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Profil Sensori, Kadar Air, Kadar Lemak dan Aktivitas Antioksidan Saus Pecel dengan Penambahan Bawang Putih Hitam

[*Sensory Profile, Water Content, Fat Content and Antioxidant Activity of Pecel Sauce with Black Garlic Addition*]

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ABSTRACT
Pecel sauce is made using peanuts and has a spicy and sweet taste. The ingredients for making pecel sauce can be innovated by adding black garlics. Black garlic is garlic that can be processed at a temperature of 60^0-80^0C for several days and has a higher antioxidant potential than garlic. Antioxidant activity is a compound that can inhibit free radical reactions. Apart from having antioxidant potential, black garlic has distinctive flavor compounds. The aim of this research is to determine the use of black garlic in pecel sauce on the sensory acceptability of pecel sauce, its chemical characteristics and antioxidant potential.In this research, black garlic was added to other ingredients and ground together. This research on pecel sauce with the addition of black garlic used a Completely Randomized Design with a formulation of adding black garlic to the pecel sauce at 4%, 8%, 12% and 18%. The results of the research showed the sensory acceptance of pecel chili sauce with the addition of black garlic. Sensory pecel chili sauce with the addition of black garlic based on the parameters of aroma, taste, texture, overall the panelists liked making pecel chili sauce with the addition of black garlic by 4%. The results of the analysis of the chemical content of pecel chili sauce with the addition of 4% black garlic had a water content of 12.52%, a fat content of 17.97% and an antioxidant activity value of 31.8%.
Key word: antioxidant, black garlic, pecel sauce, sensory

ABSTRAK
Sambal pecel dibuat dengan menggunakan kacang tanah dan memiliki rasa yang pedas dan manis. Bahan untuk membuat sambal pecel dapat diinovasi dengan menambahkan bawang putih hitam. Bawang putih hitam merupakan bawang putih yang dapat diolah pada suhu 60-80^{o}C selama beberapa hari dan memiliki potensi antioksidan yang lebih tinggi daripada bawang putih. Aktivitas antioksidan merupakan senyawa yang dapat menghambat reaksi radikal bebas. Selain memiliki potensi antioksidan, bawang putih hitam memiliki senyawa flavor yang khas. Tujuan dari penelitian ini adalah untuk mengetahui penggunaan bawang putih hitam pada sambal pecel terhadap daya terima sensoris sambal pecel, karakteristik kimianya dan potensi antioksidannya. Pada penelitian ini, bawang putih hitam ditambahkan pada bahan lain dan digiling menjadi satu. Penelitian sambal pecel dengan penambahan bawang putih hitam ini menggunakan Rancangan Acak Lengkap dengan formulasi penambahan bawang putih hitam pada sambal pecel sebesar 4%, 8%, 12% dan 18%. Hasil penelitian menunjukkan daya terima sensoris sambal pecel dengan penambahan bawang putih hitam. Sensori sambal pecel dengan penambahan bawang putih hitam berdasarkan parameter aroma, rasa, tekstur, secara keseluruhan panelis menyukai pembuatan sambal pecel dengan penambahan bawang putih hitam sebesar 4%. Hasil analisis kandungan kimia sambal pecel dengan penambahan bawang putih hitam 4% memiliki kadar air sebesar 12,52%, kadar lemak sebesar 17,97% dan nilai aktivitas antioksidan sebesar 31,8%.
Kata kunci: antioksidan, bawang putih hitam, sambal pecel, sensori

Introduction

One of the food products that can be found in Indonesia is pecel. Pecel is a food consisting of various types of vegetables served with peanut sauce called pecel sauce. Pecel sauce is made using peanuts as the basic ingredient which has a high fat content. In 100 g of pecel sauce there are 46.85 g of fat and contains 581 kcal of calories (Ramadhan, 2015). Pecel sauce has a combination of spicy and sweet flavors, and this peanut sauce has a semi-solid nature before being diluted with water, so many people like it (Sihsobhon et al., 2013). The advantages of pecel sauce are that it is effective in its use, cheap, and easy to obtain. The ingredients in making pecel sauce can be reviewed from a nutritional aspect, namely having an essential amino acid content with the type of tryptophan which can stimulate serotonin to control good mood (Sari & Sari, 2022). Pecel sauce contains folic acid, protein, fat, carbohydrates, is also widely available on the market and is popular with people throughout Indonesia (Yanuar, 2019).

