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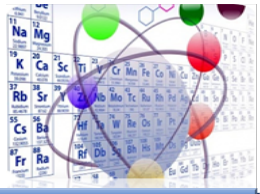

Antioxidant Activity and Organoleptic Quality of Traditional Batak Dried Arsik Seasoning

Pricilia Rotua Saruksuk, Ida Duma Riris*, Tita Juwitaningsih, Marini Damanik, Rudi Munzirwan Siregar

Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Medan 20221, Indonesia

**Corresponding author : idadumariris@unimed.co.id*

ABSTRACT

Arsik is a traditional Batak cuisine prepared using various spices that contain bioactive compounds with potential antioxidant properties. The development of dried arsik seasoning offers advantages in terms of practicality, shelf life, and product diversification while maintaining the characteristic flavor of traditional arsik. This study aimed to evaluate the antioxidant activity and organoleptic quality of dried arsik seasoning formulated with different proportions of cayenne pepper and candlenut. Three formulations (F1, F2, and F3) were extracted using the maceration method with 96% ethanol and subsequently evaluated for antioxidant activity using the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay. Organoleptic evaluation was conducted by 20 panelists using a 9-point hedonic scale based on color, aroma, taste, and texture attributes. The results showed that formulation F2 exhibited the highest extraction yield (57.1%) and antioxidant activity with a DPPH inhibition value of 70.2%, followed by F3 (68.9%) and F1 (36.3%). Organoleptic assessment indicated that F2 achieved the highest overall acceptance score (7.71), followed by F3 (7.25) and F1 (5.45). The higher antioxidant activity observed in F2 was associated with its balanced composition of spices, particularly cayenne pepper, which is known to contain antioxidant compounds such as phenolics and flavonoids. These findings suggest that formulation F2 is the most promising dried arsik seasoning formulation due to its high antioxidant activity and favorable consumer acceptance.

Keywords: dried arsik seasoning, antioxidant activity, DPPH, organoleptic evaluation, traditional Batak spices

1. INTRODUCTION

Indonesia is recognized as one of the countries with the highest biodiversity and rich culinary heritage, particularly in the utilization of spices and herbs as essential ingredients in traditional foods. Besides contributing to flavor, aroma, and color, spices are known to contain various bioactive compounds, including

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phenolics, flavonoids, alkaloids, and terpenoids, which exhibit significant antioxidant properties. These compounds have been widely reported to play an important role in scavenging free radicals and promoting human health.[1]

One of the traditional foods rich in spice utilization is Arsik, a traditional Batak dish originating from North Sumatra, Indonesia. Arsik is commonly prepared using freshwater fish cooked with a variety of spices, including andaliman (Zanthoxylum acanthopodium), turmeric, ginger, galangal, shallot, garlic, candlenut, lemongrass, red chili, cayenne pepper, and asam gelugur. Among these ingredients, andaliman is considered the key spice that provides the characteristic tingling sensation and distinctive aroma of the dish. In addition to its culinary importance, andaliman contains various bioactive compounds such as phenolics, flavonoids, alkaloids, terpenoids, and steroids that contribute to its antioxidant and antimicrobial activities.[2]

Several studies have reported that andaliman is a rich source of essential oils containing phenolic and terpenoid compounds responsible for its biological activities. Extracts of andaliman have demonstrated antioxidant and antibacterial properties against several pathogenic microorganisms. These activities are primarily associated with the presence of flavonoids, phenolic compounds, and terpenoids, which can inhibit oxidative reactions and microbial growth.[3]

Apart from andaliman, other spices commonly used in Arsik also possess considerable antioxidant potential. Cayenne pepper contains vitamin C, flavonoids, carotenoids, and phenolic compounds that contribute to free radical scavenging activity. Turmeric is rich in curcuminoids, which exhibit antioxidant and anti-inflammatory properties, whereas ginger contains gingerol and shogaol, compounds known for their antioxidant capacity. The interaction among these bioactive compounds is expected to produce synergistic effects that enhance the overall antioxidant activity of Arsik seasoning.[4]

The increasing demand for convenient food products has encouraged the development of instant and dried seasonings. Dried seasoning products offer several advantages, including easier storage, longer shelf life, and greater practicality compared to fresh seasonings. One approach to developing a stable Arsik seasoning product is through drying technology. Microwave drying has been reported as an effective drying method because it shortens drying time while maintaining the quality of bioactive compounds and sensory characteristics better than conventional drying methods.[5]

