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OPTIMIZATION OF YELLOW PASSION FRUIT PEEL EXTRACTION METHOD USING METHANOL SOLVENT TO INCREASE ANTIOXIDANT ACTIVITY

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Abstract: This study aims to determine the concentration of methanol solvent, the temperature, and the time of the shaker in the best extraction. It can produce the best antioxidant activity of the peel of the yellow passion fruit (Passiflora edulis Sims f. flavicarpa Deg) using the DPPH method. The maceration process is carried out using methanol solvents. The filtrate is concentrated with a rotary evaporator until a concentrated extract is obtained. Variations in methanol concentrations include 60, 80, and 100% (v/v) in methanol-water solvent mixtures. Shaker time variations in the extraction process include: 120, 140, and 160 minutes and shaker temperature variations in the extraction process include: 55, 65, and 75 °C. The results showed that the concentration of methanol solvent that can produce the best antioxidant activity from the peel of yellow passion fruit using the DPPH method is a concentration of 100% with an IC50 value of 31 ppm, followed by methanol solvents of 60% and 80% which produce IC_{50} values of 35 and 41 ppm, respectively. The optimum shaker time in the extraction process is 140 minutes, and the optimum shaker temperature in the extraction process is 65 ^{o}C. The conclusion is that using 100% methanol solvent, 140 minutes shaker time, and 65 ^{o}C shaker temperature can increase antioxidant activity in vitro using the DPPH method.

Keywords: *Antioxidant, Temperature, Time, Shaker, Methanol 100%, Yellow Passion Fruit*.

INTRODUCTION

Passion fruit is one of the plants that can thrive in tropical climates even though it is not native to Indonesia. Passion fruit has two types: yellow and purple passion fruit, each unique [1]. Many Indonesians do various processing on passion fruit, such as: making passion fruit juice [2], passion fruit syrup [3], and herbal tea [4]. The use of passion fruit is still focused on the fruit part only, while the utilization of the passion fruit Peel still needs to be widely done. According to [5], fruit peel waste has a high content of antioxidants. In addition, many studies state that passion fruit peel is effective as an antibacterial, anti-inflammatory, anti-hyaluronidase, anti-collagenase, antidiabetic, and antioxidant [2, 6-13].

One of the benefits and peel of passion fruit has many benefits as an antioxidant that can minimize the occurrence of oxidation reactions and prevent the formation of free radicals triggered by factors from the inside, names derived from normal metabolism, and external factors, such as drugs and pollution [14]. Antioxidants are divided into 2, namely: natural and artificial. Unlike natural antioxidants, synthetic antioxidants can provide dangerous side effects. Therefore, many researchers study to find natural sources of antioxidants [16], such as lutein, lycopene, vitamin C, vitamin E, and carotenoids that are usually found in fruits and vegetables.

Testing the antioxidant activity of the peel of purple passion fruit using extracts from ethanol solvents has been widely used in studies [6, 15-24]. But the peel of yellow passion fruit has yet to be studied much. On the other hand, passion fruit peel extracts that use methanol solvents still need to be widely used. According to [25], the antioxidant potential of passion fruit peel methanol extract is higher than that of ethanol and water extracts. Therefore, in this study, optimization was carried out in the maceration extraction process, including methanol solvent concentration, extraction time, and extraction temperature, to produce the best antioxidant activity using the DPPH method.

RESEARCH METHODS

Chemicals

Yellow passion fruit peel Simplicia powder was obtained east of the STKIP Muhammadiyah Kuningan Campus, Jl. Raya Cigugur RT.5 / RW.2 Kuningan, West Java. The chemicals include methanol, DPPH, mineral-free water, and ascorbic acid, purchased from Sigma Aldrich. All reagents are analytical classes.

Research Design

Variations in methanol concentrations include 60, 80, and 100% (v/v) in methanol-water solvent mixtures. Shaker time variations in the extraction process include: 120, 140, and 160 minutes and shaker temperature variations in the extraction process include: 55, 65, and 75 °C.

Procedure

Extraction

100 g of powder was macerated using a solvent of 1000 mL of methanol-water [26]. The maceration process is carried out for 24 hours and

then filtered into filtrate and pulp. The filtrate is concentrated with a rotary evaporator until a concentrated extract is obtained [27] [28].

Preparation of Test Sample Solutions and Antioxidant Standards

A test sample solution of methanol extract and vitamin C was made in concentrations (20, 40, 60, 80, and 100) mg/L of 50 mL each.

