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Sweet Flavor Formulation of Agarwood Leaf Extract Powder

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Abstract

Agarwood leaves powder is not very popular because of its strong flavor, which some people may find overpowering or strange. However, agarwood leaves are widely used in tea production. Thus, this study aims to develop new products from agarwood leaves which is sweet flavor of agarwood leave extract powder by using different sweetener. This sweet flavor of agarwood leave extract powder can be used as sweet seasoning powder for food like pastry and chips. To bring out the sweet flavor of agarwood leaves, the sweetener was mixed with agarwood leaf extract powder. Three formulations were created to know the suitable taste in order to enhance the sweet flavor of agarwood leaf extract powder. Formulation 1 consists of 47.51% of agarwood leave extract powder, 35.63% of stevia and 16.86% of sodium benzoate, formulation 2 consists of 47.51% of agarwood leave extract powder, 35.63% of white sugar and 16.86% of sodium benzoate while formulation 3 consists of 47.51% of agarwood leave extract powder, 35.63% of brown sugar and 16.86% of sodium benzoate. 7-point hedonic test and descriptive test were carried out to identify consumer's acceptance and sweet flavor of agarwood leave extract powder's sensory profiling through sensory evaluation. The ANOVA test on sensory results showed that most of sensory attributes for three formulations of sweet flavor of agarwood leave extract powder were significantly different (p<0.05). From the sensory test, formulation 2 was the most acceptable formulation with a mean score 5.93±2.15. In conclusion, Formulation 2 was the most acceptable in terms of overall acceptability due to its smooth appearance, bittersweet aroma, light color, sweetness, low in bitter taste and low in after taste.

1. Introduction

The botanical name for agarwood is *Aquilaria malaccensis*. Agarwood also known as 'gaharu, tengkaras and karas'[1]. It has a height of 20-40 m and the diameter of the trunk is 60 cm, the bark of the tree is smooth. Agarwood trees are commonly found in primary and secondary forests, mostly in lowland forests and hillsides. Agarwood trees are becoming more popular because of their many advantages. It is commonly recognized that the agarwood tree's trunk, bark, leaves, blossoms, fruit, and twigs may all be utilized to make a wide range of goods, including medications, cosmetics, drinks like tea, and perfumes. Agarwood also has therapeutic uses; for example, the leaves can be used to treat vomiting, the root can be used to make a herbal tea that reduces swelling, and an agarwood decoction can be used to treat diarrhea, high fever, malaria, and vomiting [2]. Agarwood has

anti-hyperglycemic, antioxidant, and antibacterial properties. According to research, agarwood leaves has high antioxidant activity and rich in flavonoid compounds. Diseases such as cancer, heart disease, diabetes and arthritis can be prevented by consuming diet high in antioxidants [3]. Agarwood leaves are now used in a variety of food products and are available insachets as tea or combined with other ingredients including coffee, cookies, and ice cream.

However, after agarwood leaves are processed into powder, it has a blunt, strong, distinct flavour that can be bitter, woody or earthy. Some people could findoverwhelming or unfamiliar, which contributes to its low level of popularity. Natural and synthetic sweeteners as sucrose alternatives such as honey, xylitol, erythritol, maltose, maltodextrin, stevia, molasses, maple syrup, coconut sugar, agave nectar, and date sugar are common sweeteners in foods [4]. Sweeteners used can affect the taste and aroma of food product such as sweetener can mask the subtle flavours and aromas of green tea [5]. Therefore, the purpose of this study are to formulate and enhance the flavour of agarwood leaf extract powder by mixing twith sweetener also to determine descriptive sensory acceptability among panelists. This end product can be use in various food product such as to coat chips.

2. Materials and Method

The Agarwood Global Venture was the source of the agarwood leaves. After collecting fresh agarwood leaves, every residue were cleaned with tap water. The leaves were dried for one hour and forty minutes at 80°C by using smoke house. To grind the dried leaves into smaller sizes, a bowl chopper was used. Fine mesh sieves were used to filter the ground leaves. The agarwood leaves were then extracted by infusing it for 30 minutes into water that was kept at 95–100°C (1:10 w/v) [6]. The agarwood leaves were turned into agarwood powder using the spray dry method. Maltodextrin was used as a carrier agent during spray drying process [7,8]. Three different formulations using agarwood leaf extract powder and three different sweeteners were used to create the sweet flavor of agarwood powder.

