

# ANTIBACTERIAL ACTIVITIES OF *PLECTRANTHUS AMBOINICUS* (LOUR.) SPRENG ESSENTIAL OIL AND PRODUCTS COLLECTED IN HOAI DUC DISTRICT, HANOI

HOẠT TÍNH KHÁNG KHUẨN CỦA TINH DẦU VÀ CÁC CHẾ PHẨM HÚNG CHANH Ở HOÀI ĐỨC, HÀ NỘI

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## ABSTRACT

*Plectranthus amboinicus* is one of the precious medicinal plants widely used in traditional Vietnamese medicine. The essential oil has many valuable biological activities in medicine. In this study, we studied the antibacterial activity of essential oil and 2 products on two strains of Gram (+) *Staphylococcus aureus* (ATCC 13709), Gram (-) *Escherichia coli* (ATCC 25922) and *Candida albicans* strains (ATCC10231) by the agar hole method. Research results show that all 3 samples have the ability to inhibit the growth of all 3 tested strains of bacteria with agar hole diameter varying from 21 - 85mm. Especially, the sample (essential oils of lemon balm, kumquat, honey) with the largest antibacterial diameter and greater than 85mm inhibited all microorganisms on the surface of the agar plate at the tested concentration.

**Keywords:** *Plectranthus amboinicus*, *Plectranthus amboinicus* of essential oil.

## TÓM TẮT

Cây húng chanh (*Plectranthus amboinicus*) là một trong các cây thuốc quý được sử dụng rộng rãi trong y học cổ truyền Việt Nam. Tinh dầu húng chanh có nhiều hoạt tính sinh học có giá trị trong y học. Trong nghiên cứu này chúng tôi đã thử hoạt tính kháng khuẩn của tinh dầu húng chanh và 2 chế phẩm của tinh dầu trên 2 chủng vi khuẩn Gram (+) *Staphylococcus aureus* (ATCC 13709), Gram (-) *Escherichia coli* (ATCC 25922) và chủng nấm *Candida albicans* (ATCC10231) bằng phương pháp lỗ thạch. Kết quả nghiên cứu cho thấy cả 3 mẫu đều có khả năng ức chế sự phát triển của cả 3 chủng vi khuẩn đã thử nghiệm. Với đường kính lỗ thạch biến đổi từ 21 - 85mm. Đặc biệt mẫu (tinh dầu húng chanh, quất, mật ong) cho đường kính kháng khuẩn rộng nhất và lớn hơn 85mm đã ức chế tất cả các vi sinh vật trên bề mặt đĩa thạch ở nồng độ thử nghiệm.

**Từ khóa:** *Plectranthus amboinicus*, cây húng chanh, tinh dầu húng chanh.

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## 1. INTRODUCTION

Today, plant-based drugs are still widely used in public health globally because they are safe, save costs, and help

maintain health. According to estimates by the World Health Organization, about 80% of the world's people are still dependent on traditional herbal medicines [1]. *Plectranthus amboinicus* (Lour.) Spreng is a perennial herb belonging to the family Lamiaceae which occurs naturally throughout the tropics and warm regions of Africa, Asia and Australia. *Plectranthus amboinicus* has a spicy taste, aroma, warm properties, helps to disinfect, relieves phlegm and is often used by folk to treat colds, sore throat, intestinal tract.



Figure 1. *Plectranthus amboinicus* (Lour.) Spreng

According to the reported results, the main components of *Plectranthus amboinicus* essential oil are carvacrol and thymol with different percentages depending on the climatic conditions, the soil at the place of collection, the time of collection and the extraction method [2]. The chemical compounds in *Plectranthus amboinicus* essential oil are highly valued in pharmaceuticals. There have been many domestic and international studies on antibacterial activity of *Plectranthus amboinicus* essential oil. By methods agar plate and concentration dilution on liquid medium. The results showed that essential oil inhibits the activity of some bacteria that cause diseases in the throat, nose, mouth and intestines such as *Staphylococcus*, *Shigella flexneri*, *sonnei*, *Shiga*, *B. subtilis*, *Es. Coli*... [3, 4], *Escherichia coli* ATCC 25922, *Candida albicans* ATCC 10231, *Enterococcus faecalis* ATCC 29212, *Aspergillus niger*, *Bacillus subtilis* ATCC 6633, *Staphylococcus aureus* ATCC 25923 and *Salmonella typhi* [5].