Pecel sauce is a fatty food product and cold storage, or at room temperature, can last for several days or even up to a month so that the quality of pecel sauce is safe and good. Storage time affects the quality of pecel sauce due to free fatty acids (Azizah et al., 2019). Antioxidant activity is a compound that can inhibit free radical reactions, according to Pulungan et al. (2022) black garlic kating type has an antioxidant activity of 89.67 ppm and black pumpkin garlic is 79.35 ppm. Other benefits of black garlic include the potential to prevent cancer, prevent heart health, brain health, increase immunity, control blood sugar (Dewi, 2018). Black garlic is garlic processed at a temperature of 600-80°C for 30-40 days (Zhafira, 2017).

Black garlic is a product produced from the fermentation of garlic under special conditions, namely a temperature of around 65-80 ^{o}C and a humidity of 70-80% of room temperature. Black garlic has a distinctive black-brown color, a pungent aroma and taste different from garlic. In addition, black garlic also contains higher levels of antioxidants and anti-inflammatories compared to garlic, and has a fairly high antibacterial level (Waskito, 2019). The use of black garlic in addition to the health sector can also be applied in the field of food processing, this is because black garlic has compounds that can provide a distinctive flavor. Several studies provide information related to the application of black garlic in food processing. The addition of 12.5% black garlic in making chocolate can affect the value of antioxidant activity. The antioxidant activity value in chocolate candy with the addition of black garlic is 64.59 ppm (Muzdhalifah, 2019).

Research on the development of sauce products with the addition of black garlic as a flavor enhancer and antioxidant provides information on the best treatment is 15:85% or 15 black garlic:85 pasta sauce (Herlina et al., 2022). Based on information from several studies, one way to improve the quality of pecel sauce is to use black garlic as one of the ingredients. The production of pecel sauce using black garlic as one of the ingredients is because of its advantages in terms of the contribution of taste, aroma and antioxidants. However, information on the production of pecel sauce using black garlic is still limited. Therefore, it is necessary to explore information about the production process of pecel sauce using black garlic, sensory acceptance, antioxidant activity. The results of the information obtained are expected to encourage the development and improvement of the quality of pecel sauce products.

Materials and methods

Materials and tools

The tools used in this study were mortar, pestle, frying pan, filter paper, thermogravimetric oven, porcelain cup, test tube, bluetip, desiccator, micropipette, reaction spatula, analytical balance, 250 ml Erlenmeyer flask, and soxhlet flask and measuring flask, condenser, clamp, beaker, analytical balance, measuring pipette and dropper pipette, aluminum foil, and furnace spectrophotometer. The materials used in this study were methanol, petroleum ether, acetic acid, water, distilled water, 2,2- diphenyl-1-picrylhydrazyl (DPPH), peanuts, garlic, kaffir lime leaves, red chili, salt, brown sugar and granulated sugar, tamarind, black garlic, kencur.

Research methods

Pecel sauce with the addition of black garlic is then analyzed using the soxhlet method for fat content (AOAC, 2005), thermogravimetric method for water content (AOAC, 2005), DPPH method for antioxidant activity (Akter *et al*., 2023), and scoring method for sensory acceptance (Basri, 2015). Carried out using Analysis of Variance (ANOVA) and if the results obtained are significant, it is continued with the Duncan Multiple Range Test (DMRT) using IBM SPSS 26 software at a confidence level of 95% ($\alpha = 0.05$).

Implementation of research

Making black garlic

The process of making black garlicbegins by weighing 1000 g of garlic. Black garlic is produced from garlic, a type of cincau garlic**.** Then put the garlic into the electric rice cooker. The specifications of the rice cooker used in this reseacrch are a machine that has two conditions, namely warm and cook. Next, the rice cooker is set to keep warm mode (the temperature condition are 70-80^{o}C humidity RH 44-48%). The next stage is to leave it for 12 days. After 12 days, the black garlic is ready to be harvested (Rochmah *et al.*,2024).

Making pacel sauce

The making of pecel sauce begins with roasting peanuts at a temperature of ± 150°C in frying pan, then roasting spices such as garlic, curly red chilies and cayenne pepper, after roasting, drain, then pound for 5 minutes the roasted spices together with spices such as brown sugar, galangal, salt, lime leaves, tamarind, and black garlic. The roasted ingredients are then roughly ground into pecel sauce. The variations in the treatment of adding black garlic include 0% (control, garlic), 4%, 8%, 12%, 16% w/w.

RESULTS AND DISCUSSION

Sensory Analysis

Sensory analysis is one of the tests used to determine the level of consumer acceptance of a product. Consumers or panelists are given a form containing the panelist's name, test date, panelist's age, and panelist's signature. The parameters of the pecel chili sauce product include five aspects, namely color, aroma, taste and overall. Sensory testing is carried out using the panelist's preference method for color, aroma, taste and overall. Hedonic testing on this pecel chili sauce uses 30 panelists, with a sensory assessment of 1 = dislike, 2 = somewhat dislike, 3 = neutral, 4 = somewhat like, 5 =

like. Then a sensory test is carried out after which statistical data analysis is carried out using the anova test and the Duncan test is carried out. The results of the sensory ui can be seen in Table 1.

