

The Exotic Plants of Indonesia: Mahkota Dewa (*Phaleria macrocarpa*), Sikaduduak (*Melastoma malabathricum* Linn) and Mengkudu (*Morinda citrifolia*) as Potent Antioxidant Sources

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Abstract— The present study aims to determine the antioxidant activity of three unique plants from Indonesia used for medicine of dried and ethanolic extract. Plants that are commonly used as medicine is *Phaleria macrocarpa* known as mahkota dewa (In West Sumatra), *Melastoma malabathricum* known as sikaduduak and *Morinda citrifolia* known as mengkudu. The DPPH methods used to the antioxidant assay. The dried *Melastoma malabathricum* dried and ethanolic extract shows the highest antioxidant activity than *Phaleria macrocarpa* and *Morinda citrifolia* both powder and ethanolic extract. Started from 0,125mg/L for PMm and 0,25mg/L for PPM can be used for antioxidant measurement with DPPH.

Keywords— *Phaleria macrocarpa*, *Morinda citrifolia*, *Melastoma malabathricum*, antioxidant.

I. INTRODUCTION

Oxidation is an important reaction that produces free radicals in food, chemicals, and even in living systems. Free radicals have an important role in processes of food spoilage and chemical materials degradation and they also contribute to more than 100 disorders in humans [1]. Antioxidants are defined as substances that even at low concentration significantly prevent oxidation of easy oxidisable substrates [2]. Free radicals are molecules or atoms with an unpaired electron. The unpaired electron results in a high level of reactivity because the free radical `seeks` another electron to fulfil a pair. Free radicals are a natural by-product of cellular metabolism, but are also generated by the external action of ultraviolet radiation, toxic substances, ozone, cigarette smoke, microbial attacks, and even intensive exercise [3]. It is generally accepted that free radicals play an important role in the development of tissue damage and pathological events in living organisms. Reactive oxygen species (ROS) have deleterious effects on cellular membranes and internal structures that might contribute to the onset of cardiovascular disease, cancer, and impairment of the immune function by altering the metabolism [4].

Antioxidants are used to retard the reaction of organic materials, such as synthetic polymers, with atmospheric oxygen. This reaction can cause the following: degradation

of the mechanical, aesthetic, and electrical properties of polymers; loss of flavor and development of rancidity in foods; and increase in the viscosity, acidity, and formation of insolubles in lubricants. The need for antioxidants depends upon the chemical composition of the substrate and the conditions of exposure [5]. Oxidation may be inhibited by various methods including prevention of oxygen access, use of lower temperature, inactivation of enzymes catalyzing oxidation, reduction of oxygen pressure, and the use of suitable packing. Another method of protection against oxidation is to use specific additives that inhibit oxidation. These are correctly called oxidation inhibitors, but today are generally called antioxidants. Antioxidants can inhibit oxidation in two ways: either by scavenging free radicals, in which case the compounds are called primary antioxidants, or by a mechanism that does not involve direct scavenging of free radicals, in which case the compounds are called secondary antioxidants. Primary antioxidants include phenolic compounds such as vitamin E (α -tocopherol). Secondary antioxidants operate by a variety of mechanisms including binding of metal ions, scavenging oxygen, converting hydroperoxides to non-radical species, absorbing UV radiation, and deactivating singlet oxygen [6].

Indonesia is a tropical country that has many species that can be used as medicine. West Sumatra is also one particular area that has a variety of plant species used as traditional

medicine community. Among the plants that are commonly used as medicine is *Phaleria macrocarpa* (Pm) known as mahkota dewa (In West Sumatra), *Melastoma malabathricum* (Mm) known as sikaduduak and *Morinda citrifolia* (Mc) known as mengkudu. The three types of plants can grow wild anywhere in West Sumatra and found many.

Phaleria macrocarpa (Scheff.) Boerl (Thymelaceae) is commonly known as crown of god, mahkota dewa, and pau. It originated from Papua Island, Indonesia and it grows in tropical areas. This plant is one of the most popular medicinal plants in Indonesia. *Pm* grows throughout the year in tropical areas reaching a height of around 1-6 m. It is a complete tree (stem, leaves, flower and fruit) and the fruit shape is eclipse with a diameter of around 3 cm. The color of the fruit is green before ripening and red when fully ripe [8]. Traditionally, *Pm* has been used to control cancer, impotency, hemorrhoids, diabetes mellitus, allergies, liver and heart disease, kidney disorders, blood diseases, acne, stroke, migraine, and various skin diseases [9].

This wild shrub belongs to the family of *Melastomataceae* and can be found growing in various parts. [10]. *Melastoma*, well-known as 'senduduk' among the local folks, can grow up to 13 feet high in the tropics and remains perennially evergreen [11]. The most recent research on Mm revealed that its bioactive constituents exhibited free radical scavenging activity and anti-inflammatory effects on mouse ear edema [12].

Mc is an evergreen or small tree that grows in many tropical regions of the world. The fruit of this tree has a history of use as both food and medicine among Pacific Islanders and in Southeast Asia [13],[14]. Several reports have described various potential health benefits of noni fruit, including immunomodulation and antioxidant activities *in vitro* and *in vivo* [15].

The objective of this research project is to study the antioxidant activity of three unique plants from Indonesia used for medicine. Pm is usually consumed as a dry fruit for beverage, the extract of Mm leaf and the extract of Mc fruit and leaves are used interchangeably in traditional medicine for their antioxidant properties. However, there is a lack of scientific evidence about the safety and efficacy of Pm, Mm and Mc use for medicinal purposes.

II. MATERIAL AND METHOD

A. Material

The dried Pm fruit, the extract of MM leaf and Mc fruit.