In the development of functional food products, antioxidant activity is an important parameter that must be evaluated. Antioxidant activity is commonly determined using the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay, which measures the ability of a compound to scavenge free radicals. This method is widely used due to its simplicity, rapid analysis, and sensitivity toward antioxidant compounds derived from natural sources.[6]

Besides antioxidant activity, organoleptic quality is a critical factor influencing consumer acceptance of food products. Organoleptic evaluation includes the assessment of color, aroma, taste, and texture attributes, which directly affect consumer preferences. Previous studies have shown that increased phenolic and flavonoid contents do not always correspond to higher consumer acceptance because changes in spice composition may alter sensory characteristics. Therefore, antioxidant activity and organoleptic quality should be evaluated simultaneously to obtain a formulation that provides both functional benefits and desirable sensory properties.[1]

Although numerous studies have investigated the antioxidant activity of individual spices, scientific information regarding the antioxidant potential and organoleptic quality of dried Arsik seasoning remains limited. Furthermore, studies examining the relationship between formulation variations, antioxidant activity, and consumer acceptance of dried Arsik seasoning are still scarce. This condition highlights the need for

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further research to develop dried Arsik seasoning products with high antioxidant activity and favorable sensory characteristics.

Therefore, this study aimed to evaluate the antioxidant activity and organoleptic quality of dried Arsik seasoning prepared with different formulations. Antioxidant activity was determined using the DPPH assay, while organoleptic characteristics were assessed through a hedonic test involving untrained panelists based on color, aroma, taste, and texture attributes. The findings of this study are expected to provide scientific information regarding the potential of dried Arsik seasoning as a functional food product derived from traditional Batak spices with high antioxidant activity and good consumer acceptance.

2. EXPERIMENTAL

2.1. Chemicals, Equipment and Instrumentation

The materials used in this study consisted of shallot (Allium cepa L.), garlic (Allium sativum L.), turmeric (Curcuma longa L.), ginger (Zingiber officinale Roscoe), galangal (Alpinia galanga L.), andaliman (Zanthoxylum acanthopodium DC.), candlenut (Aleurites moluccanus Willd.), lemongrass (Cymbopogon citratus), red chili (Capsicum annuum L.), cayenne pepper (Capsicum frutescens L.), and asam gelugur (Garcinia atroviridis Griff. ex T. Anders.) as the main ingredients for dried Arsik seasoning. Ethanol 96% was used as the extraction solvent. Distilled water was used during washing and sample preparation. Antioxidant analysis was performed using 2,2-diphenyl-1-picrylhydrazyl (DPPH) reagent and methanol as analytical solvent. The equipment used included an analytical balance, knife, cutting board, blender, microwave dryer, grinder, 80-mesh sieve, glass jars for maceration, filter paper, glass funnel, beaker glass, Erlenmeyer flask, measuring cylinder, drop pipettes, rotary evaporator, UV–Visible spectrophotometer, cuvettes, vortex mixer, and laboratory glassware.

2.2. Research Procedure

2.2.1. Preparation of Papaya Seeds

Fresh spices consisting of shallot, garlic, turmeric, ginger, galangal, andaliman, candlenut, lemongrass, red chili, cayenne pepper, and asam gelugur were sorted and washed thoroughly with running water to remove adhering dirt and impurities. The cleaned materials were cut into smaller pieces and blended according to the formulation design. Three formulations (F1, F2, and F3) were prepared by varying the proportion of cayenne pepper and candlenut. The blended seasoning mixture was dried using a microwave dryer until a constant weight was obtained. The dried product was then ground into powder and sieved through an 80-mesh sieve to obtain a uniform particle size. The dried Arsik seasoning powder was stored in airtight containers at room temperature until further analysis.

2.2.2. Extraction of Papaya Seed

Extraction was carried out using the maceration method with 96% ethanol as solvent. Dried Arsik seasoning powder was weighed and immersed in ethanol at a sample-to-solvent ratio of 1:5 (w/v). The maceration process was conducted for 3 × 24 h at room temperature and protected from direct sunlight, with occasional stirring to maximize extraction efficiency.After maceration, the mixture was filtered using filter paper to separate the filtrate from the residue. The filtrate obtained was concentrated using a rotary evaporator at 40–

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50°C until a viscous extract was produced. The concentrated extract was stored in a sealed container for further antioxidant analysis.

