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Sandalwood Fruit Hot Water Extract as an Antioxidant

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Abstract:- Sandalwood (*Santalum album* L.) cultivation is an effort to use this plant in a sustainable manner. This cultivation effort faces time challenges considering that the harvesting period of this plant takes a very long time. Therefore, this cultivation effort must be strengthened by utilizing the value of this plant before the harvest. The use of sandalwood fruit can be used as an opportunity to increase the potential economic benefits of the plant before its harvest. Communities in parts of East Nusa Tenggara have traditionally used sandalwood to increase their immune systems. The use of sandalwood fruit as an antioxidant functional food commodity is an urgent need, based on the description of this plant's traditional use of its fruit. The use of a simple extraction method with a decoction method using hot water needs to be considered to make it easier for the community to produce sandalwood fruit extract. The purpose of this study was to evaluate the antioxidant activity and total phenol content of sandalwood fruit hot water extract. The IC_{50} value of the antioxidant activity of sandalwood hot water extract is 154.07 ppm. The total amount of phenols contained in the extract is directly related to this antioxidant activity. The total phenol content of the hot water extract of sandalwood fruit is 76,012 ± 1,653 mg GAE/g. The results of this study show that sandalwood ethanol extract has higher antioxidant activity than sandalwood hot water extract (IC_{50} = 108.98ppm). Total phenol calculation results support this claim. Compared to the hot water extract, the ethanol extract of sandalwood fruit contains more total phenols. Nevertheless, the antioxidant activity of sandalwood fruit water extract is still sufficient.

Keywords:- *Antioxidant, Total Phenol, Sandalwood,* Santalum album *L., Hot Water Extract.*

I. INTRODUCTION

The genus Santalum belongs to the Santalaceae family, which consists of 19 species spread across India, Indonesia, the Philippines, the Pacific Islands, and Australia. Sandalwood (*Santalum album* L.) is the most famous and valuable species in this genus. This species is known as sandalwood, which has been famous for its use throughout the world since ancient times. The plant is an important source of sandalwood in the Santalaceae family. This hemi-root parasitic tree species is strongly associated with great traditional and commercial social importance in India and several islands of eastern Indonesia. This species is currently categorized as a vulnerable species due to the excessive exploitation of trees in their natural habitat. As a result, sandalwood products became expensive and scarce.[1,2]

To overcome overexploitation, an effort is needed to utilize the potential of this plant in a sustainable manner. Sandalwood cultivation is an effort to use this plant in a sustainable manner. This cultivation effort faces time challenges considering that the harvesting period of this plant takes a very long time. Therefore, this cultivation effort must be strengthened by utilizing the value of this plant before the harvest. The use of sandalwood fruit can be used as an opportunity to increase the potential economic benefits of the plant before its harvest.

The fruits of Santalum species are edible. That ripe sandalwood fruit is known to have a fairly high water content and is a good source of carbohydrates. The fruit of the plant contains protein, crude fat and energy value. Sandalwood fruit methanol extract and water extract are known to have a high concentration of phenolics and antioxidant activity.[3,4]

Communities in parts of East Nusa Tenggara have traditionally used sandalwood to increase their immune systems. The use of sandalwood fruit as an antioxidant functional food commodity is an urgent need, based on the description of this plant's traditional use of its fruit. The use of a simple extraction method with a decoction method using hot water needs to be considered to make it easier for the community to produce sandalwood fruit extract.

The results of the literature search conducted did not obtain information about the antioxidant activity of sandalwood fruit hot water extract. The purpose of this study was to evaluate the antioxidant activity and total phenol content of sandalwood fruit hot water extract.

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II. METHODS

A. Extraction of Sandalwood Fruit pulp powder

➢ *Sandalwood Powder Preparation*

Ripe sandalwood fruit which is purplish black is cleaned using water. The clean fruit is drained until the surface of the sandalwood fruit is dry. The fruit pulp was separated from the seeds and dried at 60ºC for 20 hours. The dried fruit pulp is blended and filtered using a 60-mesh sieve. Sandalwood pulp powder is then used to make sandalwood fruit extract.

➢ *Preparation of Sandalwood Fruit Ethanol Extract*

As much as 10 grams of Sandalwood pulp powder was macerated using 250 mL of 70% ethanol for 72 hours. The maceration results were filtered and the filtrate was separated. The ethanol solvent was evaporated using an oven at a temperature of 60ºC until a thick extract was obtained.

