



## Using the Natural Fixative from Canarium Resin of Vietnam

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### Authors' contributions

This work was carried out in collaboration between both authors. Author LHH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed the analyses of the study. Author LMXT managed the literature searches. Both authors read and approved the final manuscript.

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### ABSTRACT

**Aim and Objectives:** Nowadays, the fixative substance from natural materials is gradually replacing the fixative substance that has been synthesized from chemicals. The purpose of the study in this research is that we created a natural fragrance from Vietnamese raw material with a fixative from Canarium Album (Lour) as a natural fixative to replace artificial fixative. Canarium plant is scientifically known as Canarium Album (Lour) Raensch of the Burseraceae family. Canarium Album L. is distributed in most of Northern provinces, central Highlands, and Southeast of Vietnam.

**Materials and Methods:** The method of this process is resin extraction by volatile solvents. We use a knife to cut into the trunk and let the resin run out, then harvest this resin to make fixative. The resin is dissolved in alcohol 96% and the distilled alcohol is removed to obtain absolute Canarium. Evaluation method of the ability of absolute Canarium is performed by comparing it with other fixatives in fragrances. Raw canarium resins is taken directly from canarium plants then refined absolute canarium as the natural fixative. We use this fixative substance in combinations of

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floral, woody smells and comparison with traditional artificial fixative as Musk ketone, Musk xylene, Musk ambrette.

**Results:** The comparison results show that the ability to keep the fragrance of scent is lower than musk ambrette, musk ketone but it is better than musk xylene. Thus, canarium resin can be used as a natural fixative to replace artificial fixative in fragrance.

**Conclusions:** Through research and experiment, we can see Canarium resin is precious. It can be used as a good fixative in aromatherapy. This is a natural resin, a kind of resource available in Vietnam. Therefore, it is recommended for further research, exploitation, and effective use of this resource.

*Keywords: Canarium; natural fixative; extraction; fragrance.*

## 1. INTRODUCTION

The genus *Canarium L.* embraces about 75 species of trees which are mainly found in tropical Asia and the Pacific, and a few species in tropical Africa [1]. *Canarium L.* species often produce edible kernels, called canarium nut. Another economical interest of *Canarium L.* species is the production of resins used in foods, in fragrance, in the making of incense and varnishing. [2,3]. The resin of Canarium has been used for chest pains, for treatment of arthritis pain, for ulcerated wounds used as a rubefacient and antirheumatic when applied externally. The oleoresin has been applied as an ointment for ulcers [4,5,6,7,8,9]. The composition of the essential oil obtained from the resin of *Canarium album* (Lour.) are Monoterpenoids and Sesquiterpenoids with limonene, sabinene, elemicin,  $\beta$ -phellandrene,  $\beta$ -pinene,  $\alpha$ -terpinene,  $\gamma$ -terpinene, and terpinen-4-ol as the main components [10,11,12]. New substances in the chemical composition of *canarium L.* have antioxidant and healing effects, continue to be discovered [13,14].

Vietnam is a tropical country with many kinds of essential oils and aromatic resins. Canarium resin can be used in fragrance but little attention is given to research and use in Vietnam. Canarium is scientifically known as *Canarium Album* (Lour) Raensch of the Burseraceae family, which grows wild along rivers and canals in many parts of Vietnam. *Canarium Album L.* is distributed in most Northern provinces, Central Highlands and South East such as Son La, Ha Giang, Lang Son...Canarium is a perennial tree, living on the wetland. Trunk height of 10-25m. Roots grow strongly, spread in the muddy soil, at the base of the stem is a lot of roots grows into clusters.

In Vietnam, there have been many studies on canarium resin. This work is mainly about the

plant, the development, and the distribution of the tree. Some scientists research on canarium resin for medical treatment. Chemical composition of resin contains 18 - 30% essential oils, the main essential oil is sabinene (45%); terpinene (16.7%) ... substances such as sabinene, terpinene are used in many flavors [15,16].

