Effect of Particle Size on Fresh Turmeric (Curcuma Longa L.) and Simplicia Toward Content of Curcumin Compound

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Abstract. The effect of particle size of fresh turmeric and simplicia toward content of curcumin compounds has been carried out. The purpose of this research is to analyze the content of curcumin compounds based on the particle size of the fresh turmeric and simplicia using ethanol and water solvents. Extraction of curcumin in fresh turmeric and simplicia yield was carried out by maceration method of electrosynthetic coupling in etanol and water solvent using the infundation method, at particle sizes of 20, 80 and 140 mesh. The content of curcumin compound was analyzed as quantitatively using spectrophotometry visible at 475 nm, the linier regression is Y = 6.428x - 4.424 and R2 = 0.7594. The highest content of curcumin compound was found in the fresh turmeric and simplicia using ethanol solvent at 140 mesh particle size respectively, are 5.6 and 4.2 ppm. In water solvents, the concentration of curcumin from fresh turmeric and simplicia were 1.3 and 0.6 ppm, respectively.

Keywords: Turmeric, Curcumin, Particle Size, Extraction, Maceration of Electrosynthetic coupling

1 Introduction

Turmeric (Curcuma longa L.) is one of the plants the tribe-finding (Zingiberaceae) has many properties and benefits because they contain secondary metabolites that can be used as medicine. This causes turmeric used in a variety of beverage products such as traditional herbal drinks are now widely consumed by the public to improve health and fitness (Supandi, et al., 2016).

Turmeric contains curcuminoid compounds consisting of curcumin, desmetoksikurkumin as much as 10% and 1-5% bisdesmetoksikurkumin and other beneficial substances such as essential oils (Ikrawan, 2017). Some of the biological activity of curcumin, among others as anti-inflammatory, antioxidant, anticancer, antimutagenic, antifungal, antibacterial, antiparasitic, antiviral / anti-HIV, anticoagulant, antidiabetic (Purwaningsih, 2016). The content of curcumin compound can be extracted by extraction. The extraction process can be influenced by several factors, one of which is the size of the particles will be extracted. The particle size affects the amount of extract produced, because the smaller particle size of a substance, induce more broken cells with wider contact area between the sample and the solvent (Anam, 2010). In this study conducted on a sample of fresh turmeric extract and botanicals with the size 20, 80 and 140 mesh.

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The concentration of active substances in extract greatly influenced by particle size, time and temperature of extraction. Extraction by maceration takes a long time and solvents required coupling electro-syntesis maceration method in order to enhance the reaction between the solvent and the active compound and it takes a relatively short time and solvent bit. Curcumin concentration analysis was conducted using visible spectrophotometry.

Based on the background described above, it interested in conducting research on the influence of particle size of fresh turmeric rhizome extract and botanicals in ethanol and water to the compound curcumin visible spectrophotometry.

2 Material and method

2.1 Material

The materials needed are turmeric, 96% ethanol, distilled water and raw curcumin standard production E-Merck.

2.2 Sample processing

The samples used are fresh turmeric rhizome and simplisia. Each turmeric is cleaned, washed, drained and then chopped-chopped. Fresh turmeric rhizome after chopped smoothed with wet blender, finely sieved in 20 mesh, 80 mesh, 140 mesh. Once chopped turmeric bulbs are then dried in at 40° C. Samples are considered dry when the easily broken, and blended with a dry blender until a powder sieved using a sieve 20 mesh, 80 mesh, 140 mesh, 200 mesh.

2.3 Using turmeric rhizome ekstrakai solvents ethanol

2.3.1 Best maceration time optimization method coupling elektrosintesis

Simplicia turmeric powder weighed 5 g which have been sieved using 80 mesh sieve dissolved in 50 ml of 96% ethanol (1:10) was added to 50 ml glass beaker cover volume up with ethanol until macerated coupling pins limits electro-synthesis (Widodo, et al., 2007). Electro-synthesis coupling maceration was prepared for 6 samples with the same sieve of 80 mesh, each sample was macerated in a variety of time of 0.5, 1, 1.5, 2, and 3 hours. Then the results of maceration were evaporated and extract samples were diluted in 20 mL methanol for analyzed using a visible spectrophotometer.

2.3.2 Coupling maceration elektrosintesis on optimum time

5 g each sample fresh turmeric rhizomes and bulbs weighed was dissolved in 50 ml of 96% ethanol (1:10) then added to each 50 ml glass beaker and cover volume up with 96% ethanol until further macerated coupling pins limits the voltage electro-synthetis 20 volts for 2 hours (Widodo, et al., 2007). Results of maceration evaporated to solvent evaporated. Extraction results obtained sediment was diluted in 20 ml methanol and then analyzed using a visible spectrophotometer.

