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Research Article

EFFECT OF SOLVENT TYPE ON THE AMOUNT OF YIELD FROM MACERATION OF MORINGA PLANTS (Moringa oleifera)

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ABSTRACT

Introduction: The use of herbal plants in the field of dentistry has begun to be widely studied, but it is still not widely developed. One of the uses of herbal plants is to make them as raw materials for Moringauthwash. The Moringa plant (Moringa oleifera/Moringa) is an herbal ingredient that qualifies as an alternative antibacterial agent. The type of solvent, extraction temperature, and extraction duration are some variables that can affect the extraction yield, but the dominant type of solvent for the extraction of herbal plants, especially Moringa, is still not specific.This study aimed to determine the effect of solvent types on the amount of yield of the maceration of Moringa plants.
Method: This was a true experimental study using a factorial complete randomized design with maceration (method of extraction) on Moringa oleifera with variations in solvent types.
Results: The Kruskall-Wallis test showed that based on the solvent type treatment group, a significant value of 0.003 (<0.05) was obtained, meaning that there was an influence of the type of solvent on the amount of yield from Moringa oleifera maceration.
Conclusion: In conclusion, the type of solvent has a significant effect on the amount of yield resulting from Moringa maceration.

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INTRODUCTION

The use of herbal plants in the field of dentistry has begun to be widely studied, albeit, it is still not widely developed. One of the uses of herbal plants is to make them as raw materials for Mouthwash. This began to be done because the continuous use of synthetic Moringauthwash can cause negative consequences such as tooth discoloration, bacterial resistance, and unpleasant taste, so that, people need other alternatives to Moringauthwash with minimal side effects.[1]

Moringa plant (*Moringa oleifera*/Moringa) is an herbal ingredient that qualifies as an alternative antibacterial agent.[2] According to Garga et al,[3] Moringa can be used as herbal raw material for Moringauthwash because it has important ingredients related to antibacterial properties. In particular, Moringa contains tannins, alkaloids, saponins, and flavonoids which are polyphenolic compounds with the highest antioxidant potential that can inhibit bacterial cell membrane function and energy metabolism.[4]

Moringa leaf extract contains various active substances such as alkaloids, flavonoids, polyphenols, steroids, and glycosides.[5] Moringa leaves contain protein, beta carotene, calcium, iron, magnesium, vitamin A, vitamin C, and potassium, hence adding them to your daily diet is a good idea.[6-8] Moringa plant has stems that contain active compounds namely flavonoids and polyphenols.[9] Flavonoids and polyphenols in Moringa are active compounds that act as antibacterials. The Moringa mechanism increases the permeability of bacterial cell walls, and the antimicrobial active components in Moringa work to lyse bacteria by damaging their cell membranes.[9] Research by Zakiya et al,[10] states that its anti-inflammatory activity can play a positive role in treatment, and flavonoid chemicals found in Moringa, among others, can reduce pain when wounds are swollen and bleeding.

The compounds contained in Moringa can be withdrawn by an extraction. The effectiveness of the Moringa extraction result is determined by the amount of yield. The extraction process aims to create an equilibrium of solvent and compound concentrations in Moringa leaf cells.[11,12] The optimal solvent for the simplisia to be extracted should be used for the extraction procedure for the solvent to be maximally productive.[13] The compounds contained in Moringa have great potential as a substitute or alternative in the field of herbal medicine. Therefore, it is necessary to research Moringa extraction with the best solvent and the right method; one of the good conventional methods is the maceration method since the working technique is relatively simple.[14] Types of solvents, extraction temperature, and extraction duration are some of the variables that can affect the extraction yield.[15]

