Effect Roasting of Indonesian Sesame Seed (*Sesamum indicum L.*) on Odour Profil and Degree of Liking of The Oil

Pudji Hastuti, Wahdan, Supriyanto, and Supriyadi
Department of Food and Agricultural Product Technology, Gadjah Mada University,
Jl. Flora Bulaksumur, Yogyakarta, Indonesia
Corresponding author e-mail address: hastutipudji@yahoo.com

Abstract

Roasting of sesame seed is regarded as important treatment for developing the odour of sesame oil, however, the effect of the roasting condition on the odour in term of sensory profile has not reported yet. The aim of this study was to evaluate the effect of roasting condition on the odour profil of sesame oil. Roasting of sesame seed was carried out at three level of roasting temperature (180, 200 and 220^{0}C) and three level of roasting time (10, 20, and 30 minutes), followed by pressing using hydraulic press at 140 kN for 5 minutes for obtaining the oil. The produced oil were evaluated for the odour profil by Descriptive Sensory Evaluation method using 8 trained panels, whereas degree of liking was determined by Hedonic Scale Scoring method using 30 untrained panels. The trained panels revealed that they perceived 13 odour stimulus in the sesame oil, namely: roasty, roasty coffee-like, roasty popcorn-like, roasty potato-like, earthy potato-like, caramel-like, mushroom-like, clove-like, burnt rubbery, burn sweet, meaty, spicy, sulforous onion-like. However their intensities were varies with the roasting condition. The odour profil was presented as spiderweb figure. The degree of liking was varies with the roasting condition and the panels. Beside the odour, it was revealed that appearence also affect the degree of liking.

Keywords: *roasting, odour profil, sesame oil, descriptive sensory evaluation*

INTRODUCTION

Sesame is reported as the most ancient oilseed known and used by human as a food source. It has been cultivated for centuries in Asia and Africa, for its high content of excellect quality of oil and protein It is used as source of oil and also widely used in bakery products and confectionary goods. Sesame oil is known highly stable against oxidative change compared to other vegetable oil although it contains olec and linoleic acid. This remarkable stability due to it contain significantly high amount of natural antioxidant, including tocopherols, sesamin, sesaminol, sesamol and sesamolin (Fukuda, *et al.,* 1986). The conventional process for producing sesame oil involves cleaning, optional dehulling, roasting, grinding and pressing/oil extraction (Fukuda and Namiki, 1988). Roasting process is the important step of in producing sesame oil, because the color, composition, flavor and stability of produced oil are influenced by the roasting condition (Yoshida *et al.,* 1995; Yoshida and Takagi, 1997). Takei *et al.* (1988) in Schieberle (1995) reported that acetylpyrazin provide strong popcorn-like aroma, and has important role in favor of sesame oil. Schieberle (1995) reported that heated white Mexican sesame seed revealed 18 aroma compounds having very high Flavour Dilution Factor, and on the basis of Odour Active Value, there were roasty, coffee-like, rubbery and caramel like which have inportant contributor to overall roasty and sulphury odour in crushed sesame seed. Tamura *et al.,* (2010) identify 29 odourant compounds and reported 9 thiols contributed to sulphurous, meaty, catty and black currant-like odor in addition of coffee-like, caramel-like, and clove like smelling. Although many people claimed the used of sesame oil due to this oil has a good flavor, and reseacher reported that roasting condition influenced the oil flavor, the odor profil

of sesame oil has not been published yet. Tashiro and co-workers reported that different strain and cultication area resulted in diferent oil content and minor components in the oil. Moreover, since no reported article on the odor/flavor profile of Indonesian sesame oil, therefore this paper reports our initial work on characterization of Indonesian sesame oil flavor.

MATERIALS AND METHODS

Materials

Sesame seeds (*Sesamum indicum* L.) were purchased from local farmer in Klaten, Central Java.

Roasting and oil extraction

Whole and cleaned sesame seed (500 g) were roasted in modified cofee roasting machine at 180^0C, 200^0C or 220^0C for 10, 20 or 30 minutes, separately. After roasting, the seed were allowed to cool until 80^0C prior to be pressed using hydraulic press at 140 kN for 5 minutes. The oils were allowed overnight at room to precipitate the impurities and the clear oil were decanted, stored at cool room until there were analyzed. The work was carried out as shown in Figure 1.

