Blending Canarium Flavor (*Canarium album* L.) for Soft Candy from Natural Materials in Vietnam

ABSTRACT

Aim and Objectives: The aim of this study is to create Canarium flavor with the main ingredient (Body note) being *Canarium album* (Lour.) Raeusch essential oil and natural essential oils are found in Vietnam for soft candy product.

Materials and Methods: All the materials for making the Canarium flavor are from natural sources in Vietnam. Materials for making soft candy such as gelatin, sugar, and lemon juice are purchased in Vietnam market.

Flavor assessment experiment was conducted by olfactory. The created flavor of Canarium was tested on soft candy with 0.3% by weight.

Results: After the experiment, the flavors SC1, SC2 and SC3 having the ideal taste and smell for soft candy, were selected. The structure of flavors SC1, SC2 and SC3 include Grassy note, Green note, Fruity note, Woody note, Spicy note, Floral note, Sweete note and Spicy note. Flavors SC1, SC2 and SC3 have the same composition of 80% by weight, of which the main ingredient is Canarium oil (*Canarium album* L.) accounting for 50% by weight.

Conclusions: The flavors SC1, SC2 and SC3 were created from natural materials in Vietnam for soft candy product. Flavors SC1 and SC2, SC3 are natural, gentle and attractive scent. Flavor SC1 features a Canarium odor and a Lemon leaf flavor. Flavor SC2 contained the characteristic aroma of Canarium and the sweet-spicy flavor of Cinnamon bark. Flavor SC3 was made up of Canarium odor and the spicy-hot flavor of ginger. The flavor and taste of SC1, SC2 and SC3 are very suitable for soft candy.

Keywords: canarium, flavor**,** food, natural product, soft candy.

1. INTRODUCTION

Nowadays, natural flavorings are becoming popular and replacing synthetic flavorings in food. Scientists have come up with various standards to control natural flavors for food to ensure safety for users [1,2,3]. The aroma composition of foods has been the subject of research in recent years. The presence of volatile compounds and their composition determines the characteristic aroma and the taste of the

resulting products. Essential oils from nature are the primary source of flavors used in food because they typically contain antibacterial and antioxidant properties, making them a very effective food preservative. Essential oil is a mixture of volatile substances with aroma, which can be used as a flavoring agent for food products [4,5]. Furthermore, with the strong development of biotechnology, some food flavorings can be obtained from biosynthesis by enzymes [6,7,8].

Among the essential oils used in food, Canarium oil has a pleasant aroma of plants (Green note) that is appropriate for many food products, such as wine, beverage, candy, cake and jam. Canarium genus belongs to family Burseraceae with hundreds of species distributed mainly in Africa, Australia and Asia [9,10]. Parts of canarium tree such as wood, fruit, and resin are precious materials. Many researchers have studied canarium resin and fruit for their chemical composition [11,12,13], antibacterial and antioxidant properties [14,15]. In life and industry, Canarium fruit is processed into many types of products such as wine, syrup, beverage, jam, and apricot. Aromatic resins are used in the aromatherapy, cosmetic and therapeutic industries. Medical research has shown that Canarium resin can treat many respiratory and skin diseases [16,17].

Among the genus of Canarium, the species with the scientific name *Canarium album* (Lour.), has attracted the attention of many researchers because it is a common species and its wood, fruit and resin contain numerous valuable components that are utilized in both industry and daily life [18,19].

In Vietnam, *Canarium album* (Lour.) Raeusch is distributed in most of the northern provinces, the Central Highlands and the Southeast. The tree grows quite commonly at an altitude of 200-700 m, where there is a lot of rainfall. *Canarium album* L grows along the edges of forests, roads, around villages, along rivers and streams, is a light-loving and fast-growing tree. Formerly, at Vietnam, *Canarium. album* L. was grown mainly for timber, now some places have planted it for resin and fruit [20,21].

Today in Vietnam, the use of natural aromatic compounds as food flavor for confectionery, wine, beverage, and jam has been focused. People often choose Fruity notes such as lemon, orange, and strawberry for traditional flavors for candies. Some throat lozenges have a mint, melaleuca, and cinnamon smell. Despite having a mildly pleasant and natural scent (Green note), Canarium is rarely used in the production of candies on the market. Therefore, the purpose of this study is to create a Canarium flavor with the main ingredient (Body note) being *Canarium album* (Lour.) Raeusch essential oil and other natural essential oils are found in Vietnam. The research has practical significance to take advantage of the rich resources of essential oils as food flavor.