Now a day, there are many traditional medicines to treat a number of diseases such as colds, asthma, sore throat,

intestinal tract... with leaves of *Plectranthus amboinicus* or combined with a few ingredients such as kumquat, honey, rock sugar... However, there is no scientific evaluation of these folk remedies. In this work, we studied the antibacterial activity using the agar hole method of all 3 samples including essential oil and 2 preparations of essential oil + kumquat, rock sugar and essential oil + kumquat, honey to compare antibacterial activity of essential oils with products.

**2. MATERIALS AND METHODS**

**Plant material:** Leaves and trunk of *Plectranthus amboinicus* was collected in April 2021 in Song Phuong commune, Hoai Duc district, Hanoi city; identified by the National Center for Genetics and Breeding, Institute of Medicinal Materials.

**Microorganism strains:** *Staphylococcus aureus* (ATCC 13709), *Escherichia coli* (ATCC 25922) and *Candida albicans* (ATCC10231) were provided by the Department of Applied Biochemistry, Institute of Chemistry, Vietnam Academy of Sciences

**Methods** [6, 7, 8, 9]

The agar hole method is one of the methods to evaluate the effect of reagents on the growth of microbial strains cultured in vitro. The principle of this method is to determine the ability of the drug to diffuse into the agar layer, to inhibit the growth of bacteria around the agar hole. The larger the zone of inhibition, the stronger the effect of the drug.

**Tested microorganisms include:** *Staphylococcus aureus* (ATCC 13709), *Escherichia coli* (ATCC 25922), *Candida albicans* (ATCC10231). Microbial culture medium: Mueller-Hinton Agar (MHA), Sabouraud dextrose agar (SA). Microbial strains were stored at -80°C and activated to reach a concentration of 10<sup>6</sup>cfu/ml before conducting the experiment.

**Experiment:** Using a pipette, aspirate 100µl of the activated microorganism solution and spread it evenly on the agar surface. Pipette 50µl of sample solution onto the agar hole (6mm in size). Close the lid of the petri dish, incubate at 37°C for microorganisms to grow for 18 - 24 hours. Read and analyze the results: Remove the agar plates from the incubator. Measure and record the sterile ring size.

**3. RESULTS AND DISCUSSION**

Table 1. Results of antibacterial activity by agar hole method

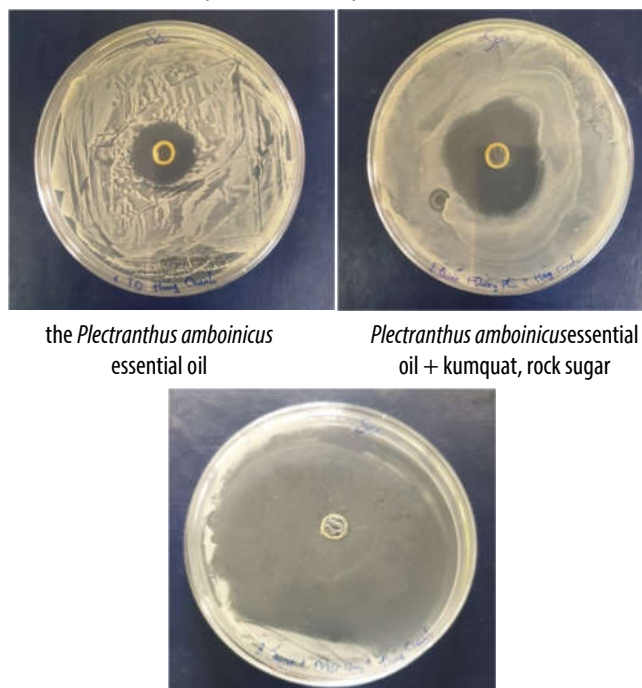
Sample	Diameter of sterile ring (mm)*		
	<i>S. aureus</i>	<i>E. coli</i>	<i>C. albican</i>
<i>Plectranthus amboinicus</i> essential oil	21	25	35
<i>Plectranthus amboinicus</i> essential oil + kumquat, rock sugar	33	54	42
<i>Plectranthus amboinicus</i> essential oil + kumquat, honey	71	42	≥85**

Note:

\* Diameter of sterile ring includes 6 mm agar hole diameter.