There are hardly any researches on fixative resins for fragrance in Vietnam. With the aim to exploit the strengths of natural resources, the research focuses on materials available in Vietnam for research and application. The purpose of our research is to create a natural fragrance from Vietnamese raw material with fixative from *Canarium Album L.* as a natural fixative to replace artificial fixative. For this purpose, we aim to Canarium resin, a fixative substance that has not been studied in Vietnam yet. The goal is to create a natural fixative substance from Canarium resin in Vietnam. The study of the fixative substance from Canarium resin is very significant in terms of science and practice. In terms of science, it is contributing meaning to the field of creating the fragrance, this is a new field and less research in Vietnam.

## 2. MATERIALS AND METHODS

### 2.1 Materials

The canarium resin used in the experiment was harvested from *Canarium album* (Lour.) in Dak Nong district, Dak Lak province, Vietnam. The raw material used in the experiment for the natural fragrance was taken from project Vietnam fragrance and essential oil VIE86033 and applied according to Indian Standards for aromatherapy. In our experiments, we used the volatile solvent is a solvent of alcohol 96%, and an odorless solvent diethyl phthalate (DEP).

## **2.2 Method of Extraction Resin from *Canarium album* (Lour.) Trees**

We extracted crude *Canarium* resin directly into the stem to allow the resin to flow into the jar. Raw *Canarium* resin is collected to make absolute resin.

We selected a place from the ground to the injection site 40-50 cm, peel of the tree 2 - 3 cm, width 3 - 4 cm. After 2 - 3 days, injection is once repeated. Each time of the injection, we cut the thin shell about 2 - 3 mm. The injections are proceeded from top to bottom. From the first injection to when the resin production of the tree is stable, is about 25 - 30 days.

## **2.3 Method of Creation Absolute *Canarium* Resin**

The method of creation for the *Canarium* absolute was to dissolve the raw resin into a 96% alcohol solvent, and then filtered and removed the solvent.

## **2.4 Method of Assessment of Product Quality**

The fragrance is diluted to 10-20 times by odorless solvent diethyl phthalate (DEP), then use paper and olfactory of the nose to evaluate the aroma. Record of odor quality and odor retention time for comparative assessment. The fragrance was assessed at different levels in Table 1.

## **3. RESULTS AND DISCUSSION**

### **3.1 Evaluate the Fixative from Absolute *Canarium* Resin in Fragrance**

We created three aroma compounds with similar structure and differences in body notes. G.1, G.1.1, G.1.2 completely from natural materials with the fixative group is the absolute *Canarium*. The structure of these fragrances includes top group, body group, fixative group (Table 2).

We use Cinnamaldehyde, Citronellal as very strong natural scent aldehydes for the top notes group. This group accounts for about 5% of the weight for the fragrance to fly quickly and the human olfactory odor easily perceives it. Cinnamaldehyde is a component with a cinnamon bark smell, it is chosen as the top group for woody odor G.1. Citronellal is a component with the smell of grass selected as

the top group for floral odor G.1.1 and fruity odor G.1.2.

Body note (body group) is the main group of fragrances, it decides the odor of the fragrance. The body note of fragrance G.1 consists of a main component, about 72% weight with woody odor such as Poumu oil, Sandalwood oil, Cedar wood oil, Vetiver oil, Ionone, Methyl ionone, so fragrance G.1 is a woody odor. Ionone, Methyl ionone have a scent of flower and wood, so they are suitable for a combination of floral and woody odor. Other constituents of the body note group account for about 15% of the weight with floral and fruity scent supporting the woody odor, making the fragrance G.1 more attractive and harmonious.