Antioxidant Test using DPPH Method

Each test sample solution and the antioxidant standard were pipetted by 0.25 mL and mixed with a 6 × 10-5 M DPPH solution of 5 mL in a test tube. Then vortex for 1 minute. After incubation for 30 minutes at room temperature, the absorbance of the reaction mixture was measured at a wavelength of 515 nm using a spectrophotometer to obtain the absorbance value of the sample. A blank solution consisting of methanol in DPPH solution is prepared and measured at the same wavelength to obtain the control absorbance value. The experiment was carried out with three repetitions. Antioxidant activity is calculated using equation (2).

Antioxidant activity (%) = (control absorbance – sample absorbance)/control absorbance × 100 %

Next, a graph of the relationship between the sample concentration (x-axis) and the percent radical inhibition of DPPH (y-axis) was created. The calculation of the IC_{50} value based on the formula of the linear regression equation

RESULTS AND DISCUSSION

The yield of Concentrated Extract of Yellow Passion Fruit Peel

In this study, optimization was carried out in the extraction process by maceration of yellow passion fruit peel with the yield of % amendment shown in Table 1. Based on the table, the result can be obtained that the greater the concentration of methanol solvent used in the maceration process, the greater the % yield produced. 100% methanol solvent is the best solvent to extract the content of secondary metabolite compounds from the peel of yellow passion fruit with a % amendment of 13.26%. The results showed that the level of the polarity of the secondary metabolite compounds from the peel of the yellow passion fruit corresponds to the polarity of the 100% methanol solvent so that it can maximize % the yield.

Table 1. The yield of concentrated extracts of yellow passion fruit peel from various treatments

Variations of methanol solvents	Simplicia weight (g)	Concentrated extract weight (g)	%Yield
Effect of methanol solvent concentration			
Methanol 60%*	100	12.06	12.06
Methanol 80%**	100	12.88	12.88
Methanol 100%***	100	13.26	13.26
Effect of shaker time in the extraction process			
120 minutes [1]	100	6.51	6.51
140 minutes [2]	100	7.08	7.08
160 minutes[3]	100	7.34	7.34
Effect of shaker temperature in extraction process			
55°C[a]	100	6.06	6.06
65°C[b]	100	6.58	6.58
75°C[c]	100	7.04	7.04

Information
* : Yellow passion fruit peel extracted with 60% methanol solvent
** : Yellow passion fruit peel extracted with 80% methanol solvent
*** : Yellow passion fruit peel extracted with 100% methanol solvent
[1] : Extracted yellow passion fruit peel with complaint time for 120 minutes
[2] : Extracted yellow passion fruit peel with complaint time for 140 minutes
[3] : Extracted yellow passion fruit peel with complaint time for 160 minutes
[a] : Yellow passion fruit peel extracted at a shaker temperature of 55°C in the extraction process
[b] : Yellow passion fruit peel extracted at a shaker temperature of 65°C in the extraction process
[c] : Yellow passion fruit peel extracted at a shaker temperature of 75°C in the extraction process

In addition, to the influence of methanol solvent concentration, the influence of shaker time in the extraction process was also studied. The results showed that using shakers in the maceration process for 160 minutes could increase % yield. The use of shakers in this study increased the contact of methanol solvents with samples of yellow passion fruit powder [29]. Furthermore, the temperature of

the shaker in the extraction process also affects the % amendment. The greater the temperature of the shaker, the greater the % of the resulting amendment. In the study, the temperature of the shaker that produced the highest % yield was 75°C. The higher temperature of the shaker used in the maceration process can accelerate the contact between the sample and the solvent [30].

Antioxidant Activity of Concentrated Extract of Yellow Passion Fruit Peel

The relationship between the concentration of methanol extract from the yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of various methanol solvent concentrations is shown in Figure 1. The effect of variations in methanol solvent concentrations on antioxidant activity using the DPPH method was studied with the results shown in Table 2. The smaller IC value of $_{50}$ indicates that the extract has better antioxidant activity [31]. Based on the table, it can be seen that the IC value of $_{50}$ decreases further following an increase in the concentration of methanol solvent used in the extraction process by maceration. Methanol solvents with a concentration of 100% or in the absence of additional water solvents in this study were able to produce the best IC 50 value of 31 ppm, followed by methanol solvents with a concentration of 60% and methanol solvents with a concentration of 80% which produced IC 50 values of 35 and 41 ppm, respectively.