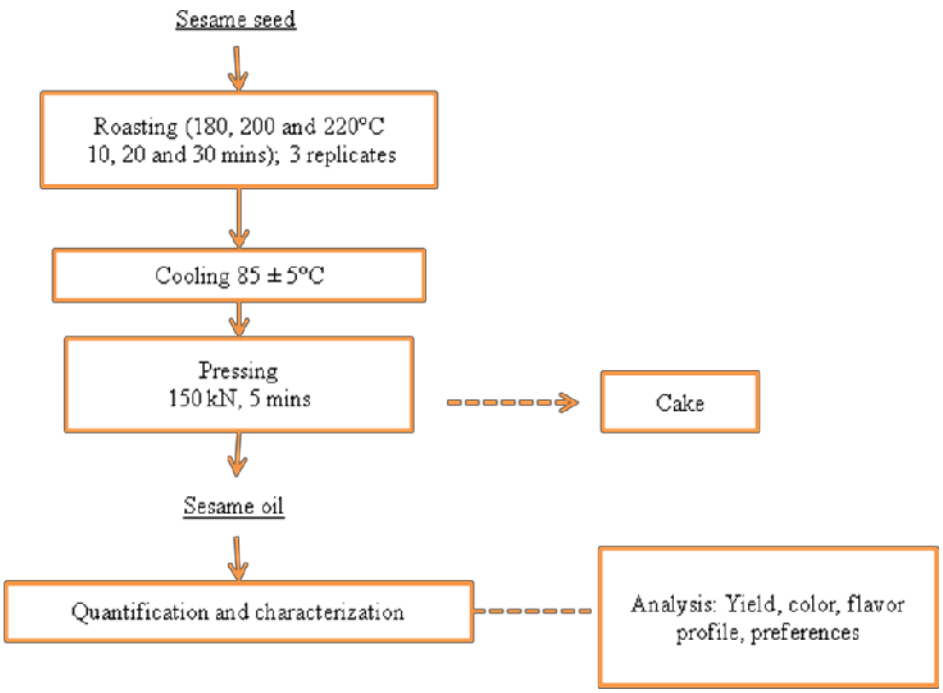

Figure 1. Research flowchart

Oil Color measurement

The measurement of oil's color was carried out based on AOCS, 1990; metode Cc 13f-92 using Lovibond Tintometer apparatus with 10 mm lovibond with cuvetes.

Sensory evaluation

Odor profile of sesame oils were determined by Quantitative Descriptive Analysis (Meilgaard, et al., (1999).

Panelis selection and training for Descriptive Analysis

Panelists were recruited on the basis of their experience on sensory evaluation, interest, time avaiability, and consumption of sesame oil. All panelists are staff and studendt in Faculty of Agricultural Technology.

Training of the panelists

During the 1st day training, the panelists were asked to describe the perceived odor of the sesame oil obtained from market (commercial sesame oil). Then, the sample standards were introduced to the panelists, and the panelists were asked to re-evaluate whether the sesame oils had these kind of odor, without rating the intensity, followed by discussion, to decide whether this oil sample has these descriptors. The standard reference intensity used for all attributes as shown in Table 1, from which the rating of the attribute intensity will be based on.

Table 1. Standard reference intensity rating used in the Quantitative Descriptive Analysis of sesame oil

Samples	Odor attributes	Intensities
Roasted sesame seed	Roasty	15
Coffee powder	Roasty, coffee-like	15
Caramel	Caramel-like	15
	Burnt, sweet	15
Popcorn	Roasty, popcorn-like	15
Washed baked potato	Roasty, potato-like	15
Unwashed baked potato	Earthy, potato-like	15
Rubber	Burnt, rubbery	15
Mixed spices	Spicy	15
Mushroom	Mushroom-like	15
Roasted meat	Meaty	15
Onion	Sulfurous, onion-like	15
Clove	Clove-like	15

On the 2nd day training, the reference samples were presented to the panelists. The panelists reviewed the reference samples and recognizing the intensity of each atributes. The panelists were then asked evaluate the odor attributes of warme up commercial sesame oil including the intensity, followed by discussion to decide which odor atributes and its intensity the sample has, until the consensus atribute and rating were assigned.

On the 3rd day training the panelists were asked to do the similar training as they have done in the 2nd day training in order to familiarized the evaluation techniques.

Sample preparation and evaluation

Nine samples sesame oil obtained from different roasting conditions were presented to the panelists in the closed bottle with three digit random number as the sample code on a tray, at room temperature, and followed monadic order. Panelists were asked to evaluate the odor of the oil in individual booth, and expressed their respons on the paper ballot

Preference test

Preference test based on aroma and color of the oil were conducted following the method as recomended by Meilgaard, *et al*., (1999), in order to measure the degree of liking to the sesame oil. This test was carried out using 30 untrained panelists.