The body note of fragrance G.1.1 consists of main component, about 81% weight with floral odor such as Tecpineol, Tecpinyl acetate, Heliotropin, Ionone, Methyl ionone, Eugenol, Isoeugenol, Ylang Ylang oil, Jasmine oil, Extract laurel flower, Geraniol, Citronellol, so fragrance G.1.1 is a floral odor. The fruit odor of Citral diethyl acetal, Methylheptenone increases the attractiveness of G.1.1.

The body note of fragrance G.1.2 consists of main component, about 67% weight with fruity odor such as Geranyl acetate, Geranyl butyrate, Geranyl formate, Citronellyl acetate, Citronellyl butyrate, Citronellyl formate, Linalool, Linalyl acetate, Linalyl cinnamate, Orange oil, Grapefruit oil, Lemon oil, Mandarin oil, Citral diethyl acetal, Methylheptenone so fragrance G.1.2 is a fruity odor. Other components with a floral scent such as Ionone, Methyl ionone, Isoeugenol, Ylang Ylang oil, Jasmine oil, Extract laurel flower, Citronellol, Geraniol increases the natural odor of G.1.2.

We use absolute *Canarium* resin about 8% by weight for the fixative group of fragrance G.1, G.1.1, and G.1.2. The fixative group decisive scent retention over time. Experiments show that absolute *Canarium* resin has a relatively good ability to retain odor.

### **3.2 Compare the Ability of the Fixative Substance**

Fragrance G.1, G.2, G.3, G.4 have the same top notes and body notes but different fixative groups (Table 2).

The fixative substance of G.1 make from absolute *Canarium* resin

**Table 1. Descriptive statistics on the ability to retain odor by smell**

Rating level	Classifying odor rating	Description of the smell
1	The smell is very strong	The original aroma of the sample
2	The smell is quite strong	The initial odor is slightly reduced
3	The smell is normal	Smell initially decreased significantly
4	The smell is weak	The odor was mild
5	The smell is very weak	The smell was initially very difficult to receive
6	The smell is gone	The smell did not recognize

**Table 2. The composition of aromatic groups**

N°	Material	Fragrances % weight						Note
		G.1	G.1.1	G.1.2	G.2	G.3	G.4	
1	Cinnamaldehyde	3	1	1	3	3	3	Top note
2	Citronellal	2	4	4	2	2	2	
3	Poumu oil	10			10	10	10	
4	Sandalwood oil	25			25	25	25	
5	Cedar wood oil	9			9	9	9	
6	Vetiver oil	11			11	11	11	
7	Tecpineol		18					
8	Tecpinyl acetate		6					
9	Hydroxy citronellal		13					Body note
10	Heliotropin		8					
11	Geranyl acetate			7				
12	Geranyl butyrate			6				
13	Geranyl formate			5				
14	Citronellyl acetate			7				
15	Citronellyl butyrate			6				
16	Citronellyl formate			4				
17	Ionone	9	10	4	9	9	9	
18	Methyl ionone	5	7	4	5	5	5	
19	Linalool	1	1	2	1	1	1	
20	Linalyl acetate	1	1	5	1	1	1	
21	Linalyl cinnamate		1	5				
22	Eugenol	1	1		1	1	1	
23	Isoeugenol	1	1	1	1	1	1	
24	Ginger oil	1	1	1	1	1	1	
25	Ylang Ylang oil	2	5	1	2	2	2	
26	Jasmine oil	2	5	3	2	2	2	
27	Extract laurel flower	1	1	2	1	1	1	
28	Orange oil	1		5	1	1	1	
29	Grapefruit oil	1		4	1	1	1	
30	Lemon oil	1		6	1	1	1	
31	Mandarin oil	1		4	1	1	1	
32	Citronellol	1	3	1	1	1	1	
33	Geraniol	1	3	1	1	1	1	
34	Citral diethyl acetal	1	1	2	1	1	1	
35	Methylheptenone	1	1	1	1	1	1	
36	Canarium absolute	8	8	8				End note Fixative group
37	Musk ketone				8			
38	Musk xylene					8		
39	Musk ambrette						8	
	<b>Total</b>	100	100	100	100	100	100	

The fixative substance of G.2 make from artificial musk ketone

After 96 hours, scent of fragrance G.4 gives no smell.