2.3.3 Using solvent extraction of turmeric rhizome air

Turmeric was prepared with solvent extraction in infusion water. 5 g turmeric bulbs was added to the pot and add 50 mL infusion water, then heated in for 15 minutes, until the temperature inside the pot reaches 90C, while stirring occasionally, then infusion with a flannel cloth while still hot and the filtrate accommodated. The extraction solvent aerated until reduced water obtained viscous extract and then continued quantitative analysis using visible spectrophotometer (MOH, 1979).

2.4 Quantitative analysis of curcumin content compounds

2.4.1 Preparation of parent solution curcumin

Weighed as much as 20 mg of curcumin and added to the standard raw flask in 100 ml ethanol, then added to the line of the mark in order to obtain a concentration of 200 ppm (Parent Solution I). 2.5 ml of solution I was added to 50 ml flask cover volume up with ethanol as 10 ppm (Parent Raw Solution II / LIB II).

2.4.2 Determination of the maximum wavelength

Determination of the maximum wavelength was prepared with 3 ml of Parent Solution I and dissolved in 50 ml ethanol obtained 12 ppm solution. This solution was measured at a wavelength of 400-800 nm.

2.4.3 Determining straight line equations

1 ml, 2 ml, 3 ml, 4 ml and 5 ml of LIB II (Solution Parent Raw II) was pippeted then added10 ml ethanol (as concentration of 1 ppm, 2 ppm, 3 ppm, 4 ppm, 5 ppm. These solution were measured by visible spectrophotometer at a predetermined wavelength.

2.4.4 Concentration determination of curcumin in samples

Weighed as much as 20 mg extract of curcumin and dissolved in 100 ml ethanol to obtain a concentration of 200 ppm (solution 1). 2.5 ml of curcumin of solution 1 was added to the flask 50 ml and cover volume up to 50 ml with ethanol derived concentration of 10 ppm (solution 2). Absorbance was measured using a visible spectrophotometer at a predetermined wavelength.

3 Results and discussion

3.1 Best maceration time optimization method coupling elektrosintesis

Extraction of Turmeric carried out to obtain compound curcumin by maceration method coupling elekcro-synthesis, with extract time of macerated are 0.5, 1, 1.5, 2, 2.5 and 3 hours at rated voltage 20 volts using elektrosintesis tool, and maceration time optimization of electro-synthetis coupling methods can be seen in Table 1.

Table 1. The maceration time optimization of the best methods of coupling electro-synthetis

No	Maceration Time	Concentration (ppm)	Absorbance
1.	0.5 hours	0.6	0.775
2.	1 hour	0.8	.818
3.	1.5 hours	2.0	1,000
4 '	2 hours	3.7	1,268
5.	2.5 hours	2.8	1,125
6.	3 hours	2.1	1,009

Based on Table 1 shows that the best time of maceration results elektrosintesis coupling method is obtained at the time of 2 hours with concentration of 3.7 ppm. It indicate the compound curcumin was extracted completely by in 2 hours causes more solvent sum up / pull curcumin compound of samples if compare in 0.5 hours, 1 hour and 1.5 hours. However, in 2.5 hours and 3 hours curcumin concentration were decreased, since the amount of solute in the solvent was saturated and can not be dissolved again (Ramdja, et al., 2009), need 2 hours curcumin for completed extraction and in 2.5 and 3 hours will generate another compound beside the curcumin. It maceration time results obtained was similar with previous studies conducted by Widodo..

3.2 Coupling maceration elektrosintesis on optimum time

Eeach sample after sieved with 20, 80 and 140 mesh and then dissolved in 96% ethanol subsequently macerated coupling electro-synthesis on voltage optimum is 20 volts for 2 hours, obtained data from the maceration coupling elektrosintetis using ethanol (Table 2)

Table 2. Maceration Elektrosintesis Coupling Using ethanol solvent

No	Samples	Ethanol extracts (g)		
		20 mesh	80 mesh	140 mesh
1.	Ethanol extracts (g) Fresh turmeric rhizome	2.23	2.25	2.18
2.	Turmeric rhizome simplicia	2.12	2.14	2.16

3.3 Using solvent extraction of turmeric rhizome air

Each sample fresh turmeric rhizomes and bulbs after 20,80,140 and sieved with a 200 mesh sieve were extracted using a solvent of water with infundation method, where the sample is heated at a temperature of 90 C for 15 minutes infundation results obtained using aqueous solvent extract can be seen in Table 3 as follows :