Kemit et al reported[16] that the yield of avocado leaf extract *(Persea americana Mill*) was particularly affected by the use of solvent types with different variations. Four types of solvents were used in their research. Based on the results, ethanol solvent treatment produced avocado leaf extract with the best yield. According to Noviyanty et al,[17] different types of different solvents affected the yield produced in the maceration of red dragon fruit (*Hylocereus polyrhizus*) skin. The study used four different types of solvents. According to research findings, 95% ethanol solvent provided the maximum yield value and was the optimum solvent for extracting dragon fruit skin. The type of solvent was very influential on the yield value of herbal plant extraction, but the dominant type of solvent for herbal plant extraction, especially for Moringa, was still not specific.[18]

Given the background that has been studied before, the thing stated as problem topic is the type of solvent that affects the amount of yield from maceration of Moringa plants, therefore, we are interested in determining the effect of solvent type on the amount of yield from the maceration of Moringa plants.

METHODS

This was a true experimental study using a factorial complete randomized design with a maceration extraction method on *Moringa oleifera* with variations in solvent types. Samples were Moringa leaves and stems obtained from Moringa vegetation at Lubuk Minturun, Koto Tangah, Padang, West Sumatra. Based on calculation with the Federer formula, a total of four samples were set per treatment group. There were six treatment groups, so that, 24 samples were needed.

In the manufacture of simplisia powder, Moringa leaves and stems were cleaned using running water, so that, it was free from toxic substances and dirt, and then they were aerated slowly at room temperature so that all parts were evenly dry. After drying, the Moringa samples were sorted again so that the unnecessary parts were separated. Moringa samples were ground into powder using a blender to expand the surface so that chemical compounds were easily dissolved in the solvent. Fine Moringa powder was sifted to produce granules with a macroparticle size of 10 mesh (1-2 mm), then Moringa powder was ground again using a disk mill and sifted until it got microparticle-sized granules of 100 mesh (126-149 μm).

In the Moringa extraction process by maceration method, the finished material was weighed and filled into the Erlenmeyer flask. Each particle-sized category of material was extracted with three different types of solvents, namely ethanol, double distilled water H_2O (dd H_2O), and n-Hexane. The ratio used between Moringa and the solution was 1:10 (10 g simplisia: 100 ml solvent) and then stirred. Aluminum foil was applied to cover the Erlenmeyer flask, then the extraction was performed using the maceration method at room temperature for 24 hours. During the process, stirring was done once every six hours, so that the extract obtained was mixed with the solvent. Then the extract was evaporated by solvent with a rotary evaporator resulting in a viscous extract which was further weighed and labeled, and then the yield was calculated. The resulting extract was weighed in a container, then the weight was compared to the initial weight of the powder and then was clicked 100% with the formula:

$$\text{Yield (\%)} = \frac{B1}{B2} \times 100\%$$

B1 = Weight of the final extract

B2 = Weight of initial raw material

Research data were reviewed using a descriptive analysis approach. Anova's univariate parametric analysis was used to test the hypothesis, provided normally distributed data. The non-parametric Kruskall-Wallis method was used to evaluate the research hypothesis if the data were not normally distributed and were not homogeneous.

RESULT AND DISCUSSION

The process of making Moringa yield treated with three variations of solvents used the maceration method. The maceration was carried out using a ratio of material and solvent, which is 1: 10 (10 g: 100 ml), and then yield analysis and statistical analysis were carried out.

Table 1 shows the analysis of maceration yield results. The highest Moringa yield percentage was obtained from the combination of treatment between the particle size variable of 100 mesh and the type of solvent dd H_2O with the average treatment yielding 29.70% yield. The lowest Moringa yield percentage was obtained from a combination of treatment between a particle size of 10 mesh and an n-Hexane solvent type with an average treatment yielding 0.64% yield.