Table 1 Results of sensory analysis of pecel sauce with the addition of black garlic

Sample	Parameter		
	Aroma	**Taste**	**Texture**
Control	$3.27^{a} \pm 0,21$	$3.20^{a} \pm 0,30$	$2.90^{a} \pm 0,30$
4%	$3.40^{ab} \pm 0,32$	$3.67^{a} \pm 0,24$	$3.63^{b} \pm 0,28$
8%	$3.83^{bc} \pm 0,40$	$3.57^{a} \pm 0,33$	$3.23^{ab} \pm 0,30$
12%	$3.87^{bc} \pm 0,25$	$3.57^{a} \pm 0,31$	$3.37^{ab} \pm 0,28$
16%	$4.27^{c} \pm 0,39$	$3.27^{a} \pm 0,26$	$3.07^{ab} \pm 0,26$

Aroma

Aroma is one of the product parameters in testing sensory properties (organoleptic) using the sense of smell (Lamusu, 2018). Based on Table 1, it can be seen that the results of the sensory assessment of the aroma parameters of the pecel sauce sample with the addition of black garlic on the sensory acceptance of the parameters showed that they were significantly different. The assessment of the addition of black garlic on the aroma parameters produced from the pecel sauce showed that the most preferred addition to the aroma parameters was the treatment of 8%, 12% and 16% w/w and the treatment did not differ significantly in the texture preference parameters. This shows that the more black garlic is added, the higher the level of preference for the aroma parameters of the pecel sauce. Pecel sauce with the addition of black garlic on antioxidant activity and sensory acceptance has a distinctive aroma of pecel sauce. Additional ingredients for making pecel sauce are black garlic, the aroma of pecel sauce comes from the addition of black garlic. The more black garlic is added, the stronger and more pronounced it will be. Active aroma compounds in black garlic include acetate which gives a sour aroma, furaneol compounds give a caramel aroma, also 3 vinyl-1-2-dithiacyclohex gives a spicy aroma and taste, and butinolactone gives a caramel aroma, propionaldehyde gives a cooked aroma (Yang et al., 2019).

Taste

Taste is one of the determining factors of panelists' preference for food products, besides that taste is also an organoleptic property that can represent product quality (Anggraeni et al., 2016). Based on Table 1, it can be seen that the results of the taste parameter assessment on the pecel sauce sample with the addition of black garlic showed no significant difference. This shows that the addition of black garlic has the same level of preference as the pecel sauce without the addition of black garlic (control treatment). However, from the average value of the most preferred taste parameters, the treatment of adding 4% w/w black garlic. Panelists tend to prefer it with a little addition of black garlic. This is possible because black garlic has a distinctive taste and panelists tend to like it with a little addition of black garlic. Black garlic has a taste, namely trimethylamine gives an ammoniacal, fruity, spicy taste, and propane compounds give a spicy taste, also 2-methyl-propanal gives a fresh, fruity, spicy taste, and methyl acetate gives a sweet taste (Najman et al., 2022). On the other hand, the taste of pecel sauce with the addition of black garlic is dominated by a spicy taste. So that the distinctive taste of black garlic is dominated by the sensation of spicy taste from chili and a little spicy taste from black garlic.

Texture

Texture is one of the factors in determining a food product that is seen from the physical properties including size, shape, quantity and elements of the formation of materials that can be felt by the sense of touch and taste. Based on Table 1, it can be seen that the results of the assessment of preferences for texture parameters in pecel sauce samples with the addition of black garlic show that they are significantly different. This provides information that the addition of black garlic increases the parameters of preference for pecel sauce. The addition of black garlic that has the most preference for texture parameters is the addition of 4% black garlic w/w. The more black garlic added to pecel sauce slightly increases the preference for texture parameters. Pecel sauce with the addition of more black garlic has a slightly softer texture, so it has the potential to reduce preferences for texture parameters. Based on Table 1 on sensory characteristics, it can be seen that the addition of black garlic increases preferences, especially for texture and taste parameters, this is known from the significantly different significance values. However, the taste parameters show that the addition of black garlic to the pecel sauce has the same preference as the pecel sauce without the addition of black garlic (control). Overall, the formulation that tends to be most preferred by panelists is the pecel sauce with the addition of 4% w/w of black garlic.

Chemical Analysis

A chemical analysis was carried out in the form of water content, fat content and antioxidant activity value in pecel sauce based on the sensory characteristics of pecel sauce with the addition of black garlic. Chemical analysis was carried out on pecel sauce with black garlic as much as 4% w/w because the addition of black garlic that has the most preference for texture parameters is the addition of 4% black garlic w/w and from the average value of the most preferred taste parameters, the treatment of adding 4% w/w black garlic. The results of the chemical analysis of pecel sauce with the addition of black garlic can be seen in Table 2.