Table 3. Infundation using solvent extract air

No	Samples	Ethanol extracts (g)		
		20 mesh	80 mesh	140 mesh
1.	Fresh turmeric rhizome	2.29	2.32	2.28
2.	Turmeric rhizome simplicia	2.19	2.26	2.24

3.4 Concentration determination of curcumin in samples

Based on the data obtained by visible spectrophotometry curcumin concentration in samples of fresh turmeric rhizome and botanicals that using ethanol and water in a variety of particle size using a sieve 20, 80 and 140 mesh. The data obtained are presented in Table 4 and Table 5.

Concentration of the compound curcumin against fresh turmeric rhizome and botanicals in ethanol and water at a particle size of 20, 80 and 140 mesh on fresh turmeric rhizome is higher than simplisia turmeric, it indicate the bulbs turmeric has undergone a drying process which causes the compound curcumin on the sample was reduced. There was also a reduction in solvent extracted performed by aerated initiate the sample at long time in the air that causes oxidation of curcumin compound so that the concentration of curcumin decreased.

Water and ethanol 96% is used for fresh turmeric rhizome extract and botanicals shows significant different concentrations of curcumin. It is confirm the concentrations of curcumin in turmeric rhizome fresh and botanicals using ethanol 96% higher than using water-soluble matter because curcumin has properties of soluble in ethanol, acetone, glacial acetic acid, and alkali hydroxide compared to the water and diethylether (Kiso, 1985). Based on the polarity of ethanol and curcumin are polar induce the solvent is able to sum up the content of chemical compounds well and provide results of the highest concentrations of curcumin. In the case of ethanol is advantages compared to water and methanol.

Additionally the methods used in extracting turmeric rhizome using ethanol is different with water. Turmeric extraction using ethanol by maceration method with electro-syntesis coupling active substances with electrochemical techniques, while turmeric extraction using water was conducted by infundation that the sample was heated on water bath at 90C for 15 minutes. Heating at high temperatures cause the concentration of curcumin in aqueous solvent is lowered.

Particle size also affected difference concentrations yield of curcumin in turmeric compound. Known concentrations of curcumin in turmeric which have been sieved using a sieve 20, 80 and 140 mesh obtained the highest concentrations of curcumin on the particle size with a 140 mesh. One of the factors that affect the extraction process is the particle size so that the number of active compounds that are interested also influential. According to Heat & Reinocius (1986). The smaller of particle size, the more cells was broken and expand the surface area of contact between the solvent and sample. Therefore, the particle size of 140 mesh produce a higher concentrations of curcumin compared than the size of 20 mesh and 80 mesh.

The surface of plant cells are more widely also will facilitate the process of absorption (absorption) occurs between the solvent and extracting samples in the compound curcumin, curcumin concentration in order to obtain 140 mesh size is 5.6 ppm is higher than 20 mesh (2.9 curcumin concentration ppm) and 80 mesh (curcumin concentration of 3.1 ppm). It cause the solvents were absorbed perfectly on the sample when the solvent extraction process will

more absorbing / pull active ingredient curcumin on samples with a 140 mesh. However, the smaller (fine) particle size 200 mesh causes the concentration of curcumin decreased the fresh turmeric and botanicals.

Table 4. The concentration of curcumin on turmeric rhizome in ethanol

No	Sieve size	Turmeric rhizome Fresh		Simplicia Turmeric rhizome	
		Concentration (ppm)	Absorbance	Concentration (ppm)	Absorbance
1.	mesh 20	2.9	1,137	1.8	0.963
2.	mesh 80	3.1	1,167	2.9	1,143
3.	mesh 140	5.6	1,553	4.2	1,347

Table 5. The concentration of Curcumin on turmeric rhizome in Water

No	Sieve size	Turmeric rhizome Fresh		Simplicia Turmeric rhizome	
		Concentration (ppm)	Absorbance	Concentration (ppm)	Absorbance
1.	mesh 20	0.5	0.772	0.2	0.717
2.	mesh 80	1.1	0.866	0.3	0.742
3.	mesh 140	1.3	0.886	0.6	0.775

4 Introduction

The concentrations of the compound curcumin found in turmeric have the highest fresh with a particle size of 140 mesh and coupling electro-synthesis maceration extraction method is 5.6 ppm. The best solvent used is ethanol and the optimal solvent water is fresh turmeric rhizome with a particle size of 140 mesh, obtained concentration of 1.3 ppm.

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