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Study on creation of an indocalamus leaf flavor

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Abstract

Flavors represent a small but significant segment of food industry. Sensory characteristics play an important role in the process of consumer acceptance and preference. Indocalamus leaf takes on a pleasant odor and indocalamus leaf flavor can be used in many products. However, indocalamus leaf flavor formula has not been reported. Therefore, developing an indocalamus leaf flavor is of significant interests. Note is a distinct flavor or odor characteristic. This paper concentrates on preparation and creation of indocalamus leaf flavor according to the notes of indocalamus leaf. The notes were obtained by smelling indocalamus leaf, and the results showed that the notes of indocalamus leaf flavor can be classified as: green-leafy note, sweet note, beany note, aldehydic note, waxy note, woody note, roast note, creamy note, and nutty note. According to the notes of indocalamus leaf odor, a typical indocalamus leaf flavor formula was obtained. The indocalamus leaf flavor blended is pleasant, harmonious, and has characteristics of indocalamus leaf odor.

Keywords: sensory analysis; formulas; aroma; flavor.

Practical Application: Indocalamus leaf flavor formula was obtained by sensory analysis of the aroma.

1 Introduction

Bamboo is a tribe of flowering perennial evergreen plants in the grass family Poaceae, subfamily Bambusoideae, tribe Bambuseae. It is used as building material, handicraft article, food material and traditional medicine (Lu et al., 2005). The chemical compounds in bamboo leaves are also used more widely and deeply in food processing and the development of new pharmaceutical. The chemical compounds of bamboo leaves were lavonoids, phenolic, proteins, carbohydrates, exogenous antioxidants, amino acids, etc. (Jin & Yin, 2012). Indocalamus is a genus of bamboos that has been utilized for centuries because of the aroma and health protection effects. Indocalamus leaves are often used as wrappers for steamed 'zongzi' (see Figure 1), which is a traditional Chinese food, made of glutinous rice stuffed with different fillings and wrapped in Indocalamus leaves. In the Western world, 'zongzi' is also known as rice dumpling or sticky rice dumpling (Sun, 2013).

The indocalamus leaf imparts its own unique smell and flavor to the rice. Because of the special fresh flavor of indocalamus leaves, according to relevant records, Chinese people have developed the custom of making 'zongzi' which dated back to period of Warring States period. A popular belief amongst the Chinese of eating 'zongzi' involved commemorating the death of Qu Yuan, a famous Chinese poet from the kingdom of Chu who lived during the Warring States period (Lu et al., 2005; Jin & Yin, 2012; Qin et al., 2013).

At present, indocalamus leaves have been used widely in food processing. The aroma odor of indocalamus leaf is attracting more and more attention. The odor of indocalamus leaves is a very delightful and indocalamus leaf flavor can be used in 'zongzi' and many other food products. However, indocalamus leaf flavor formula has not been reported. Therefore, developing an indocalamus leaf flavor is of significant interests. The formulations of flavors and fragrance created by flavorists or perfumers usually are secret in perfume and flavor industries. How to produce a flavor formulation has rarely been reported. Flavor science is a combination of art and technology and the main 'instrument' is the nose of a perfumer or flavorist. Although there is no single "correct" technique for the formulation of a flavor, there are general guidelines as to how a flavor can be constructed. A flavor usually contains many ingredients which are typically organized in a flavor for the specific role they will play (Zhu et al., 2015). These ingredients can be roughly grouped into four groups: primary scents, modifiers, blenders and fixatives. Note is a distinct flavor or odor characteristic, which can be identified by smell (Zhu et al., 2013). According to the notes of indocalamus leaf, indocalamus leaf flavor can be created. This article concentrates on preparation of indocalamus leaf flavor according to the notes of indocalamus leaf. An indocalamus leaf flavor formula was given. The indocalamus leaf flavor obtained according to the formula is pleasant, harmonious, and has characteristic odor of indocalamus leaf.

2 Materials and methods

2.1 Materials

All the raw materials for blending indocalamus leaf flavor were food-grade. The natural raw material, vanilla tincture, was purchased from Robert Company. Other raw materials were

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Figure 1. Indocalamus leaves (a) used as wrappers and steamed 'zongzi' (b).

synthetic and were purchased from Beijing Aroma Chemical Co. Ltd.

