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The Effect Of Different Solvent Extraction On Chemical Content And Quercetin Levels Of Ketapang (*Terminalia cattapa* L.)

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Abstract

Ketapang has flavonoid content that is quercetin. The appropriate solvent can attract the active compound of quercetin on ketapang. The selection of solvents adjusts different levels of polarity with the aim of obtaining the best solvent. This study aims to determine the difference between extraction solvents to the quercetin levels of ketapang leaves.

Simplisia leaves of ketapang made by winding. Maceration is carried out on ketapang leaves using 3 different solvents namely n-hexane, ethyl acetate, and ethanol 90%. The viscous extract obtained was analyzed for yield value and the phytochemical screening test was do qualitatively. Quercetin level measured by UV-Vis Spectrophotometry at a maximum wavelength of 375.6 nm. The absorbance value obtained is entered into the standard quercetin curve equation with the equation y=0.0885x+0.0037.

The results of the yield value of ketapang leaf extracts with each different type of solvent resulted in different yield values, as well as the results of phytochemical screening and percent quenching levels obtained.

Keywords: Terminalia cattapa L., Yield Extract, Phytochemical, Quercetin

Introduction

Ketapang (*Terminalia catappa* L.) is a plant that thrives in the lowlands to highlands, coastal forests, swamp forests, and river flows (Herli and Wardaniati, 2019). Ketapang leaves are known to contain chemical compounds in the form of phenolics, alkaloids, flavonoids, tannins, saponins, and triterpenoids (Istarina et al., 2015).

The choice of solvent can affect the resulting extract. Research conducted by Herli and Wardaniati (2020) showed the results of phytochemical screening of ethanol extracts containing alkaloids and flavonoids, while the hexane fraction contains steroids and the ethyl acetate fraction contains only flavonoids. The solvent can also affect the yield value obtained. Ciplukan extract produced a significant difference in yield with extracts obtained using ethanol which had higher yields than ethyl acetate and hexane (Julianti et al., 2019).

This study aims to determine the effect of differences in extraction solvents on the yield value, chemical content of quercetin content of ketapang leaves. The research function is to determine the effective solvent so that the level of quercetin produced can be maximized, besides that it can determine the difference in the levels of quercetin in ketapang leaves.

Method

Materials and tools

The materials used in this study were leaves of ketapang, ethanol 90%, n-hexane, ethyl acetate, and pro-analytical ethanol. Analysis was performed using UV-Vis Spectrophotometry (Genesys 10s).

Ketapang Leaves Extraction

One kg of ketapang leaves each cut into small pieces and then dried by aerating then blended to form a powder. The powders were macerated using 3 solvents, namely n-hexane, ethyl acetate, and ethanol 90% for 3 x 24 hours. The filtrate obtained from each solvent then concentrated using the wind dry method. The obtained extracts were calculated and analyzed

for their yield values, then phytochemical screening tests were carried out which were alkaloids, flavonoids, saponins, terpenoids, and tannins.

Preparation of quercetin standard curve

The standard solution of quercetin whose absorbance will be measured was made in various concentrations, namely 0.5 ppm, 1 ppm, 2 ppm, 4 ppm, 6 ppm, 8 ppm, 10 ppm, and 12 ppm. Absorption measurements were carried out with a maximum wavelength of 375.5 nm.

Measurement of quercetin content in ketapang leaf extract

Ketapang leaf extracts were weighed as much as 10 mg, each diluted with 1 ml of ethanol p.a. 100 l of the solution was taken and put into a 10 ml volumetric flask, then add ethanol p.a to the mark. The dilution of the solution was carried out to a concentration of 100 ppm. The sample solution that had been diluted to a concentration of 100 ppm was measured for absorbance using UV-Vis Spectrophotometry at maximum waves. Checking the sample solution was made in 3 replications (Yunita and Khodijah, 2020).

Results and Discussion

The yield of the extract produced in this study is a comparison between the weight of the extraction result and the weight of the raw materials used for the extraction process. The results of extract yields in Table 1 show that leaf extracts with ethanol 90% solvent obtained extract yield values compared to leaf extracts with hexane and ethyl acetate solvents. This indicates that differences in types of solvents affect the yield value of the resulting extract.

Table 1. The results of the yield value of ketapang leaf extract

Solvent	Extract Yield (%)
Ethanol 90%	5,20±0,15*
Ethyl acetate	2,85±0,11*
n-Hexane	2,25±0,18*

*There are significant differences between solvent groups

Based on the solvent used, it is known that the higher the polarity level of the solvent, the higher the yield of the extract obtained (Noviyanty et al, 2019). This study showed that from the three solvents, it was found that the type of solvent ethanol 90% in the leaves showed the highest yield which gave the greatest yield compared to the types of hexane and ethyl acetate solvents. This is because the ethanol solvent has a high polarity so that it can produce more yields than other solvents (Azis et al., 2014). The factor that affects the extract yield value is the higher the amount of solvent used, the more optimal the release of the target compound into the solvent can be and the solvent saturation can also be avoided. However, after the amount of solvent is increased by a certain amount, the increase in yield is relatively small and tends to be constant.