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Materials are Used to Prepare the Fragrance

Citronella oil, Lemongrass oil, Cajeput oil, Canarium oil, Orange oil, Sweet orange oil, Mandarin oil, Grapefruit oil, Lemon oil, Lime oil, Sassafras oil, Pepper oil, Peppermint oil, Palmarosa oil, Jasmine oil, Basil oil, Membrane oil, Marjoram oil, Ginger oil, Cinnamon bark oil and Lemon leave oil are extracted from plant sources available in Vietnam. Vanillin is used in food bought in the market.

2.1.2 Soft candy for sensory evaluation

The ingredients for making soft candy include gelatin, sugar, and lemon fruit juice bought in Vietnam market. Those ingredients were mixed with water, then melted, stirred, and cooled to 60^{o}C; then added the created flavor to the candy solution at the rate of 0.3% and stirred well before pouring into the mold.

2.2 Method of Preparation and Assessment odor

2.2.1 Methods are Used to Prepare Canarium Flavor

Structure of Canarium flavor are Top group, Body group, Support for Body group, Harmony group and Fantasy group (Table 1.).

Table 1. Structure and Function of Canarium flavor

N^0	Structure of flavor	Function in flavor
1	Top group	Make it easy for olfactory to recognize odors
2	Body group	Body group Is the main component of the flavor and determines the nature and characteristics of the odor.
3	Support for Body group	It supports the main aroma, making the scent of flavor more perfect and attractive
4	Harmony group	It creates harmony and comfort for the flavor
5	Fantasy group	The fantasy group has changed a part of the flavor to create an attractive taste

Notes of Canarium flavor are Green note, Fruity note, Woody note, Spicy note, Floral note, Grassy note and Sweet note . (Table 2.)

Table 2. Main notes in the Canarium flavor for soft candy

N^0	Notes of	Fragrant substance	Attention

	Canarium flavor		
1	**Green note**	Green note of odor of Canarium oil (*Canarium album* L.)	Main ingredient
2	**Fruity note**	Fruity note of Orange oil, Sweet orange oil, Mandarin oil, Grapefruit oil, Lemon oil and Lime oil.	Main ingredient
3	**Woody note**	Woody note of Sassafras oil.	Sub-ingredients
4	**Spicy note**	Spicy note of Pepper oil, Peppermint oil, Ginger oil and Cinnamon bark oil	Sub-ingredients
5	**Floral note**	Floral note of Palmarosa oil and Jasmine oil.	Sub-ingredients
6	**Grassy note**	Grassy note of Basil oil, Membrane oil and Marjoram oil	Sub-ingredients
7	**Sweet note**	Sweet note odor of Vanillin	Sub-ingredients

2.2.2 Method of Evaluation

To select the best fragrance combination and evaluate the quality of the scent, we have followed the method of the international experts of the project VIE86033 training [22]. Aromatic substances were selected with the initial recipe on a small scale about of 10g. The ingredients were mixed according to the original preliminary formula, heated at 50^{o}C for 4 hours with a magnetic stirrer, then left at room temperature for 72 hours to assess the flavor. After evaluating, the experimental group discussed and decided to add or remove ingredients to proceed with the next formula. The experiment continued until a relatively complete formula was selected, after that, we carried out on a large scale of 100g to get the fragrance into the test for products. The fragrance was tested on soft candy with 0.3% weight.

3. RESULTS AND DISCUSSION

After the experiment, we have selected flavors SC1, SC2 and SC3 for soft candy (Table 3.)**.**

Table 3. The composition of Canarium flavor

N^{o}	Material	Science name	Flavor % weight			Note of odor	Structure of flavor
			SC1	SC2	SC3		
1	Citronella oil	*Cymbopogon*		5			