2.2 Methods

The note methods of flavor creation referred in literatures (Zhu et al., 2013, 2014, 2015) were adopted to develop indocalamus leaf flavor. A flavor is a mixture (added to impart or help impart a taste or aroma in food) of odorous materials derived from synthetic and natural sources (Burdock, 2010). Each ingredient of a flavor has its own distinct odor characteristic. This distinct odor characteristic is called as 'note' in perfume and flavor industries (Billot & Well, 1981). A flavor usually consists of various notes. Flavor formulations can be constructed by the notes. In the experiment, Fresh and cooked indocalamus leaves were smelled by nose to identify the notes of odor. According to the sensory character of indocalamus leaves obtained by smelling, the notes of indocalamus leaf flavor were identified. Indocalamus leaf flavor was constructed from the notes of indocalamus leaf odor. The aromatic raw materials are also usually classified into groups according to their notes. In light of the notes of the raw materials and that identified by smelling indocalamus leaf, proper raw materials were selected and blended to imitate the odor of indocalamus leaf and to create indocalamus leaf flavor formulations. The experimental design used in the creation of the flavor is based on the building up of the formulation by use of known notes of the indocalamus leaf and the introduction of aromatic raw materials.

3 Results and discussion

3.1 Notes of indocalamus leaf flavor

The creation of a flavor to a large extent is an art, but there is a good deal of science in the creation of flavor. Note is a distinct flavor or odor characteristic. Identification of the notes of indocalamus leaf is one important step to create indocalamus leaf flavor. The olfactory characteristics of indocalamus leaf were studied and smelling was applied in this study. The notes of indocalamus leaf flavor, which obtained by olfactory characters of indocalamus leaf, are shown in Figure 2.

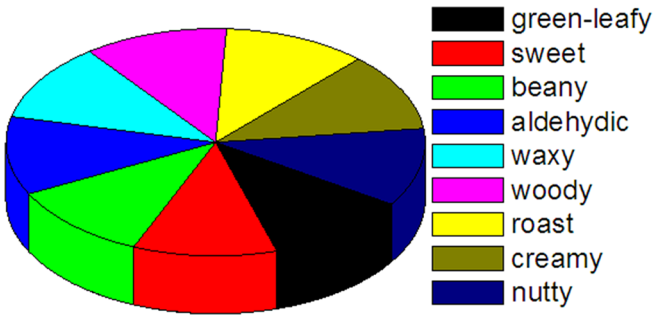

Figure 2. The notes of indocalamus leaf obtained by smelling.

These notes can be classified as: green-leafy note, sweet note, beany note, aldehydic note, waxy note, woody note, roast note, creamy note, and nutty note. The classification of these notes is based on the odor characteristics of indocalamus leaf. Flavor and perfume can be divided into various notes in light of their olfactory characteristics (Billot & Well, 1981; Zhou & Xiao, 2007). From these notes, flavor formulation can be constructed and raw materials with these notes can be adopted to blend the flavor.

3.2 Raw materials selected

When one is dealing with a lot of raw materials of widely differing characteristic odors, it is essential to have some means of dividing them into different groups, in order to facilitate selection and blending (Billot & Well, 1981). Usually, aroma raw materials are divided into different notes based on their own odor characteristics. These notes of raw materials and odor characteristics were reported in literatures (Zhou & Xiao, 2007; Burdock, 2010). According to the notes of indocalamus leaf and aroma raw materials, corresponding raw materials can be selected to imitate the odor of indocalamus leaf and to blend indocalamus leaf flavor.

Leaf alcohol, cis-3-hexenyl acetate, isophorone, benzyl acetate and linalool have green-leafy note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to provide green-leafy note in blending indocalamus leaf flavor. Especially,

leaf alcohol is a colorless liquid with the characteristic odor of leaf and freshly cut grass. It is used to obtain natural green top notes in flavors and perfumes.

Ethyl maltol, maltol, methylcyclopentenolone, furaneol and β-damascenone are of sweet note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to present sweet note in blending indocalamus leaf flavor. The furanones and pyranones are oxygen-containing heterocyclic compounds associated with both caramelized and Maillard flavors. The odor characters most common to this group of compounds would be sweet, caramel-like. Maltol is one of the first compounds in this class. Ethyl maltol has a caramel odor but is approximately four to six times stronger in flavor strength than maltol. Furaneol, like maltol and ethyl maltol, is a flavor enhancer for sweet products. Furaneol itself has a burnt pineapple odor. Cyclotene has a very characteristic sweet maple character. These materials can be used in indocalamus leaf flavor mainly to impart sweet note (Burdock, 2010; Surburg & Panten, 2006).