2.1 Sweet Flavor Formulation of Agarwood Leaf Extract Powder

To enhance the sweet flavor, agarwood leaf powder was mixed with sweeteners. The agarwood powder was grounded two times by using blender and was then sieved. Same goes to the sweeteners, it was also be grounded and sieved until get the fine texture powder. Fine agarwood powder and fine sweeteners powder were mixed together in a bowl. There are three formulations of each sample are shown in Table 3.1 were created based on [9,10] descriptions.

Table 3.1 *Formulation of each samples*

Sample	Formulation	Ingredients (%)
789	Formulation 1 (F 1)	- 47.51% of agarwood powder - 35.63% of stevia - 16.86% of sodium benzoate
456	Formulation 2 (F 2)	- 47.51% of agarwood powder - 35.63% of white sugar - 16.86% of sodium benzoate
123	Formulation 3 (F 3)	- 47.51% of agarwood powder - 35.63% of brown sugar - 16.86% of sodium benzoate

2.2 Sensory Evaluation

The prepared sweet flavor of agarwood leaf powder was evaluated by using hedonic test and descriptive test. A scoresheet of 7-point hedonic scale ranges from 7 which represented for most acceptable and 1 which represented for least acceptable or dislike was used to evaluate the acceptance based on some sensory attributes which are appearance, aroma, flavor, sweetness, bitterness, aftertaste and overall acceptance of three samples.

Descriptive test was used to gain sweet flavor of agarwood leaf extract powder sensory profiling. The test was carried out by using trained panelists of final year of Bachelor's Degree of Food Technology students. After individual evaluations, panelists were discussed their perceptions and reach agreement on each intensities of attributes such as aromas and flavors based on the reference standard representing such as sugar, caffeine, original agarwood powder, cinnamon, cocoa powder and roasted coffee beans. After that, the structured scale

Enhanced Knowledge in Sciences and Technology Vol. 4 No. 2 (2024) p. 623-627

measuring 9.0 cm was used to quantify the perceived intensity of each sensory attributes. The panelists were evaluated each sample and marking their perception of each attribute's intensity on the scale from low intensity to high intensity.

2.3 Statistical Analysis

Statistically, all the collected data on sensory evaluation were analyzed. All three samples were all performed in triplicate. The statistical software SPSS 20.0 and Microsoft Office Excel 2019 were utilized to calculate the results of the study. The standard deviation and the mean over three replicates were used to present the data. $P<0.05$ shall be designated as the significance value. The ANOVA analysis was performed on the sensory evaluation data [11]. Mean score, standard deviation and spider plots were used to interpret the quantitative descriptive analysis (QDA).

3. Results and Discussion

The descriptive test assessed sensory attributes like color, aroma, flavor, and acceptability using a 9.0 cm structured scale, with higher scores indicating stronger intensity attributes. 7-point hedonic scale assessed sensory attributes like appearance, color, aroma, flavor, and acceptability by representing 7 scale as the most acceptable and 1 represented as the most disliked.

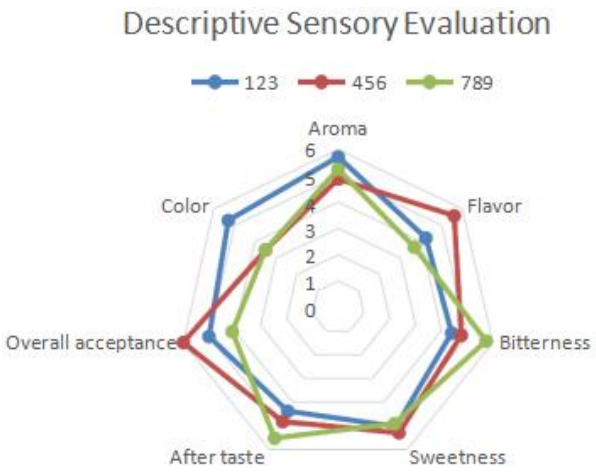

Fig. 3.1 *Spider web plots represent sensory profiles*

Table 3.2 *Mean score for each sensory attributes in descriptive test*

Formulation	Attributes					
	Aroma	Flavor	Bitterness	Sweetness	After taste	Overall acceptance
F 1	5.72±1.90	3.67±2.11	5.73±2.03	4.90±2.17	5.52±2.10	4.10±2.17
F 2	4.88±1.50	5.60±2.11	4.77±1.87	5.30±2.07	4.82±2.00	5.93±2.15
F 3	5.25±2.54	4.23±1.28	4.40±2.06	5.03±2.27	4.38±1.96	4.97±2.03