RESULTS and DISCUSSION

Oil yield

The oil yielded from pressing of different roasting condition of the sesame seed in the range of 40.2 up to 43.3% , while from unroasted seed found to be lower than this values, Table 2.

Table 2. Oil yield (% db) obtained from different roasting conditions.

	Roasting time, minutes		
Roasting temperature, ^{0}C	10	20	30
180	42.9 ± 0.13	42.2 ± 0.14	41.1 ± 0.17
200	43.3 ± 0.14	42.5 ± 0.11	41.1 ± 0.14
220	42.6 ± 0.17	41.0 ± 0.14	40.2 ± 0.15
unroasted	39.7 ± 0.11		

All values are mean of three replicates ± standard deviation.

Roasting found to increase oil yield, it facilitate oil expression, however, if roasting is carried for prolong time may slightly decrease the oil yield.

The color of oil

The color of oil obtained from roasted sesame seed under different roasing conditions compared to unroasted seed and a sample of commercial sesame seed is shown in Table 3.

Table 3. The color of sesame oil obtained from different roasting conditions, expressed as Red and Yellow values in Lovibond Tintometer

Roasting condition (^{0}C/min)	**Red**	**Yellow**
180/10	0.80	1.45
180/20	0.95	2.00
180/30	2.35	4.60
200/10	0.90	2.45
200/20	2.40	6.35
200/30	4.35	8.80
220/10	1.55	4.00
220/20	6.60	8.50
220/30	9.20	24.10
Unroasted	0.70	1.60
Commercial sesame oil	4.90	10.00

It was found that oil of unroasted seed less red and yellow intensity, or lighter color than that from roasted seed. The longer and the roasting time and the higher the roasting temperature resulted in the darker color (brown) of the oil, as express in the higher values of redness and yellowness in lovibond tintometer scale. The increase of the color of the oil seemed to be due to the results of non-enzymatic browning reaction at elevated roasting temperature. The formation of brown substances in some thermally processed food due to non-enzymatic browning reaction Maillard-type, the reaction of reducing sugars and free amino acids or amides. As the reaction time prolong, the reaction products more accumulated, and the appearance of the oil getting darker. This results is agree with previous work (Lee *et al*., 2002) who worked on roasted safflower seed and Yoshida and Takagi (1997).

The odor profil

The odor profil obtaine by Quantitative Descriptive Analysis (QDA) using 8 trained panelists is shown in Figure 2. The panelists detected 13 odor attributes, including roasty, roasty

coffee-like, caramel-like, roasty popcorn-like, roasty potato-like, burnt, rubbery, musroom-like, burn, sweet, meaty, sulphurous onion-like, clove like, and earthy potato-like. Previous work reported by Schieberle (1995) had explained that roasting may generate more than 220 volatile compounds. These compounds of cause affect to the flavor of roasted sesame oil, especially the odor of the oil. The result of this work revealed that roasty notes were the dominant odor descriptor. The longer the roasting time and the higher the roasting temperature resulted in strongger or higher intensity of roasty notes.

