

Abstract

Garlic is a familiar spice in all households and in medicine. It is also known for its potent antioxidant and anti-cancer properties.

This study determined the optimal combination of operating parameters for the hydrodistillation of Ly Son garlic essential oil. The effects of distillation time, water-to-material ratio, soaking time in NaCl solution, and NaCl concentration on the yield of essential oil extraction were investigated.

The results established the optimal extraction conditions as follows: distillation time of 2.5 hours, soaking time of 1 hour, NaCl concentration of 2%, and a water-to-material ratio of 1:7. Under these conditions, the maximum yield obtained was 3%. Ly Son garlic exhibited the highest antioxidant capacity, while Phan Rang garlic showed the lowest.

Introduction

Vietnam boasts a diverse climate, topography, and soil composition. This diversity gives rise to distinct garlic varieties in different regions, each with its unique characteristics in terms of ingredients and flavor. Notable examples include Ly Son garlic and Phan Rang garlic. However, research on these specific garlic types remains limited. This study aims to investigate the composition and antioxidant activity of three different Vietnamese garlic essential oils.

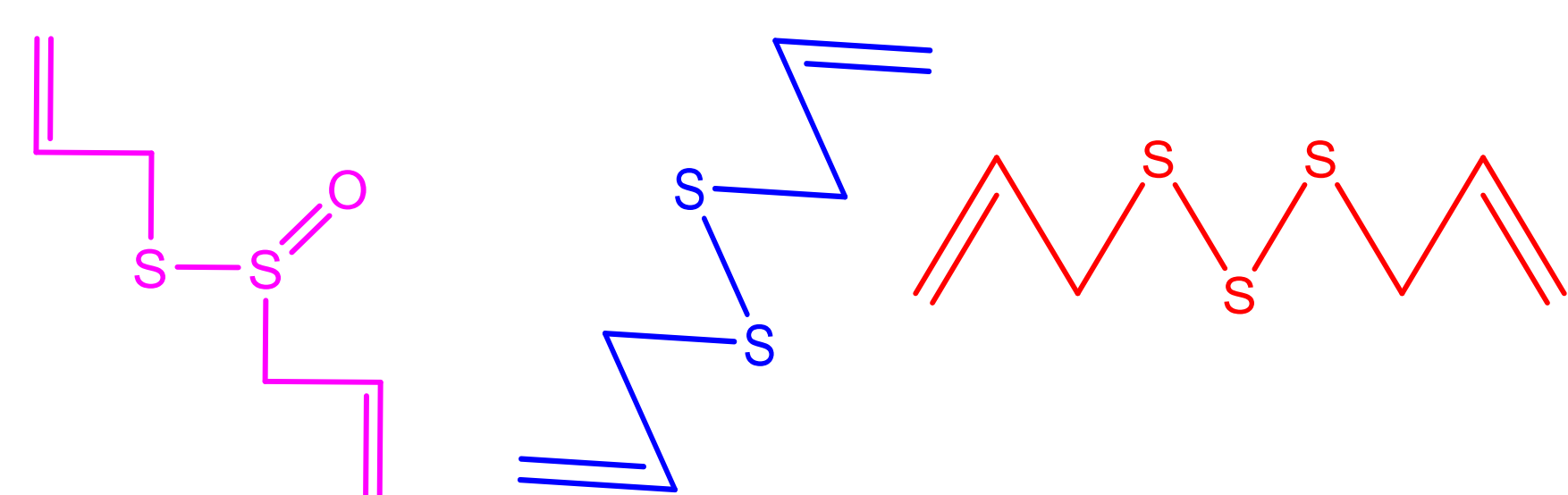


Figure 1. Main compositions of garlic oil.

Methods and Materials

Materials

Three garlic varieties - multi-clove Ly Son, single-clove Ly Son, and Phan Rang - were procured from their respective regions in Vietnam and harvested in June 2020. Garlic cloves were prepared by separating, peeling, and discarding damaged ones. Unused portions were vacuum-packed and refrigerated.

Essential Oil Extraction

A Clevenger distillation apparatus was employed to extract essential oils from 100g of finely chopped multi-clove Ly Son garlic. The process involved immersing the garlic in a NaCl solution and distilling the mixture. The effects of distillation time (90-210 min), salt concentration (0-4%), soaking time (30-150 min), and water-to-material ratio (3/1-11/1) on essential oil yield were examined using a one-factor-at-a-time approach.