Vanillin, vanilla, ethyl vanillin, piperonal, phenyl methyl ketone, and the lower lactones C5-C8 are of beany note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to give beany note in blending indocalamus leaf flavor. Vanilla has a beany, sweet odor and characteristic flavor. Vanilla extract is the solution in aqueous ethyl alcohol of the sapid and odorous principles extractable from vanilla beans. Vanilla extracts are used extensively in flavor. Vanillin is the most abundant volatile aromatic constituent of cured vanilla beans. Small quantities are used in perfumery to round and fix sweet, balsamic fragrances. Ethyl vanillin does not occur in nature and its odor resembles that of vanillin but is approximately three times as strong. Ethyl vanillin gives beany, sweet, balsamic notes. Vanilla extract, Ethyl vanillin and vanillin can be used in indocalamus leaf flavor to present sweet and beany notes. Piperonal is a white crystal with a beany, sweet-flowery, heliotrope-like odor. It is also an important beany ingredient of flavor compositions (Burdock, 2010; Surburg & Panten, 2006).

Cis-4-Heptenal, hexanal, octanal, nonanal, and decanal are of aldehydic note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to give aldehydic note in blending indocalamus leaf flavor. Aliphatic aldehydes are among the most important components used in perfumery. The fatty aldehydes occur widely in nature and impart aldehydic, fruity and roast characters to flavor compositions (Burdock, 2010; Surburg & Panten, 2006). These lower aldehydes, such as C7-C10, can be used to blend indocalamus leaf flavor and add aldehydic note.

Ethyl myristate, ethyl laurate, ethyl dodecanoate, and ethyl teradecanoate are of waxy note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to provide waxy note in blending indocalamus leaf flavor.

2,6,6,-Trimethylcyclohex-2-ene-1,4-dione, Isophorone, and cedar wood oil are of woody note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to provide woody note in blending indocalamus leaf flavor. Cedar wood oil is light yellow to pale brown liquid with a characteristic cedar wood odor. Its taste characteristics are woody, cedar, dry, sandalwood-like with floral nuances (Burdock, 2010).

2,4-Dimethyl-5-acetylthiazole, 4-Methyl-5-thiazoleethanol, 4-Methyl-5-thiazoleethanol acetate, 2,5-Dimethylpyrazine, and 2- acetylpyridne are of roast and nuts notes (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to provide roast and nuts notes in blending indocalamus leaf flavor. Many nitrogen- and sulfur-containing heterocycles have been identified in the aroma fractions of foods (Reineccius, 2006). In roasted products and heat-treated foods, these heterocycles are formed from reducing sugars and simple or sulfur-containing amino acids by means of Maillard reactions. Thiazoles are examples of nitrogen- and sulfur-containing heterocycles. Alkythiazoles give green, nutty, roasted, vegetable, or meaty notes. Pyrazines are important raw materials to present roast and nutty notes. There has been a long-term interest in pyrazines due to their impact on the flavor of many thermally processed foods (Reineccius, 2006). The sensory properties of the pyrazines are quite diverse. The alkyl pyrazines generally possess roasted. Pyridine compounds possess a wide range in odor properties. The contribution of the pyridines to flavor is dependent on the individual pyridine structure and its concentration in the food. 2-acetyl-pyridine is tobacco-like in odor (Reineccius, 2006; Surburg & Panten, 2006).

δ-decalactone, δ-dodecalactone, δ-undecalactone, δ-nonalactone, hydroxyketone acetoin, and 2,3-butanedione are of creamy note (Zhou & Xiao, 2007; Burdock, 2010). These raw materials can be selected to provide creamy note in blending indocalamus leaf flavor. Vanillin, ethyl myristate, and ethyl laurate can also provide the creamy note. *Cis-4-Heptenal* also has an odor reminiscent of fried, buttery aroma, and can also be used to impart creamy note (Burdock, 2010).

3.3 A typical indocalamus leaf flavor formula

According to the notes of indocalamus leaf odor and the raw materials selected, an indocalamus leaf flavor was obtained. A typical indocalamus leaf flavor formula is shown in Table 1.

As shown in Table 1, isophorone is used for imparting woody, slightly green and herbal taste. Isophorone has a peppermint-like odor which can enhance the fresh feeling of the flavor (Burdock, 2010).

Cis-4-Heptenal has an odor reminiscent of heptaldehyde. The odor is suggestive of fried fats on dilution. It is used to impart an aldehydic note and a fried, buttery flavor.

Ethyl myristate has a mild, waxy, soapy odor reminiscent of orris. Ethyl laurate has a floral, fruity odor (Burdock, 2010). These two materials adopted in the formula to present waxy and creamy notes.

2,4-Dimethyl-5-acetylthiazole is a heterocyclic thiazole that has an odor of roasted nut. In the formula, it provides nutty, roasted, woody nuances.