		winterianus Jowitt.				Grassy note	Top group
2	Lemongrass oil	*Cymbopogon citratus* Stapf.			5		
3	Cajeput oil	*Malaleuca cajuputi* Powel	5				
4	Canarium oil	*Canarium album* (Lour.) Raeusch	50	50	50	Green note	Body group
5	Orange oil	*Citrus nobilis* Lour.	3	3	3	Fruity note	Support for Body group
6	Sweet orange oil	*Citrus Sinensis* (L.) Osbeck	2	2	2		
7	Mandarin oil	*Citrus reticulata* Blco.	2	2	2		
8	Grapefruit oil	*Citrus grandis* (Linn) Osbeck	1	1	1		
9	Lemon oil	*Citrus aurantifolia* Sw.	1	1	1		
10	Lime oil	*Citrus hystrix*	1	1	1		
11	Sassafras oil	*Cinnamomum parthenoxylon* Meissn	1	1	1	Woody note	
12	Pepper oil	*Piper nigrum* Linn.	1	1	1	Spicy note	
13	Peppermint oil	*Mentha arvensis* Linn.	1	1	1		
14	Palmarosa oil	*Cymbopogon martinii* Wats	2	2	2	Floral note	
15	Jasmine oil	*Jasminum sambac* (L.)	1	1	1		
16	Basil oil	*Ocimum basilicum* Linn.	1	1	1	Grassy note	
17	Membrane oil	*Litsea cubeba* (Lour.) Pers	2	2	2		
18	Marjoram oil	*Elsholtzia ciliata* Hyland	1	1	1		
19	Vanillin	*Vanilla planifolia*	10	10	10	Sweete note	Harmony group
20	Ginger oil	*Zingiber officinale* Rosc.			15		Fantasy

21	Cinnamon bark oil	*Cinnamomum cassia* Presl.		15		Spicy note	group
22	Lemon leaves oil	*Citrus aurantifolia Sw.*	15				
	Total		100	100	100		

3.1 Top group

The role of the Top group is to stimulate the sense of smell so that the olfactory senses can easily recognize the main odor in the natural flavor complexes. Aromatic substances for Top notes often have a strong odor, quickly evaporate and account for a low percentage. Depending on the type of the product, the components of Top group are accordingly chosen.

We used a 5% weight ratio for Top group including aromatic components suitable for soft candy such as Citronella oil, Lemongrass oil, and Cajeput oil.

3.2 Body group

Body group is the main group, the backbone that determines the nature of the fragrance. The proportion of this group is often very high compared to the whole flavor complexes. In order to make the fragrance more attractive while retaining the essence of the Canarium odor, Canarium oil (*Canarium album* L.) was chosen as the primary component accounting for 50% weight of the entire natural flavor complexes.

In addition, the scent of Canarium oil is fresh, mellow and seductive, which is the scent of a natural product, consequently, it is ideal for all kinds of aromas for food.

3.3 Support for Body group

Support for Body group includes Fruity note, Woody note, Spicy note, Floral note and Grassy note. This is the group that supports the smell of the main group and contributes to the attraction of the flavor complexes. Fruity notes including Orange oil, Sweet orange oil, Mandarin oil, Grapefruit oil, Lemon oil, and Lime oil, primarily supported the Body group of the flavor complexes. Woody note was enhanced by the addition of Sassafras oil component. The ingredient contributed to Spicy notes including Pepper oil and Peppermint oil. The components of Jasmine oil, and Palmarosa oil supported the Floral notes. Basil oil, Membrane oil, and Marjoram oil are the Grassy note of the flavor.

3.4 Sweet group

In Table 3. the composition of Canarium flavor is a collection of many aroma groups including Green note and supporting groups are Fruity note, Woody note, Spicy note, Floral note, and Grassy note. The Harmony group has the role of creating harmony between the components in the fragrance. Vanillin

components have a mild aroma that supports different aroma notes that work together to create a scent that creates a more attractive aroma. Therefore, Vanillin having a gentle scent was chosen to support different notes working together to create a more attractive fragrance.

3.5 Fantasy group

To make the fragrance become more appealing, the natural flavor complexes were added with some components that have a strong odor and are distinct from the main odor, which is called Fantasy group. The role of Fantasy group is not only affecting the sense of smell but also affecting taste to create attractiveness for food. The Lemon leaves oil, Cinnamon bark oil and Ginger oil were chosen for Fantasy group to create the smell and taste of the soft candy.

Flavor SC1 features a Canarium scent and a Lemon leaf flavor. Flavor SC2 contained the characteristic aroma of Canarium and the sweet-spicy flavor of Cinnamon bark. Flavor SC3 was made up of Canarium odor and spicy-hot flavor of ginger. The compositions of three Canarium flavors SC1, SC2 and SC3 provided an appropriate smell and taste for soft candy.

Canarium flavors SC1, SC2 and SC3 are a combination of many scents including Green note, Fruity note, Woody note, Spicy note, Floral note, Grassy note, Sweete note, Spicy note mixed together to create an attractive natural odor, suitable for food product like soft candy.