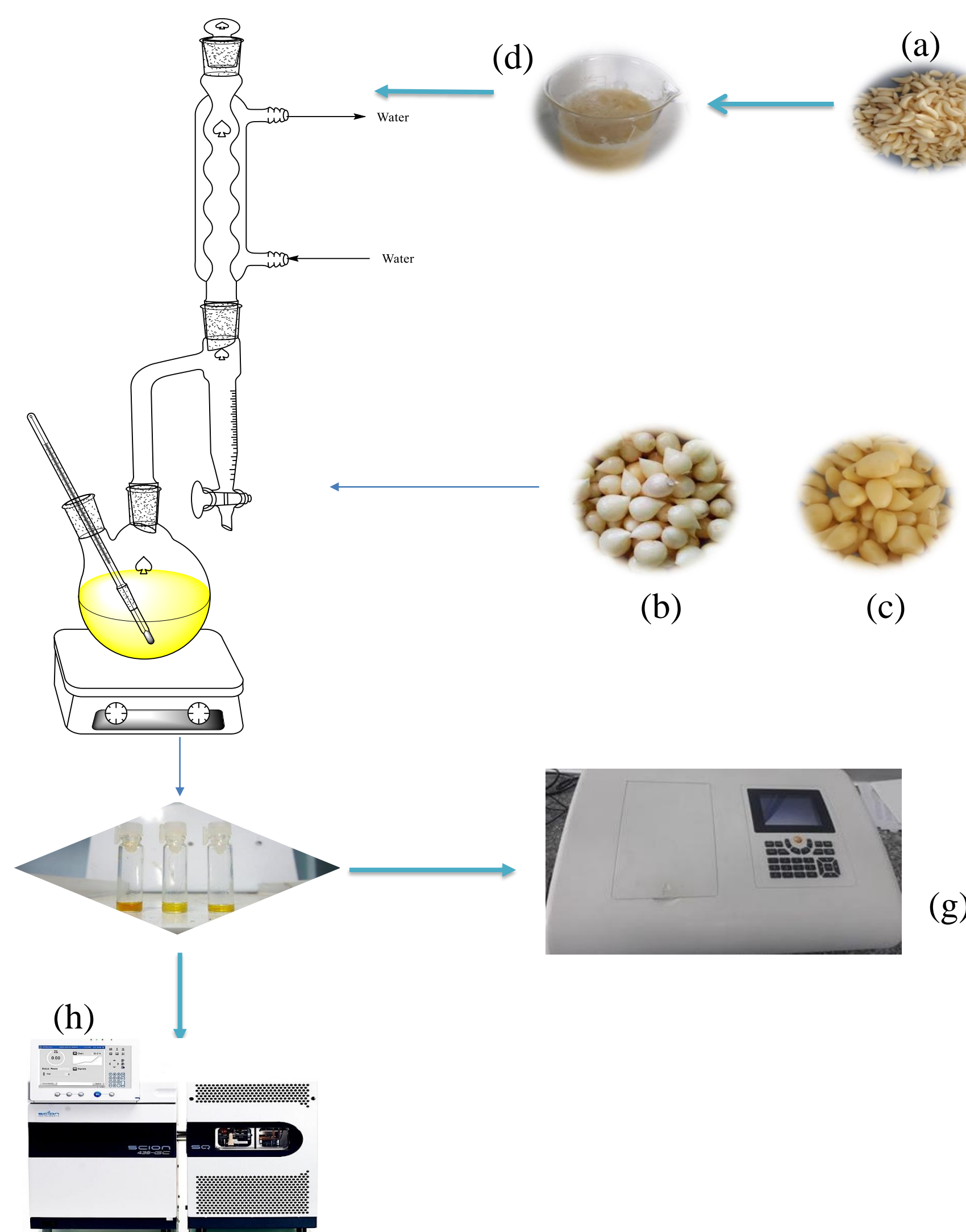


Figure 2. Experimental process.

Table 1. Survey parameters.

DESCRIPTION	CONDITION
Distillation time (hour)	1.5h, 2h, 2.5h, 3h, 3.5h
Concentration of NaCl (%)	0%, 1%, 2%, 3%, 4%
NaCl soaking time (hour)	0.5h, 1h, 1.5h, 2h, 2.5h
Material/water ratio (g/ml)	1:3, 1:5, 1:7, 1:9, 1:11

Results & Discussion

Optimal distillation parameters for garlic essential oil: NaCl soaking time 1 hour, water:material ratio 7:1, distillation time 2.5 hours, NaCl concentration 2%

The highest essential oil yield of 3% was obtained from multi-clove Ly Son garlic under optimal distillation conditions: distillation time of 150 minutes, salt concentration of 2%, soaking time of 60 minutes, and a water-to-material ratio of 7:1.