Table 1. Analysis of yield results

Samples	Solvent	Repetition	Yield (%)	Average (%)
100 Mesh	n-Hexane	1	2.84	
		2	2.91	2.93
		3	3.02	
		4	2.95	
	Ethanol	1	13.57	
		2	13.45	13.59
		3	13.65	
		4	13.70	
	dd H_2O	1	29.87	
		2	29.65	29.70
		3	29.50	
		4	29.77	
10 Mesh	n-Hexane	1	0.66	0.64
		2	0.65	
		3	0.61	
		4	0.66	
	Ethanol	1	1.54	1.58
		2	1.53	
		3	1.58	
		4	1.66	
	dd H_2O	1	12.74	12.78
		2	12.62	
		3	12.77	
		4	12.99	

One important factor in choosing an effective treatment to measure the amount of extracted components in an ingredient is the test result analysis. The Shapiro Wilk normality test on the treatment of ethanol, dd H_2O, and N-hexane solvent types obtained significant values of <0.05 (0.001, 0.001, 0.002 respectively), meaning that the data distribution was proved not normal. The results of the hoMoringageneity test using the Levene test in the solvent type group obtained a significant value (0.000) <0.05, meaning that the data were not homogeneous. The use of methods to answer hypotheses using the Kruskall-Wallis nonparametric test. Based on the Kruskall wallis test, in the solvent type treatment group, a significant value of (0.003) <0,05 was obtained, meaning that there was an influence of the type of solvent on the amount of yield from the results of Moringa maceration. So it can be concluded that the particle size of simplisia, the type of solvent, and the combination of treatments have a significant effect on the amount of yield resulting from Moringa maceration.

This research was initially carried out to make simplistic granules or dry powder from Moringa plants measuring macroparticles and microparticles. Because the accuracy of using fine materials would make the dissolving process shorter and better, granules of different sizes were produced. Then, the Moringa simplistic granules were macerated with a variation of common solvents that were not toxic or harmful.

n-Hexane solvents include non-polar solvents. This solvent has volatile properties and is stable during the dissolving process. Maceration with n-Hexane solvent resulted in the smallest average yield in this study because this solvent is a nonpolar compound which results in weak attraction between Moringalecules. Due to its low polarity, n-Hexane cannot produce maximum Moringa yield, plus the Moringa content compound is dominated by polar compounds which causes the solubility of compounds macerated with n-Hexane to be slower. n-Hexane can be used effectively for the extraction of simplisia which contains compounds that are also nonpolar because the similarity of polarity equilibrium between compounds makes the compounds easily soluble.[19]

Ethanol is a flexible and polar solvent, therefore, ethanol is excellent for pre-extraction. Maceration with ethanol solvent results in a smaller average yield than dd H_2O solvent, because solvent polarity, extracted chemicals, and extracted simplistic all have a role in high solubility. Compounds with the same polarity will be more easily attracted or dissolved by solvents with the same level of polarity. The polarity of the Moringa compound content is higher than ethanol which makes the solubility rate of symplysis in ethanol less fast.[18,20] Ethanol solvents have two groups that differ in polarity, namely a hydroxyl group that is polar and a nonpolar alkyl group. Moringa has groups of compounds with high polarity, so the alkyl group in ethanol will require a longer reaction with the polarity group of Moringa compounds which causes a decrease in the dissolution rate of Moringa simplisia.[21]

dd H_2O solvent is a polar solvent and dd H_2O is purely distilled water. Maceration with dd H_2O solvent resulted in the largest average yield in this study, because dd H_2O has a higher polarity than ethanol and n-hexane, and the characteristics of Moringa compounds have the same polarity as dd H_2O. This polarity makes the dissolution rate in maceration Moringa with dd H_2O solvent faster.[22] dd H_2O solvent became the dominant solvent of ethanol solvent in this study, this is in line with research by Wicaksono et al,[23] the lower the amount of ethanol and the higher the amount of dd H_2O, the higher the yield of Moringa extract. The proper level of solvent polarity used for the Moringa extraction process results in many components being soluble. The increasingly acidic state of the solvent causes more and more compound walls to break so that more and more yields are extracted.

CONCLUSSION

The type of solvent has a significant effect on the amount of yield resulting from Moringa maceration. The best combination of simplisia particle size treatment and solvent type in this study was a combination of 100 mesh (126-149 μm) simplisia microparticle size with dd H_2O solvent which produced an average yield of 29.70%.

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