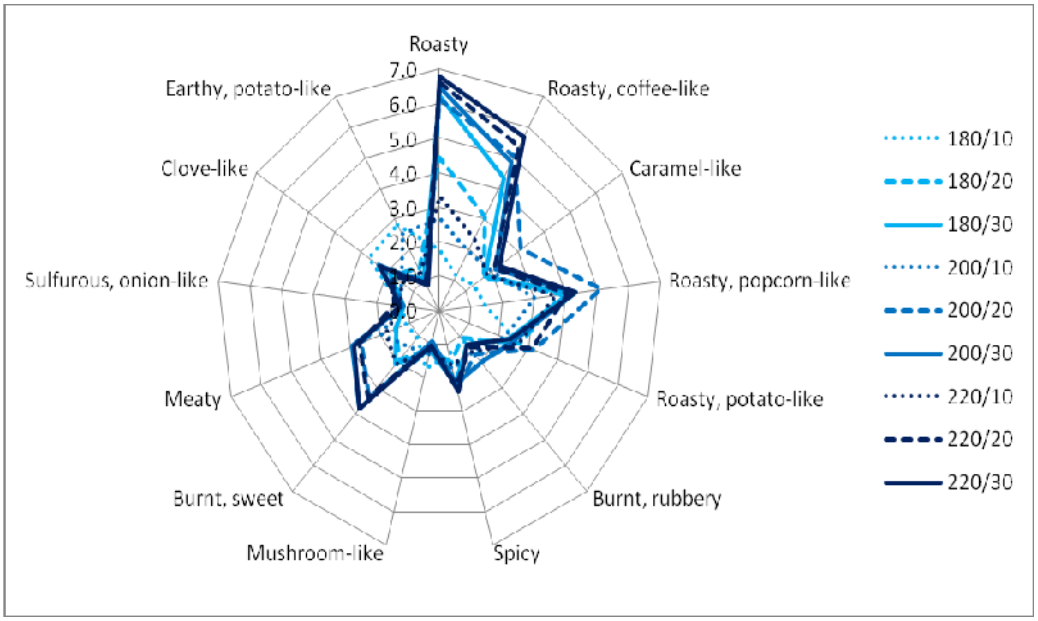

Figure 2. Odor profile of 9 sesame oils obtained from different roasting conditions (at 180, 200, and 220^{0}C for 10, 20 and 30 minutes). Intensity scale: 1 indicates very low intensity and 15 indicates equal to reference sample intensity.

Aroma and color preferences

The result of preference test on oil on the basis of oil's color and aroma using 30 untrained panel and degree of liking scale from 1(extremely dislike) until 7 (extremely like), is presented in Table 4.

Table 4. Degree of liking to the oil obtained from different roasting conditions. Value of 1 represent dislike extremely, 7 represent like extremely.

Roasting condition (^{0}C/min)	Aroma	Color
180/10	5.2	5.7
180/20	5.0	5.2
180/30	4.3	4.4
200/10	5.5	5.6
200/20	4.5	4.0
200/30	3.2	3.3
220/10	5.2	5.2
220/20	2.4	2.7
220/30	2.3	2.5
Unroasted	4.4	5.5
Commercial sesame oil	2.4	2.1

It was found that the degree of liking in the range of 2.3 until 5.7 out of 7 level of the degree og liking. It is surprising that the degree of liking to the unroasted sesame oil is high, around 5 out of 7. The oil prepared by roasting at 200^0C for 10 minutes has the highest value of the degree of liking. Roasting the sesame seed for 10 minutes prior to be pressed, found gave good oil in term of degree of liking. The longer the roasting time tend to decrease the degree of liking to the oil. Since degree of liking is varies with the consumer, it is suggested that before chosing the roasting condition, the consumer aspect should be taken into account.

CONCLUSION

Roasting of sesame seed prior to oil pressing in an important step for preparation. Roasting facilitate the oil pressing and allowing the reaction to take place within the seed, and this may resulted in enhanching the aroma of the oil. However, roasting condition should be choosen in order to meet the need of the potential consumer.

REFERENCES

Fukuda, Y., Nagata, M., Osawa, M., & Namiki, M. (1986). Chemical aspects of the antioxidative activity of roasted sesame seed oil, and the effect of using the oil for frying. *Agricultural and Biological Chemistry*, 50, 857–862.

Fukuda, Y. dan M. Namiki. 1988. Recent studies on sesame seed and oil. *Nippon Shokuhin Kogyo Gakkaishi, 35:* 552-562.

Meilgaard, M., G.V. Civille dan B.T. Carr. 1999. *Sensory Evaluation Techniques*. 3rd ed. CRC Press LLC., Florida.

Schieberle, P. 1991. Primary odorants in popcorn. *J. Agric.Food Chem., 39*: 1141-1144.

Schieberle, P. 1996. Odour-active Compounds in Moderately Roasted Sesame. *FoodChemistry*, 55(2): 145-152.

Tamura, H., A. Fujita, M. Steinhaus, E. Takahisa, H. Watanabe dan P. Schieberle. 2010. Identification of Novel Aroma-Active Thiols in Pan-Roasted White Sesame Seeds. *J. Agric. Food. Chem*, 58: 7368-7375.

Yoshida, H. dan S. Takagi. 1997. Effect of Seed Roasting Temperature and Time on the Quality Characteristics of Sesame (*Sesamum indicum*) Oil. *J Sci. Food Agric., 75*: 19-26.

Yoshida, H., J. Shigezaki, S. Takagi dan G. Kajimoto. 1995. Variation in the Composition of Various Acyl Lipid, Tocopherols, and Lignans in Sesame Seed Oil Roasted in a Microwave Oven. *Journal of Science and Food Agricultural*, 68: 407-415.