Essential oils extracted from three valuable Vietnamese garlic varieties - multi-clove Ly Son garlic, single-clove Ly Son garlic, and Phan Rang garlic - under optimized conditions exhibited distinct colors and pungent flavors.

Multi-clove Ly Son garlic contained the highest levels of diallyl disulfide and allyl methyl trisulfide (20.26% and 20.88%, respectively) and showed the highest antioxidant activity.

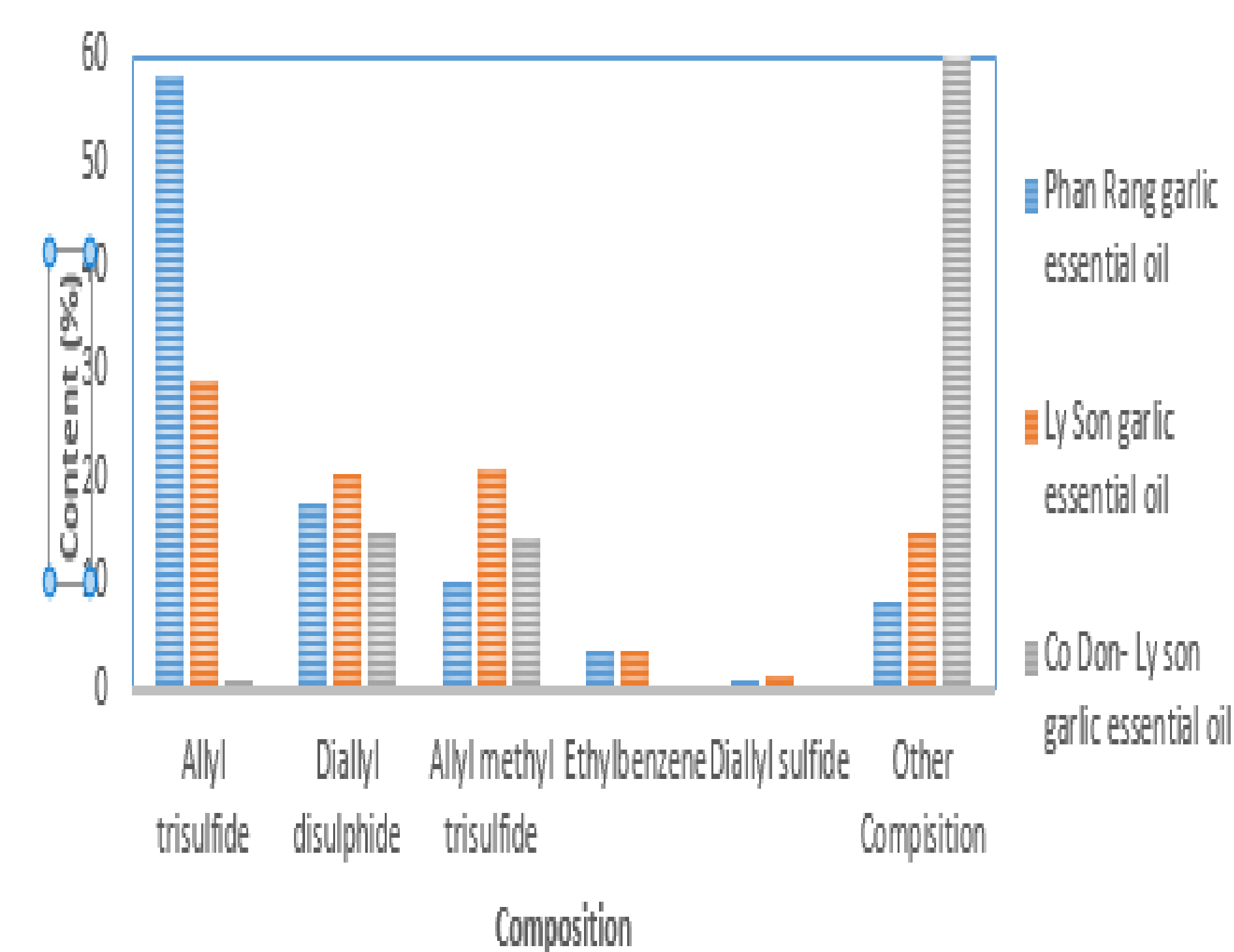


Chart 1. Result of GCMS

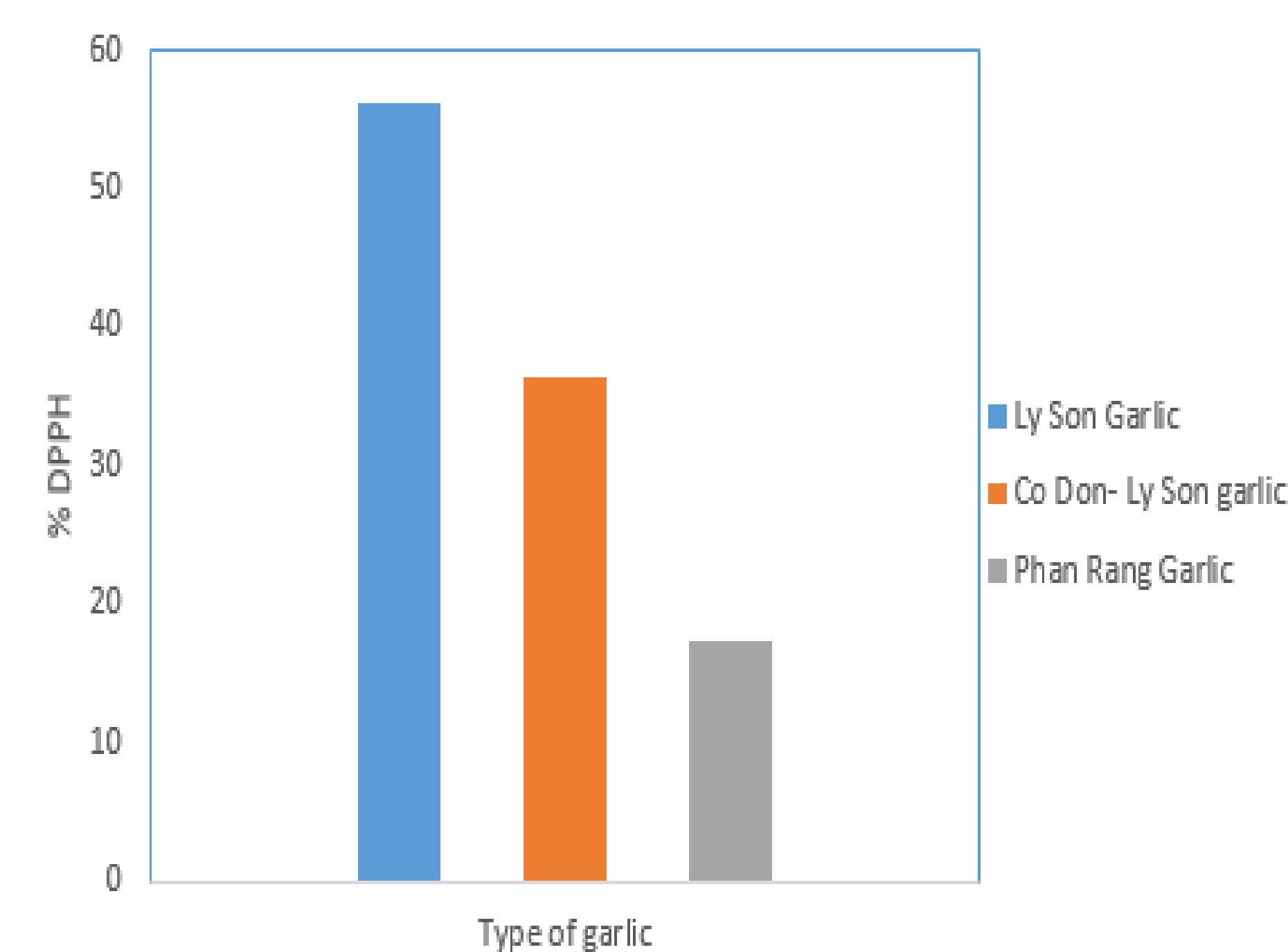


Chart 2. Result of DPPH

Conclusions

Ly Son garlic oil has demonstrated significant antioxidant potential, making it a promising candidate for various applications.

However, despite being a characteristic garlic variety in Vietnam, the research on Ly Son garlic oil remains relatively limited. While its antioxidant properties have garnered some attention, a comprehensive exploration of its medicinal attributes, including anticancer and antibacterial activities, is imperative to fully understand its therapeutic potential.

The distillation process of multi-clove Ly Son garlic yielded the highest essential oil content of 3% under optimal conditions: 150 minutes of distillation time, 2% salt concentration, 60 minutes of soaking time, and a water-to-material ratio of 7:1. Essential oils extracted from three premium Vietnamese garlic varieties - multi-clove Ly Son, single-clove Ly Son, and Phan Rang - under optimal conditions exhibited distinct colors and pungent flavors. Multi-clove Ly Son garlic contained the highest levels of diallyl disulfide (20.26%) and allyl methyl trisulfide (20.88%), and demonstrated the highest antioxidant activity.

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