Table 3.1 showed spider web plots that represent sensory profiles while Table 3.2 showed mean score for each sensory attributes in descriptive test. Highest mean score indicates longer spoke and high intensity. As shown in Table 3.2, the total of 5.93 mean score was resulted from the overall acceptance for the F2 while the second highest mean score which is 4.97 was F3. However, F1 which is 4.10 were less acceptable among panelists. In terms of sweetness characteristic, F2 has highest intensity which it have mean score 5.30 while F1 has lowest mean score, 4.90, lowest intensity of sweetness. As shown in Figure 3.1, spoke length for sweetness of F2 is almost 6 cm. Panelists perceived it as moderately sweet compared to other formulations. This showed that F2 has highest sweetness intensity because it has longest spoke for sweetness attributes. For overall acceptance point of view,

F2 has longer spoke which means it has highest intensity. This is because F2 has longest spoke for sweetness but shorter spoke for bitterness.

Table 3.3 *Mean score for each sensory attributes in hedonic test*

Formulation	Appearance	Aroma	Color	Sweetness	Bitterness	After taste	Overall acceptance
F 1	6.36±0.749[a]	5.46±1.297[a]	6.76±5.651[a]	3.80±1.927[b]	4.60±1.49[b]	5.90±1.19[a]	4.32±1.54[b]
F 2	6.40±0.782[a]	5.64±1.167[a]	6.18±0.825[a]	4.98±1.332[a]	4.34±1.47[b]	4.86±1.78[b]	5.70±1.50[b]
F 3	6.30±0.863[a]	5.84±1.241[a]	6.14±1.088[a]	4.62±1.602[b]	4.40±1.75[b]	5.06±1.40[a]	5.16±1.34[a]

Different letters in the same column indicate statistically significant difference ($p < 0.05$), according to ANOVA (one-way)

Table 3.3 depicted the result of hedonic test of sweet flavor of agarwood powder. For hedonic test, high mean score means high acceptable among panelists. Based on Table 3.3, in hedonic test, for the overall acceptance, it was found that F2 was highest compared to F3 and F1 which are5.70±1.50, 5.16±1.34 and 4.32±1.54. In terms of sweet characteristic, F2 has the highest acceptable with 4.98±1.332. Meanwhile, F1 has lowest sweetness with 3.80±1.927. To sum up the findings, most of panelists love F2 as it had right formulation which is high in sweet taste. From Table 3.3, it found that for the overall acceptance, there are significance difference ($p < 0.05$) between sweetness, after taste and overall acceptance. Meanwhile, there were not significant difference ($p > 0.05$) between appearance, aroma, color and bitterness. In terms of aroma, F3 has the highest score while F1 has the lowest score which means F3 got the highest acceptance among the panelist. However, the aroma scores between F3, F2 and F1 were not significantly different ($p > 0.05$).

Table 3.4 *List of detected aroma and flavor among panelists*

Attributes	
Aroma	**Flavor**
Astringent	Ashy
Distinct leafy	Bitter
Herb	Bittersweet
Leafy	Blunt
Pleasant	Cinnamon
Woody	Earthy
	Leafy
	Matcha
	Seaweed
	Smoky
	Sweet

As shown in Table 3.4 above, panelists can detect several aroma and flavour during descriptive test (QDA) after trained panelists discussion based on the agreement of few references given [12]. This attribute showed the sweet flavour of agarwood leaf extract powder sensory profiling.

4. Conclusion

The study successfully developed a sweet flavor formulation of agarwood leaf extract powder, Formulation 2, which is the most acceptable due to its smooth appearance, bittersweet aroma, light color, sweetness, low bitter taste, and low after taste. The study also used sensory evaluation to gain consumer acceptance and sweet flavor

signature profiling. The use of smoke house and bowl chopper during grinding resulted in a fine powder texture and faster spray drying process.