Table 2. Chemical Analysis Results of Pecel Sauce with the Addition of Black Garlic

Sample	Analisys	Methods	Result
Addition of black garlic 4% w/w	Water Content	Thermogravimetri	12,52% ± 0,80
	Fat Content	Soxhlet	17,97% ± 1,31
	Antioksidant Activity	DPPH	31,8% ± 2,93

Water Content

The water content test of pecel sauce with the addition of black garlic used the thermogravimetric method. The results of the water content test of pecel sauce with the addition of black garlic using the thermogravimetric method were 12.52%. The water content of pecel sauce with the addition of black garlic 4% w/w is also not much different from other research Titania (2020) regarding the chemical and organoleptic tests of the quality of white sweet potato formulation pecel sauce which had a water content of 13.87%. Based on Table 2, it can be seen that the water content of the pecel sauce product is lower when compared to previous studies. This is supported by factors such as raw materials, roasting temperature and interactions between raw materials and roasting temperature. The roasting process at a temperature of 150°C for 15 minutes, the higher the roasting temperature and the longer the roasting time used, the lower the water content produced. This is because the higher the

temperature and the longer the time used during the roasting process, the faster the water in the ingredients will evaporate (Adi et al., 2023; Irmayanti et al., 2018).

Fat Content

The fat content of pecel sauce products with the addition of black garlic using the soxhlet method. The results of the fat content of pecel sauce with the addition of black garlic were 17.97%. Fat is one of the most important sources of energy needed, especially by humans to carry out daily activities. Fat is a molecule consisting of oxygen, hydrogen, carbon and nitrogen and phosphorus. Fat also functions as a protector of the body from low temperatures, a solvent for vitamins A, D, E, and K and as a component of gallbladder disease (Andrès et al., 2024). The principle of fat content is to separate the fat in the ingredients using a solvent in the form of petroleum ether by extraction using a soxhlet and fat flask, then weighed and stated as the weight of fat. The results of the fat content test using the soxhlet method have a significant effect on the fat content of pecel sauce. The results of the fat content test on pecel sauce products with the addition of black garlic when viewed based on Table 2 can be seen that the results of the fat content analysis using the soxhlet method are lower when compared to other pecel sauce studies. Ramadhan (2015) study on the effect of the proportion of peanuts with different fat content and brown sugar on the characteristics of low-fat pecel sauce has a fat content of 20.24%. The fat content of pecel sauce with the addition of black garlic is influenced by one of the raw materials, one of which is peanuts. The more peanuts used in the raw materials of pecel sauce, the more the fat content will be affected.

Antioxidant Activity Value

Making pecel sauce with the addition of black garlic has a potential antioxidant value. Antioxidant activity is a molecule that can inhibit the oxidation of other molecules. Testing of pecel sauce with the addition of black garlic uses the spectrophotometric method. The working principle of DPPH is the presence of hydrogen atoms from antioxidants that bind to free electrons in radical compounds so that they will cause changes from free radicals to non-radicals (Setiawan et al., 2018). Antioxidants are inhibitors of the oxidation process, even at relatively small concentrations, these antioxidants work synergistically to stabilize free radicals that play a role in the processes of photoaging, carcinogenesis and immunosuppression. Antioxidants also function to add or remove one electron to neutralize ROS (reactive oxygen species), so that free radicals become stable and inhibit the oxidation process (Andarina & Djauhari, 2017; Mulyani et al., 2023). Based on Table 2, the results of antioxidant testing on pecel sauce samples with the addition of 31.8% black garlic, while according to research Pulungan et al. (2022) the results of the antioxidant activity value of yellow lumbu black garlic were 79.35 ppm with the IC50 method. The antioxidant activity content of black garlic comes from phenolic compounds which are able to ward off free radicals. In addition, there are also other compounds such as Compounds that are able to ward off free radicals are called antioxidants. Black garlic is known to contain bioactive compounds, such as phenolics, flavonoids, pyruvate, thiosulfate, S-allycysteine (SAC), and S-allymercaptocysteine (SAMC) (Chang et al., 2024; Cita & Cahyaningrum, 2023).

CONCLUSION

The making of pecel sauce with the addition of black garlic is known that the panelists in terms of sensory acceptance prefer the addition of black garlic of 4% w/w when compared to other

formulations. Pecel sauce with the addition of black garlic of 4% w/w in each chemical test with an antioxidant activity value of 31.8%, water content of 12.52% and fat content of 17.79%. This shows that pecel sauce with the addition of black garlic has the potential to have antioxidant value.

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