4. CONCLUSION

From natural materials in Vietnam, we have created the natural, gentle and attractive scent of SC1, SC2 and SC3 for soft candy. Flavors SC1, SC2 and SC3 have the same composition 80% by weight of which the main ingredient is Canarium essential oil (*Canarium album* L.) accounting for 50% by weight. The main difference is the mild spicy of SC1, the sweet-spicy flavor of SC2, warm-spicy of SC3. The flavor and taste of SC1, SC2 and SC3 are very suitable for soft candy.

6. ETHICAL APPROVAL

It is not applicable

REFERENCES

1. Samuel MC, Gerhard E, Shoji F, Nigel JG, Peter FG, Stephen SH, Ivonne MCMR, Jeanne MD, Christie LH, Sean VT. Updated procedure for the safety evaluation of natural flavor complexes used as ingredients in food. Food and Chemical Toxicology. 2018; 113: 171-178.
2. Jun MR, Jeon WS, Ho CT. Health Promoting Properties of Natural Flavor Substances. Food Science and Biotechnology. 2006; 15(3): 329-338.
3. Ángel CS and Ángel CB. Flavor and Aroma Analysis as a Tool for Quality Control of Foods. Foods 2021; 10(2): 224.

4. Kanza S, Imran P, Muhammad F, Jahangir C, Zaryab A, Hina B &Muhammad Z. Application of essential oils in food industry: challenges and innovation. Journal of Essential Oil Research. 2022; 34(2): 97-110.

5. Sundaresan B, Selvaraju V, Mohammad SA, Rajendran V, Dharmar B. Role of essential oils in food safety: Antimicrobial and antioxidant applications. 2019; 2(2): 49-55.

6. Ian L G. Biotechnological Production of Natural Flavor Materials. Flavor Chemistry. New York, 1999; pp 211–227.

7. Schwab W, Davidovich-Rikanati R, Lewinsohn E. Biosynthesis of plant-derived flavor compounds. Plant Journal. 2008; 54: 712-732.

8. Adelaide B, Carlos G & Isabel B. Generation of Flavors and Fragrances Through Biotransformation and De Novo Synthesis. Food and Bioprocess Technology. 2018; 11:2217–2228.

9. Hinge VK, Wagh SK, Bhattacharyya SC. Constituents of Indian black dammer resin. Tetrahedron. 1965; 21:3197-3203.

10. Leenhouts PW, Kalkman C, Lam HJ. Canarium (Burseraceae). Flowering Plants. Leiden University Netherlands. 1956; Vol.5: 249–296.

11 . Zhen-cheng L , Kang-Chen YZ , Yong-hong P . Nutritional composition of *Canarium pimela* L. kernels. Food Chemistry . 2011; 125(2): 692-695.

12 . Koudou J, Abena AA. Chemical composition and pharmacological activity of essential oil of *Canarium schweinfurthii.* Fitoterapia. 2005; 76(7-8):700-703.

13. Bhuvanendran R, Vasista RC, Dutt S. Chemical Examination of *Canarium Bengalense* Roxb. Current Science. 1963; 32:162-163.

14. Suruse PB, Duragkar NJ, Shivhare UD, Bodele SB. Study of Antimicrobial Activity of Canarium strictum Gum Resin. Research Journal of Pharmacognosy and Phytochemistry. 2010; 2(6): 435-437.

15. Ragunathan M, Senthamarai R. Anti-inflammatory Activity of Essential Oil of *Canarium Strictum* Roxb. Iranian Journal of Pharmaceutical Sciences. 2013; 9 (2): 13-21.

16. Desha M, Nagarajan B, Jesubalan D. Future prospects for the critically medicinally important species, *Canarium strictum* Roxb, A Review. International Journal of Conservation Science. 2018; 3(3): 231-237.

17. Suruse PB, Duragkar NJ, Bodele SB, Kale MK . Evaluation of pharmacological activities of isolated triterpenoids from *Canarium strictum.* International journal of universal pharmacy and life sciences. 2011; 3:110-119.

18. Zhiyong HX. Nutritional composition of the kernels from *Canarium album* L. Food Chemistry. 2007; 102(3): 808-811.

19. Tamai M, Watanabe N, Someya M, Kondoh H, Omura S, Zhang PL, et al. New Hepatoprotective Triterpenes from *Canarium album*. Planta Medica. 1987; 55 : 44-47.

20. Pham HH. An Ilustrated Flora of Vietnam . Published by the author, Montreal. 1992; 2 : 450.

21. Vo VC. Dictionary of Vietnamese Medicinal Plants, Medicine, Ho Chi Minh City. 1997; 1249.

22. Jain S. Processing of Vietnam eseessential oils and related natural products, DP.VIE 86033. 1998; p 40.