The fixative substance of G.3 make from artificial musk xylene

The results in Table 3 show that the fixative of fragrance G.4 is the best and fixative of fragrance G.3 is the weakest. The fixative of fragrance G.1 is not equal to fixative of fragrance G.4 and fragrance G.2 but better than fixative of fragrance G.3. It shows that fixative from Canarium resin is weaker than artificial musk ambrette, musk ketone but better than artificial musk xylene.

The fixative substance of G.4 make from artificial musk ambrette

Evaluate the odor retention capacity of G.1, G.2, G.3, G.4 in Table 3.

During the first 6 hours all four types of fragrance G.1, G.2, G.3, G.4, with the woody odor, the difference cannot be distinguished.

Canarium resin is fixative because it contains polymers and substances difficult to evaporate [17]. Some other natural resins also have good odor retention such as Siam Benzoin resinoid, Benzoin Sumatra resinoid, Labdanum, Myrrh, Olibanum, Storax, Tolu balsam. Currently, Canarium resin is less commonly used as a fixative such as Siam Benzoin resinoid. Siam Benzoin resinoid resin has been studied and widely used as a fixative in aromatherapy [18]. The scent of Canarium resin is not as good as Siam Benzoin resinoid, however, Canarium resin is abundant in Vietnam that can be exploited in large quantities for the fragrance industry.

After 12 hours, the fragrance G.3 reduces the odor more than the other three fragrances.

After 60 hours, scent of fragrance G.3 gives no smell.

After 72 hours, scent of fragrance G.1 gives no smell.

After 84 hours, scent of fragrance G.2 gives no smell.

**Table 3. Review and evaluate the odor storage capacity of G.1, G.2, G.3, G.4**

N <sup>o</sup>	Time (hours)	Fragrance			
		G.1	G.2	G.3	G.4
1	0	The woody odor is very strong	The woody odor is very strong	The woody odor is very strong	The woody odor is strong
2	2	The woody odor is quite strong	The woody odor is quite strong	The woody odor is quite strong	The woody odor is quite strong
3	6	The woody odor is quite strong	The woody odor is quite strong	The woody odor is quite strong	The woody odor is quite strong
4	12	The woody odor is average	The woody odor is average	The woody odor is weak	The woody odor is average
5	24	The woody odor is weak	The woody odor is average	The woody odor is weak	The woody odor is average
6	36	The woody odor is weak	The woody odor is weak	The woody odor is poor	The woody odor is weak
7	48	The woody odor is poor	The smell of wood is weak	The woody odor is poor	The woody odor is weak
8	60	The woody odor is poor	The woody odor is poor	No more smells	The woody odor is weak
9	72	No more smells	The woody odor is poor	No more smells	The woody odor is poor
10	84	No more smells	No more smells	No more smells	The woody odor is poor
11	96	No more smells	No more smells	No more smells	No more smells

#### 4. CONCLUSION

The experiment has been shown that absolute Canarium resin is suitable with woody floral odor than fruity odor.

Evaluation and comparison of the possibility fixative of absolute canarium resin with some other artificial fixative are often used, showing the fixative from Canarium resin has a good retention ability. However, its ability to keep the fragrance of scent is lower than musk ambrette, musk ketone but it is better than the musk xylene.

Through research and experiment, we can see Canarium resin is precious resin. It can be used as a good fixative in aromatherapy. This is a precious natural resin, a kind of resource available in Vietnam. Therefore, it is recommended study of the abundance of the species in the forests and management techniques of the species, harvest times and percentage of fragrance present, for further exploitation and effective use of this resource.

#### CONSENT

It is not applicable.

#### ETHICAL APPROVAL

It is not applicable.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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