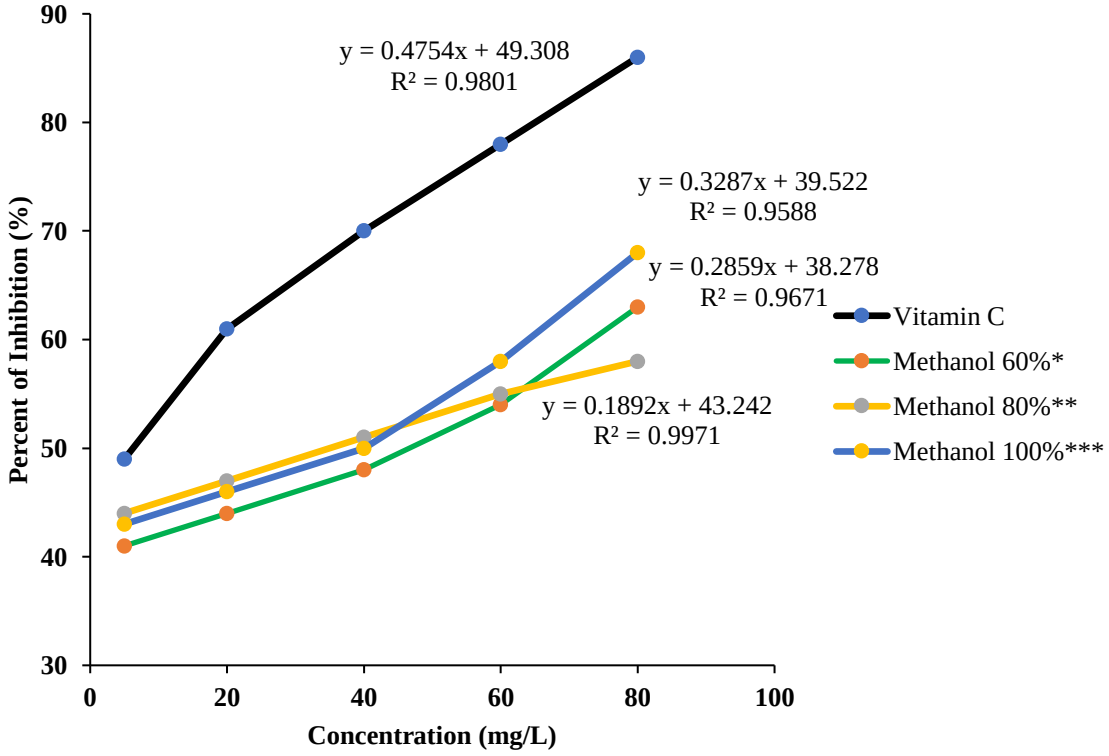

Figure 1. The relationship between the concentration of methanol extract of yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of various methanol solvent concentrations

Table 2. Effect of methanol solvent concentration on antioxidant activity of yellow passion fruit peel extract

Variations in methanol solvent concentrations	Linear line equation	Linearity	IC_{50} value (ppm)
Vitamin C	y = 0.4754x + 49,308	R^2 = 0.9801	1.46
Methanol 60%*	y = 0.2859x + 38,278	R^2 = 0.9671	41
Methanol 80%**	y = 0.1892x + 43,242	R^2 = 0.9971	35
Methanol 100%***	y = 0.3287x + 39,522	R^2 = 0.9588	31

Information
* : Yellow passion fruit peel extracted with 60% methanol solvent
** : Yellow passion fruit peel extracted with 80% methanol solvent
*** : Yellow passion fruit peel extracted with 100% methanol solvent

The relationship between the concentration of methanol extract of yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of shaker time variation in the maceration extraction process is shown in Figure 2. The effect of shaker time variation in the maceration extraction process on antioxidant activity using the DPPH method was also studied, with the results shown in Table 3. Based on the table, it can be known that the time of the shaker in the best extraction process that produces the best antioxidant activity is 140 minutes. On the other hand, a shaker time of 160 minutes can decrease antioxidant activity using the DPPH method. It can be caused by the length of time the shaker can damage the content of secondary metabolite compounds contained in the peel of yellow passion fruit and potentially increase the process of loss of secondary metabolite compounds in the extracted solution due to evaporation [32].