2,5-Dimethylpyrazine has a characteristic odor of earthy, potato-like odor. It imparts nutty, fatty and oily nuances.

Methylcyclopentenolone has a sweet flavor somewhat similar to licorice. This compound is also reported to have a nutty odor and a maple-licorice aroma in dilute solution. It provides

Table 1. A typical indocalamus leaf flavor formula.

No	Raw material	wt %
1	Isophorone	0.040
2	1% *cis*-4-Heptenal	0.025
3	10% Ethyl myristate	0.060
4	1% Ethyl laurate	0.400
5	2,4-Dimethyl-5-acetylthiazole	0.025
6	1% 2,5-Dimethylpyrazine	0.020
7	1% Methylcyclopentenolone	0.030
8	1% 2-Acetylpyridine	0.005
9	Leaf alcohol	0.040
10	*n*-Nonanal	0.020
11	Vanillin	0.190
12	4-Methyl-5-thiazoleethanol	0.060
13	4-Methyl-5-thiazoleethanol acetate	0.080
14	Ethyl maltol	0.800
15	1% 2,6,6,-Trimethylcyclohex-2-ene-1,4-dione	0.050
16	Vanilla tincture	0.300
17	4-Hydroxy-2,5-dimethyl-3(2*H*)-furanone	0.020
18	Indocalamus leaf base	3.000
19	Propylene glycol	94.835
Total		100

sweet, maple, and nutty nuances (Reineccius, 2006; Surburg & Panten, 2006).

4-Hydroxy-2,5-dimethyl-3(2*H*)-furanone (Alletone) has a sweet, fruity, strawberry, hot sugar, fruity caramel or "burnt pineapple" aroma. Ethyl maltol has a very sweet, fruit-like odor of immense tenacity and sweet, fruity taste with initial bitter-tart flavor; rapid loss of flavor per se. It is four to six times more potent than maltol. These two materials are employed in the formula mainly to impart sweet and roasted taste characteristics and notes (Reineccius, 2006; Surburg & Panten, 2006).

2- Acetylpyridne is a colorless liquid with tobacco-like aroma. It presents green and nutty nuances.

4-Methyl-5-thiazoleethanol has an odor typical of thiazole compounds; somewhat pleasant, reminiscent of beef and nut-like, on extreme dilution. 4-Methyl-5-thiazoleethanol acetate has an odor reminiscent of meat. These two ingredients are used in the formula to provide roasted and nutty taste characteristics.

2,6,6,-Trimethylcyclohex-2-ene-1,4-dione has a woody, musty sweet aroma. It also has a leafy odor of tea. This ingredient is employed in the formula mainly to present leafy and woody notes.

3-Hexen-1-ol (leaf alcohol) has an intense, grassy-green odor, not as strong as the corresponding aldehyde, and a characteristic herbaceous, leafy odor on dilution. It provides fresh, green and leafy taste characteristics.

N-Nonanal has a strong, fatty odor developing an orange and rose note on dilution. It has a fatty, citrus-like flavor. It used in the formula to provide aldehydic and waxy nuances.

Vanillin has a characteristic, creamy, vanilla-like odor with a very sweet taste. It can provide sweet, vanilla-like, creamy-coumarin, notes. Vanilla has a sweet, beany, ethereal odor and characteristic flavor. Vanilla extract is the solution in aqueous ethyl alcohol of the sapid and odorous principles extractable from vanilla beans. Vanilla tincture is used in indocalamus leaf flavor to present sweet and beany notes. Moreover, vanilla tincture is a natural material; it can also enhance the natural feeling of indocalamus leaf flavor (Reineccius, 2006; Surburg & Panten, 2006).

The indocalamus leaf flavor blended according to formula as shown in Table 1 has a pleasant, harmonious odor, with characteristics of indocalamus leaf. The flavor developed is very similar to the odor of cooked Zongzi.

4 Conclusions

This article concentrates on preparation of an indocalamus leaf flavor according to the notes of indocalamus leaf. Based on the odor of the indocalamus leaf, the notes of indocalamus leaf flavor were obtained and could be classified as: caramellic note, roast note, milky note, beany note, green note, aldehydic note, sweet note, nutty note, vegetative note and fruity note. According to the notes of indocalamus leaf, corresponding raw materials were selected to develop an indocalamus leaf flavor. An indocalamus leaf flavor formula was obtained. The indocalamus leaf flavor blended according to the formula is pleasant, harmonious, and has characteristic odor of indocalamus leaf.

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