➢ *Preparation of Sandalwood Fruit Aqueous Extract*

A total of 10 grams of Sandalwood pulp powder was added to 250 mL of water and heated at 90ºC for 15 minutes. The result of this heating is filtered and the filtrate is separated. The water solvent was evaporated using an oven at a temperature of 80ºC until a thick extract was obtained. The viscous extract was spread evenly to form a thin layer on a stainless steel plate and further dried using an oven at 60ºC for 24 hours to obtain a dry extract.

B. Sandalwood Fruit Extract Antioxidant Activity Test

Determination of antioxidant activity adapts the method proposed by Aryal et al. (2019) with modifications to the use of 96% ethanol solvent to replace methanol solvent and the use of DPPH with a concentration of 100 ppm. A test solution of sandalwood fruit extract was prepared in 96% ethanol solvent with various levels of concentration, each 2 mL of the test solution was given 2 mL of 100 ppm 2,2'diphenylpicrylhydrazyl (DPPH) radical solution in ethanol. The mixture was incubated for 40 minutes in the absence of light. The same procedure was carried out on a blank in the form of 2 mL of 96% ethanol solution. Parameters measured antioxidant inhibition activity.[5]

C. Determination of Total Phenol of Sandalwood Fruit Extract

The total phenolic determination of sandalwood fruit extract adapted to the method proposed by Aryal et al. (2019). Take 1 ml of the extract and mix it with 5 ml of 10% folic-ciocateu reagent and leave it for 3 minutes, then add 4 ml of 7.5% sodium carbonate. The mixture was then homogenized and incubated for 60 minutes. After 60 minutes, the absorbance of the mixture was read at a wavelength of 765 nm. The same procedure is carried out on standard. The standards used were gallic acid with concentrations of 10, 25, 50, 75, and 100 ppm. Standard absorbance was measured at a wavelength of 765 nm. The standard calibration curve is used as a reference to determine the Total Phenol in the extract.[5]

III. RESULTS AND DISCUSSION

The results of determining antioxidant activity can be seen in table 1 and table 2 below:

Table 1. Antioxidant Activity of Sandalwood Fruit Ethanol Extract

sample	Concentration (ppm)	% Inhibition
Sandalwood Fruit Ethanol Extract	200	65,426
	100	50,388
	500	41,163
	25	33,023

Table 2. Antioxidant Activity of Sandalwood Fruit Hot Water Extract

sample	Concentration (ppm)	% Inhibition
Sandalwood Fruit Hot Water Extract	200	53,643
	100	45,039
	500	43,876
	25	37,907

According to the analysis of antioxidant activity, the sandalwood fruit's ethanol extract had an IC_{50} value of 108.36 ppm and its hot water extract had an IC_{50} value of 154.07 ppm. The amount of phenol present overall in the extract is directly correlated with this antioxidant activity. The findings from measuring the Total Phenol concentration in the ethanol extract and hot water extract of Sandalwood fruit are displayed in Table 3 below.

Table 3. Total phenol content of fruit extracts of sandalwood

Extracts	Total Phenol (mgGAE/g)
Sandalwood Fruit Ethanol Extract	85.938 ± 2.173
Sandalwood Fruit Hot Water Extract	76.012 ± 1.653

Based on Table 3, it is known that the Total Phenol content of the Sandalwood fruit extract is quite high. Referring to the many studies that have been conducted, it is known that the total phenol content is closely related to antioxidant activity.[5,6,7,8,9,10,11]

Based on the findings of this study, it is known that sandalwood ethanol extract has a greater level of antioxidant activity than sandalwood hot water extract (IC_{50} = 108.98 ppm). The outcomes of calculating total phenol support this assertion. Compared to the aqueous extract, the sandalwood fruit's ethanol extract has more total phenol. Nevertheless, the antioxidant activity of sandalwood fruit water extract is still sufficient.

IV. CONCLUSION

The IC_{50} value of the antioxidant activity of sandalwood hot water extract is 154.07 ppm. The total amount of phenols contained in the extract is directly related to this antioxidant activity. The total phenol content of the hot water extract of sandalwood fruit is 76,012 ± 1,653 mg GAE/g. The results of this study show that sandalwood ethanol extract has higher antioxidant activity than sandalwood hot water extract (IC_{50} = 108.98ppm). Total phenol calculation results support this claim. Compared to the hot water extract, the ethanol extract of sandalwood fruit contains more total phenols. Nevertheless, the antioxidant activity of sandalwood fruit water extract is still sufficient.

COMPLIANCE WITH ETHICAL STANDARDS

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➢ *Disclosure of conflict of interest*

The authors whose names are listed on this paper declare that we have no conflict of interest.

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