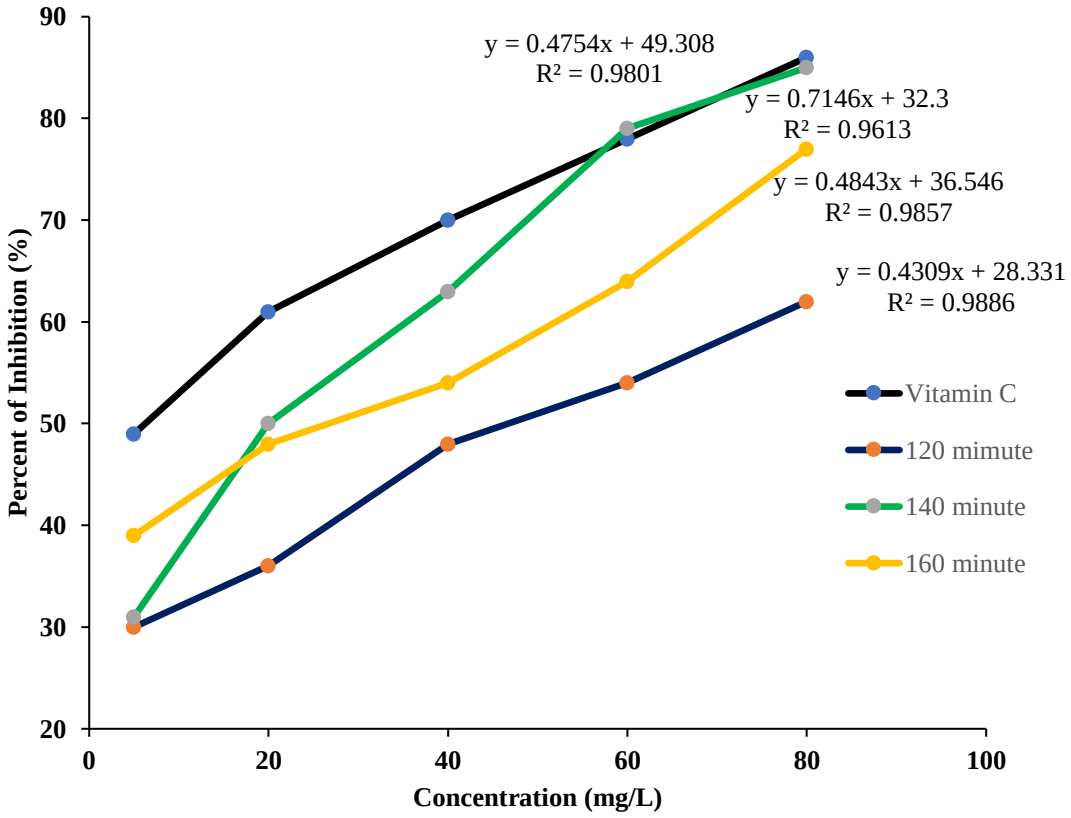

Figure 2. The relationship between the concentration of methanol extract of yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of shaker time variation in the maceration extraction process

Table 3 Effect of shaker time in the extraction process on the antioxidant activity of yellow passion fruit peel extract

Shaker time variations	Linear line equation	Linearity	IC_{50} value (ppm)
Vitamin C	y = 0.4754x + 49.308	R^2 = 0.9801	1.46
120 minutes[1]	y = 0.4309x + 28.331	R^2 = 0.9886	50.29
140 minutes[2]	y = 0.7146x + 32.3	R^2 = 0.9613	24.77
160 minutes[3]	y = 0.4843x + 36.546	R^2 = 0.9857	27.78

Information:
[1]: Extracted yellow passion fruit peel with complaint time for 60 minutes
[2]: Extracted yellow passion fruit peel with complaint time for 80 minutes
[3]: Extracted yellow passion fruit peel with complaint time for 100 minutes

Furthermore, the relationship between the concentration of methanol extract of yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of shaker temperature variations in the maceration extraction process is shown in Figure 3. The effect of shaker temperature variations in the maceration extraction process on antioxidant activity using the DPPH method was also studied, with the results shown in **Table 4.** Based on the table, it can be known that the

temperature of the shaker in the best extraction process that produces the best antioxidant activity is 65 °C. On the other hand, the temperature of the shaker set at 75 °C can cause a decrease in antioxidant activity using the DPPH method. The high temperature of the shaker can damage the content of secondary metabolite compounds contained in the peel of yellow passion fruit and potentially increase the loss of secondary metabolite compounds in the extracted solution due to evaporation [32].