2.2.3. Determination of Extraction Yield

The extraction yield was calculated by comparing the weight of the concentrated extract with the initial weight of papaya seed powder using the following equation:

$$\text{Yield (\%)} = (\text{weight of dried /sample weight of extract}) \times 100$$

2.2.4. Antioxidant Activity Assay Using DPPH Method

Antioxidant activity was determined using the DPPH free radical scavenging method. A specific volume of sample extract was mixed with DPPH solution and incubated in a dark condition for 30 min at room temperature. The absorbance of the reaction mixture was measured using a UV–Visible spectrophotometer at a wavelength of 517 nm. The percentage of radical scavenging activity (% inhibition) was calculated using the following equation:

$$\% \text{ Inhibition} = [(A_{control} - A_{sample}) / A_{control}] \times 100$$

where Acontrol is the absorbance of the DPPH solution without extract and Asample is the absorbance of the extract–DPPH mixture.

2.2.4. Organoleptic Evaluation

Organoleptic evaluation was conducted using a hedonic test involving 20 untrained panelists. The dried Arsik seasoning formulations (F1, F2, and F3) were prepared and presented randomly to the panelists. The panelists evaluated four sensory attributes, namely color, aroma, taste, and texture, using a 9-point hedonic scale, where 1 = dislike extremely, 5 = neither like nor dislike, and 9 = like extremely. The average score for each sensory attribute was calculated to determine the level of consumer acceptance of each formulation.

2.2.4. Data Analysis

The antioxidant activity results were expressed as percentage inhibition values, while organoleptic data were presented as mean scores. The formulation with the highest antioxidant activity and the best organoleptic acceptance was identified as the optimum dried Arsik seasoning formulation.

3. RESULTS AND DISCUSSION

3.1. Extraction Yield of Dried Arsik Seasoning

Extraction yield is an important parameter that indicates the amount of soluble compounds successfully extracted from a sample using a particular solvent. In this study, extraction was performed by maceration using 96% ethanol for 3 × 24 h. The extraction yields of dried Arsik seasoning are presented in Table 1.

Table 1. Percentage yield of papaya Arsik seasoning

Formulation	Extract Weight (mg)	Sample Weight (mg)	Yield (%)
F1	228.09	523	43.6

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F2	299.07	523	57.1
F3	215.02	523	41.1

The difference in extraction yield indicates that solvent selection is a crucial factor in optimizing the extraction of bioactive compounds from natural materials As shown in Table 1, formulation F2 produced the highest extraction yield (57.1%), followed by F1 (43.6%) and F3 (41.1%). The higher yield obtained from F2 indicates the presence of a greater amount of ethanol-soluble compounds in this formulation. The variation in extraction yield may be attributed to differences in the proportions of cayenne pepper and candlenut among the formulations. The optimized composition in F2 likely enhanced the extraction of bioactive compounds. Furthermore, 96% ethanol is known to effectively extract semi-polar compounds such as phenolics, flavonoids, alkaloids, and terpenoids commonly found in spices used in Arsik seasoning.

3.2. Antioxidant Activity of Dried Arsik Seasoning

The antioxidant activity of dried Arsik seasoning extracts was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay. This method measures the ability of antioxidant compounds to neutralize DPPH free radicals, resulting in a decrease in absorbance. The absorbance values and percentage inhibition obtained are presented in Table 2.

Table 2. Antioxidant activity of dried Arsik seasoning extracts

Sample	Mean Absorbance	% Inhibition
F1	0.490	36.3
F2	0.230	70.2
F3	0.240	68.9
Ascorbic acid	0.002	99.7