\*\* the sample inhibits all microorganisms on the surface of the agar plate at the test concentration.

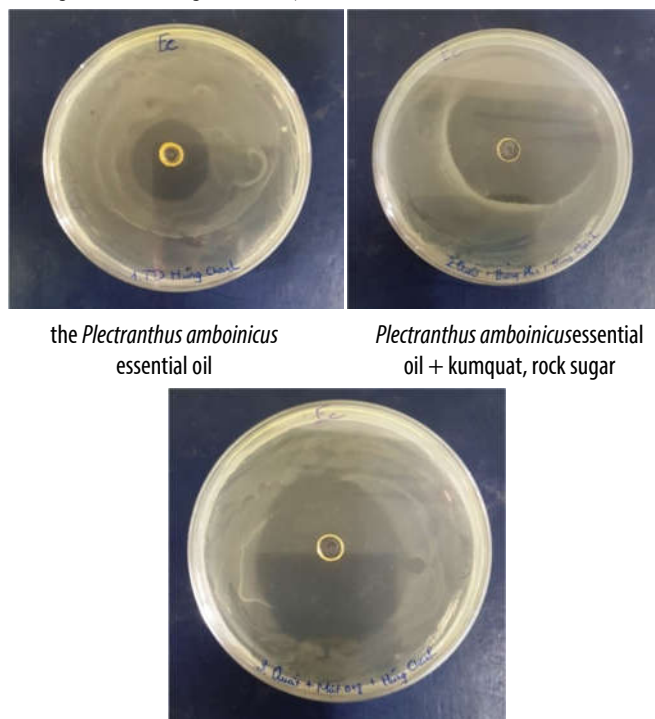
The antibacterial activity was determined based on the ability to inhibit bacterial growth through the antibacterial rings appearing on the agar plate (Figures 2, 3, 4). The antibacterial ring diameters of the *Plectranthus amboinicus* essential oil and 2 products are presented in Table 1.



the *Plectranthus amboinicus* essential oil      *Plectranthus amboinicus* essential oil + kumquat, rock sugar

*Plectranthus amboinicus* essential oil + kumquat, honey

Figure 2. Results against *Staphylococcus aureus* (ATCC 13709)



the *Plectranthus amboinicus* essential oil      *Plectranthus amboinicus* essential oil + kumquat, rock sugar

*Plectranthus amboinicus* essential oil + kumquat, honey

Figure 3. Results against *Escherichia coli* (ATCC 25922)

Research results show that all 3 samples have the ability to inhibit the growth of all 3 tested bacterial strains. Among

them, the ability to inhibit *Candida albicans* (ATCC 10231) is the strongest.



the *Plectranthus amboinicus* essential oil



*Plectranthus amboinicus* essential oil + kumquat, rock sugar



*Plectranthus amboinicus* essential oil + kumquat, honey

Figure 4. Results against *Candida albicans* (ATCC 10231)

The antibacterial level of the two products was higher than that of the pure essential oil, namely: (i) For the *Staphylococcus aureus* (ATCC 13709), the antibacterial diameter of the pure essential oil was 21mm, while in the preparation of essential oil + kumquat sugar increased to 33mm and reached 71mm in the preparation of essential oil + kumquat honey; (ii) For the *Escherichia coli* (ATCC 25922), the antibacterial diameter of pure essential oil was 25mm, while in the preparation of essential oil + kumquat sugar and essential oil + honey kumquat 54mm respectively 42mm; (iii) Antifungal results against *Candida albicans* (ATCC 10231) gave similar results for samples. Especially essential oil of lemon basil kumquat honey results in the widest antibacterial diameter greater than 85mm

inhibited all microorganisms on the surface of the agar plate at the test concentration.

We used the agar hole method to study the antibacterial activity of lemon basil essential oil against the above 3 strains of bacteria. The results showed that lemon balm essential oil was able to inhibit the growth of all 3 tested strains of bacteria. This result is consistent with published reports.

#### 4. CONCLUSION

With research results on antibacterial activity of *Plectranthus amboinicus* essential oils and 2 products by the jelly hole method helps us to have more scientific basis to confirm the value of traditional remedies in medicine.

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#### THÔNG TIN TÁC GIẢ

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