Table 2. Phytochemical screening of ketapang leaf extract

Group of compounds	EtOH	EtAc	Hex
Alkaloids	+	-	-
Tannins	+	-	-
Saponins	-	-	-
Flavonoids	+	-	-
Terponoids	+	+	+

Notes: (+): positive; (-): negative; EtOH: Ethanol 90%; EtAc: Ethyl Acetate; Hex: n-Hexane

The differences in the results of phytochemical screening can be influenced by environmental factors where they grow, which vary in influencing the growth of plants of the same type, including the chemical content of the compounds they produce, both in terms of quantity and in terms of composition (Uddin, 2019). The phytochemical content of secondary metabolites such as flavonoids from a plant will be different in each region because it is influenced by several environmental factors including light, temperature, pH and altitude where it grows which will affect the phytochemical content of a plant (Sholekah, 2017). The polarity of the solvent can affect the yield of the chemical compounds contained. A compound will dissolve well in solvents that have the same polarity (Savitri et al, 2017). This shows that the compounds in ketapang leaves have a polarity close to ethanol 90%, because the yield of the compound is based on the similarity of polarity with the solvent.

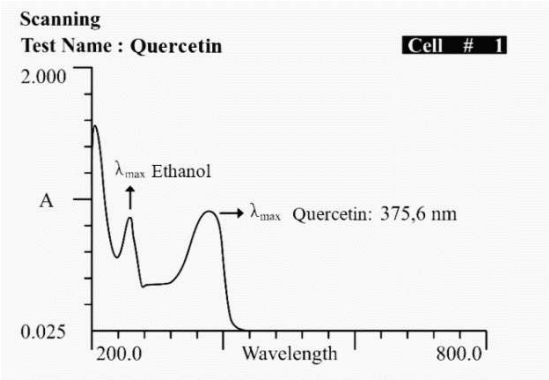

Figure 1. Quercetin Maximum Wavelength

The maximum wavelength of quercetin obtained was 375.6 nm (Figure 1). Research conducted by Yunita et al., (2020) showed the results of the quercetin wavelength of 361.8 nm. According to Bancirova (2015), the wavelength of quercetin is 380 nm, while the other peaks show the wavelength of the ethanol solvent. Research conducted by Clarke (2011) showed that ethanol has a wavelength of 210 nm so that it can be seen that ethanol does not interfere with the absorbance of quercetin.

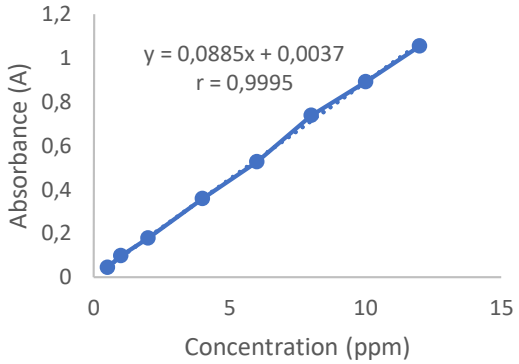

Figure 2. Quercetin Standard Curve

The standard curve in Figure 2 is made by measuring quercetin standards with concentrations of 0.5 ppm, 1 ppm, 2 ppm, 4 ppm, 6 ppm, 8 ppm, 10 ppm and 12 ppm. Determination of the absorbance of standard solutions by Lambert-Beer law, namely the higher the concentration, the higher the absorbance value because the absorbance will be directly proportional to the concentration of the substance contained in the sample (Neldawati and Gusnedi, 2013).

Calculation of the standard curve using the form of a linear regression equation, namely y = bx + a, the results obtained are y = 0.0885x + 0.0037 with a value of r (correlation coefficient) of 0.9995. The value of r shows the linearity relationship between 2 variables. The value of r close to 1 indicates a linear calibration curve so that there is a relationship between the concentration of the quercetin solution and the absorption value (Alfiansyah, 2017). The results of the measurement of quercetin levels in 10 mg extract using ethyl acetate solvent were greater than ethanol 90% and hexane solvents (Table 3).

Table 3. Quercetin content of ketapang leaf extract

Solvent	Quercetin Level (ppm)
	Leaf
Ethanol 90%	4,557 ± 0,141*
Ethyl acetate	6,528 ± 0,307*
n-Hexane	0,938 ± 0,102*

*There are significant differences between solvent groups

Research by Aguda and Chen (2016) states that the solubility of quercetin will be better in the ester and acid groups compared to alcohol groups such as ethanol, propanol and butanol. The highest content of flavonoid compounds was found in the ethyl acetate fraction of kelubut leaves (Passiflora foetida L.) then the n-butanol fraction, methanol extract, and the n-hexane fraction (Fadillah et al., 2017). This statement is in line with research showing that the concentration of quercetin content of ketapang leaves using ethyl acetate as solvent is higher than using ethanol 90% and hexane as solvent.

Conclusions

The results of the yield value of ketapang leaf extracts with each different type of solvent resulted in different yield values, as well as the results of phytochemical screening and percent quenching levels obtained. This study concluded that differences in solvents affected the yield value, chemical content and percent content of quercetin in ketapang leaf extract.

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