The results showed that formulation F2 exhibited the highest antioxidant activity with a percentage inhibition of 70.2%, followed by F3 (68.9%) and F1 (36.3%). Ascorbic acid, used as the positive control, exhibited the highest inhibition value (99.7%). A higher percentage inhibition indicates a stronger free radical scavenging capacity. The superior antioxidant activity observed in F2 may be associated with its optimized spice composition, particularly the proportion of cayenne pepper, which contains vitamin C, flavonoids, carotenoids, and phenolic compounds known for their antioxidant properties.[7] In addition to cayenne pepper, the antioxidant activity of Arsik seasoning may also be influenced by the presence of andaliman, turmeric, ginger, shallot, garlic, and other spices. Andaliman contains phenolics, flavonoids, alkaloids, and terpenoids, while turmeric is rich in curcuminoids and ginger contains gingerol compounds. These bioactive constituents may interact synergistically, contributing to the overall antioxidant activity of the extract.[8] Interestingly, although F3 contained a higher proportion of cayenne pepper, it did not exhibit the highest antioxidant activity. This finding suggests that increasing the concentration of a single ingredient does not necessarily lead to greater antioxidant activity because interactions among bioactive compounds may affect extraction efficiency and compound stability during processing.[9]

3.2. Organoleptic Properties of Dried Arsik Seasoning

Organoleptic evaluation was conducted using a 9-point hedonic scale involving 20 untrained panelists. The sensory attributes evaluated included color, aroma, taste, and texture. The mean sensory scores are presented in Table 3.

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Table 3. Mean organoleptic scores of dried Arsik seasoning

Formulation	Color	Aroma	Taste	Texture	Overall Acceptance
F1	5.45	5.50	5.40	5.45	5.45
F2	8.10	7.60	8.55	6.60	7.71
F3	7.15	8.45	6.85	6.55	7.25

The organoleptic evaluation showed that formulation F2 achieved the highest overall acceptance score (7.71), followed by F3 (7.25) and F1 (5.45). According to the hedonic scale, F2 and F3 were generally liked by the panelists, whereas F1 was rated between neutral and slightly liked. For color, F2 received the highest score (8.10), indicating that its appearance was the most attractive to the panelists. This result may be related to the balanced proportion of chili peppers and spices, which produced the characteristic reddish-yellow color of Arsik seasoning. In terms of aroma, F3 obtained the highest score (8.45). This finding may be associated with the stronger aroma generated by the higher proportion of cayenne pepper and aromatic spices present in this formulation. The highest taste score was observed in F2 (8.55), suggesting that the balance between cayenne pepper and candlenut contributed to a more desirable flavor profile. Similarly, F2 achieved the highest texture score (6.60), indicating better overall sensory quality compared to the other formulations. Overall, F2 not only exhibited the highest antioxidant activity but also received the highest level of consumer acceptance. These findings suggest that F2 represents the optimum formulation, providing a balance between functional properties and sensory quality.

3.3. Relationship Between Antioxidant Activity and Organoleptic Acceptance

The results indicated a positive relationship between antioxidant activity and consumer acceptance. Formulation F2 exhibited both the highest antioxidant activity (70.2%) and the highest overall organoleptic score (7.71). This finding suggests that increasing the concentration of bioactive compounds does not necessarily compromise sensory quality. Conversely, F1 showed the lowest antioxidant activity and the lowest organoleptic acceptance among the formulations. This result indicates that the spice composition in F1 was less effective in producing desirable sensory characteristics and biological activity. Therefore, formulation F2 can be considered the most promising dried Arsik seasoning formulation due to its superior antioxidant activity and favorable organoleptic properties. The formulation successfully combines functional benefits with consumer acceptability, making it a potential functional food product derived from traditional Batak spices.

4. CONCLUSION

This study demonstrated that different formulations of dried Arsik seasoning influenced both antioxidant activity and organoleptic properties. The extraction yields obtained from formulations F1, F2, and F3 were 43.6%, 57.1%, and 41.1%, respectively, with F2 producing the highest yield. Antioxidant analysis using the DPPH method revealed that formulation F2 exhibited the highest radical scavenging activity with an inhibition value of 70.2%, followed by F3 (68.9%) and F1 (36.3%). Organoleptic evaluation conducted by 20 untrained panelists showed that formulation F2 achieved the highest overall acceptance score (7.71),

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followed by F3 (7.25) and F1 (5.45). Formulation F2 received the highest scores for color, taste, texture, and overall acceptance, indicating a favorable balance between functional properties and sensory quality. Based on the antioxidant activity and organoleptic evaluation, formulation F2 was identified as the optimum dried Arsik seasoning formulation. The findings suggest that dried Arsik seasoning has the potential to be developed as a functional food product derived from traditional Batak spices with both antioxidant benefits and good consumer acceptance.

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