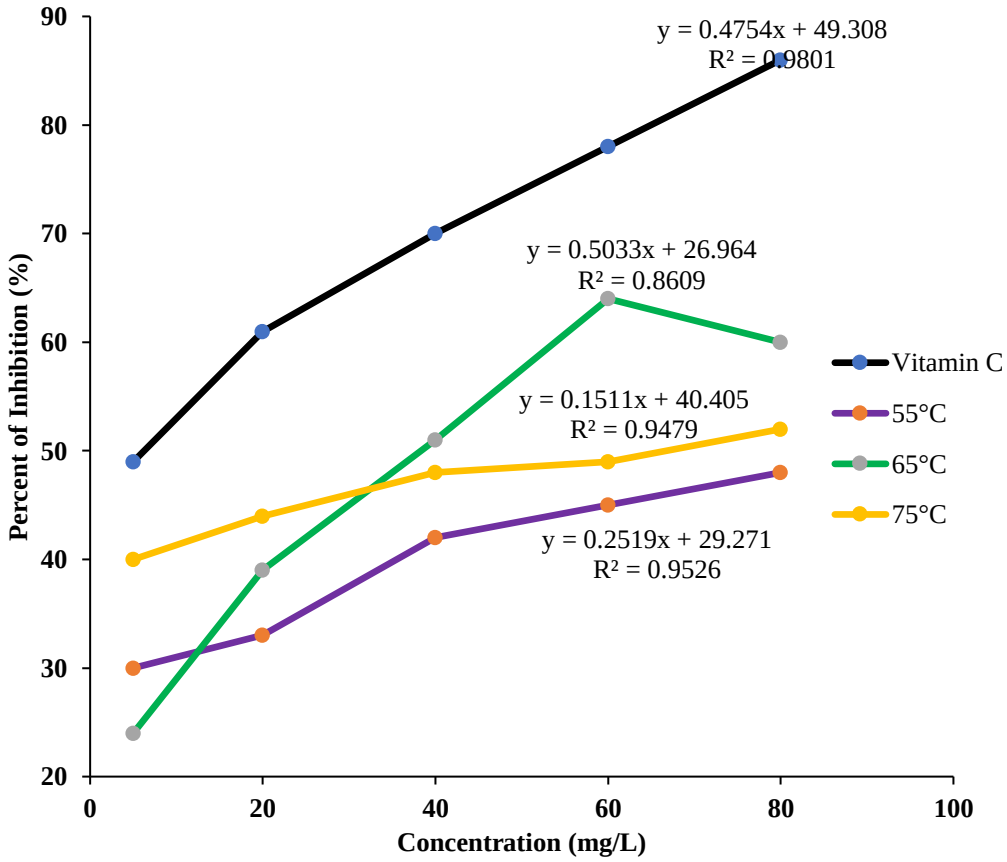

Figure 2. The relationship between the concentration of methanol extract of yellow passion fruit peel and the percentage of DPPH radical inhibition in the treatment of shaker temperature variations in the maceration extraction process

Table 4. Effect of shaker temperature in the extraction process on the antioxidant activity of yellow passion fruit peel extract

Shaker temperature variations	Linear line equation	Linearity	IC_{50} value (ppm)
Vitamin C	y = 0.4754x + 49.308	R^2 = 0.9801	1.46
55°C[a]	y = 0.2519x + 29.271	R^2 = 0.9526	82
65°C[b]	y = 0.5033x + 26.964	R^2 = 0.8609	45.77
75°C[c]	y = 0.1511x + 40.405	R^2 = 0.9479	63.5

Information:
[a]: Yellow passion fruit peel extracted at a shaker temperature of 55°C in the extraction process
[b]: Yellow passion fruit peel extracted at a shaker temperature of 65°C in the extraction process
[c]: Yellow passion fruit peel extracted at a shaker temperature of 75°C in the extraction process

CONCLUSION

The concentration of methanol solvent that can produce the best antioxidant activity from the peel of yellow passion fruit using the DPPH method is a concentration of 100% with an IC50 value of 31 ppm, followed by methanol solvents of 60% and 80%, which produce IC_{50} values of 35 and 41 ppm, respectively. The optimum shaker time in the extraction process is 140 minutes, and the optimum shaker temperature in the extraction process is 65 °C. The conclusion is that using 100% methanol solvent, 140 minutes shaker time, and 65 °C shaker temperature can increase antioxidant activity in vitro using the DPPH method.

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