose, et.al. 2014, *Quantification of Allicin by High Performance Liquid Chromatography- Ultraviolet with Effect of Post- Ultrasonic Sound and Microwave Radiation on Fresh Garlic Cloves*, Vol. 10 Issue. 38., p.S288-S293

Research Title	Research Method	Variable	Result	Research Difference
Determination and estimation of allicin in allium sativum ¹⁴	Experimental	Dependent: The quantitative estimation of the amount of allicin in the extract was 81.37%. Independent: The type of local garlic available on the market, the extraction method used (cold press method), and the analysis method applied High-Performance Liquid Chromatography, (HPLC) were examined.	The reliminary test showed the presence of allicin compounds in the garlic extract, with HPLC analysis indicating that the amount of allicin compounds in the extract was 81.37%	

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¹⁴ Sirjan Singh, et.al. 2020. *Determination and Estimation of Allicin in Allium sativum*, Journal of Evolution of Medical and Dental Sciences, Vol. 9 Issue. 49., p. 3711-3715