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Conflict of Interest

No conflict of interests regarding the publication of the paper.

Author Contribution.

The author confirms sole responsibility for the following: ***Study conception and design:*** *Umi Umairah Binti Nazim, Balkis A Talip;*, ***Data collection:*** *Umi Umairah Binti Nazim;*, ***Analysis and interpretation of results:*** *Umi Umairah Binti Nazim;* ***Manuscript preparation:*** *Umi Umairah Binti Nazim, Balkis A Talip.*

References

[1] Yabi, S., & Othman, F. B. (2022a). The references of al-Hafiz Ibn Hajar in the Sciences of Hadith in "Fath Al-Bari. Journal of Hadith Studies, 7(2), 1–17.

[2] Abbas, P., Hashim, Y. Z. H., & Mohd-Salleh, H. (2018). Uninfected agarwood branch extract possess cytotoxic and inhibitory effects on mcf-7 breast cancer cells. Journal of Research in Pharmacy, 23(1), 120-129.

[3] Halim, A. P., Wijayanti, N., Hidayati, L., & Nuringtyas, T. R. (2022). Antioxidant activity evaluation of agarwood Aquilaria malaccensis Lamk. leaves extract using DPPH, FRAP and ABTS assays. Advances in Biological Sciences Research.

[4] Drioli, E., Correa-Delgado, M., Córdova-Almeida, R., Lara-Nava, D., Chávez-Muñoz,M., Velásquez-Chávez, V. F., Hernández-Torres, C. E., Gontarek-Castro, E., & Ahmad, M. S. (2022). Natural sweeteners: Sources, extraction and current uses in foods and food industries. Food Chemistry, 370, 130991.

[5] Tavagnacco, L., Engström, O., Schnupf, U., Saboungi, M., Himmel, M. E., Widmalm, G., Cesáro, A., & Brady, J. W. (2012). Caffeine and sugars interact in aqueous solutions: a simulation and NMR study. The Journal of Physical Chemistry B, 116(38), 11701–11711.

[6] Wisutthathum, S., Kamkaew, N., Inchan, A., Chatturong, U., Paracha, T. U., Ingkaninan, K., Wongwad, E., & Chootip, K. (2019b). Extract of Aquilaria crassna leaves and mangiferin are vasodilators while showing no cytotoxicity. Journal of Traditional and Complementary Medicine, 9(4), 237–242.

[7] Papoutsis, K., Golding, J. B., Vuong, Q., Pristijono, P., Stathopoulos, C. E., Scarlett, Pérez- C. J., & Bowyer, M. (2018). Encapsulation of citrus by-product extracts by spray-drying and freeze-drying using combinations of maltodextrin with soybean protein and carrageenan. Foods, 7(7), 115.

[8] Rajabi, H., Ghorbani, M., Jafari, S. M., Mahoonak, A. S., & Rajabzadeh, G. (2015). Retention of saffron bioactive components by spray drying encapsulation using maltodextrin, gum arabic and gelatin as wall materials. Food hydrocolloids, 51, 327-337.

[9] Fitriana, M., Halwany, W., Kartika, Y., Anwar, K., Siswadi, S., Rizki, M. I., Rahmanto, B. T., & Andriani, S. (2022). Formulation and physical stability of syrup containing gaharu (Aquilaria microcarpa Baill.) leaves extract.Jurnal Riset Industri Hasil Hutan, 14(1), 33.

[10] Dipti, T., & Latika, Y. (2021). Formulation and quality evaluation of turnip green (Brassica rapa) powder incorporated food products. Pharma Innovation, 10(4), 653–657.

[11] Lieu, M., Nam, D. N. C., Phuong, T. T., & Thuy, D. T. (2021). Effect of stevia rebaudiana on the bioactive compounds from agarwood leaf (Aquilaria spp.) by lactic fermentation and spray drying. Microbiology and Biotechnology Letters, 49(2), 201–209.

[12] Marques, C., Correia, E., Dinis, L., & Vilela, A. (2022). An overview of sensory characterization techniques: from classical descriptive analysis to the emergence of novel profiling methods. Foods, 11(3), 255.