B. Extraction Process

Fruit of Pm and leaf sikaduduak were extract with maceration processing by using 99.6% ethanol with a ratio of 1:1. After extraction, each extract evaporated with vacuum evaporator at a temperature of 40C for 1 hour.

C. Preparation of Dried Extract

Fruit of Phaleria, Mc and leaf of Mm were dried in oven and powdered.

D. The antioxidant method

The antioxidant activity of the dried fruit of Pm, the extract of Mm leaf and the extract of Mc fruit will be determined using the DPPH method. The method established by Tagashira and Ohtake (1998) was used with slight modification. Powder extracts of Mm, Pc and Mc were prepared at 2 mg/L, 1mg/L, 0.5 mg/L, 0,25mg/L, 0,125mg/L and 6,25mg/L in methanol. Ethanol extract of Mm, Pm and Mc were prepared at 10 mg/L, 5 mg/L, 2,5mg/L, 1,25mg/L, 0,625mg/L, 0,3125mg/L and 0,15625mg/L in methanol. A test sample solution was added to 3,8 mL of 50µM DPPH methanolic solution. After fortexing, the mixture was incubated for 30 minutes at room temperature. The changes of DPPH in color were measured at 517 nm. The differences in absorbance between a test sample and a control was expressed as DPPH radical Scavenging Activity.

The percentage was calculated by the following formula :

Percentage of DPPH Radical Scavenging Activity

$$y = \frac{\text{Abs Control} - \text{Abs sample}}{\text{Abs control}} \times 100$$

E. Total polyphenol

A 1 ml of extract was transferred to a test tube and orderly added 1 ml of 95% ethanol and 5 ml istilled water. 0.5 ml (50%) of Folin-Ciocalteu solution reagent was added to each sample. After 5 minutes, 1 ml of 5% Na₂CO₃ was added, the samples were mixed and allowed to stand 1 h in darkness and absorbance were measured at 760 nm ,against 95% ethanol as blank. Total polyphenol content were standardized against gallic acid and expressed as micrograms phenol/g sample gallic acid equivalen (GAE).

III. RESULT AND DISCUSSION

A. Percentage of Extract

The three exotic plants we prepared in two forms, dried fruit or leaf and extract in ethanol. We have obtained the results as shown in Figures 1 and 2. Medicine from natural resources are very important, because syntehtic medicine could be harmful to human health. Pm (*Phaleria macrocarpa*), Mc (*Morinda citrifolia*) and Mm (*Melastoma malabathricum*) are potent source as antioxidant.

PPm (Powder of *Phaleria macrocarpa*), PMc (Powder of *Morinda citrifolia*), PMm (Powder of *Melastoma malabathricum*),

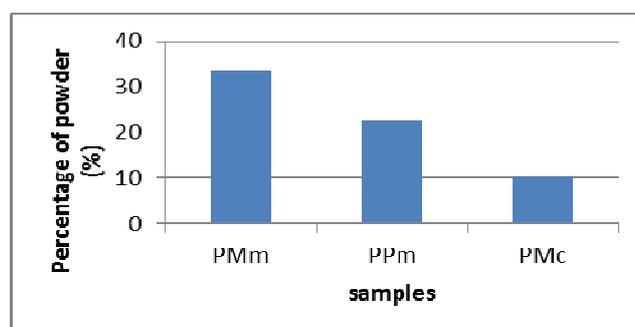


Fig. 1. Powder percentage of dried fruit and leaf of Pm, Mc and Mm.

Figure 1 showed that Mm have the highest percentage of powder. It depend on the water content content of the leaf. While the fruit of Mc, as a fruit have amount of water content. The use of dried leaf or fruit become common because the effectiveness to consume. The process was very simple, first dried the leaf or fruit then dried

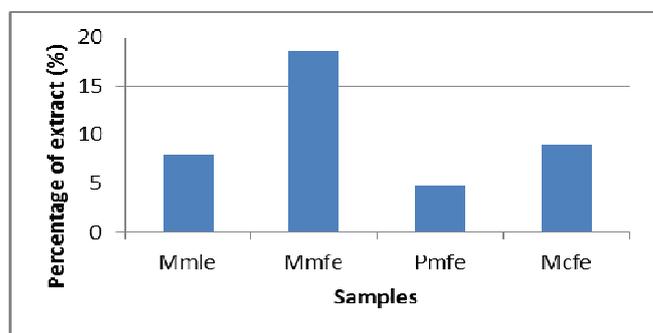


Fig. 2. The ethanol extract percentage of Pmfe (*Phaleria macrocarpa* fruit extract), Mcfe (*Morinda citrifolia* fruit extract), Mmle (*Melastoma malabathricum* leaf extract) and Mmf (*Melastoma malabathricum* fruit).

We measure leaf and fruit of Mm, and the result showed fruit have more high percentage in ethanol extract. Figure 2 showed that the use of ethanol can extract the bioactive compound from leaf and fruit.

B. DPPH Radical Scavenging Activity

The antioxidant activity measured by using DPPH as the radical solution. The result of antioxidant activity of PPM, PMC and PMm showed from Figure 2.

The antioxidant activity were measured by using DPPH as a stable free radical. The radical scavenging activity of the organic compound DPPH is considered a good *in vitro* model that is widely used to assess antioxidant efficacy within a very short time. In its radical form, DPPH disappears upon reduction by an antioxidant compound or a stable diamagnetic molecule, resulting in a color change from purple to yellow, which could be taken as an indication of the hydrogen-donating ability of the tested samples [16]. Concentration played an important for measurement. Figure 3 showed that Pmm and Ppm were have very high antioxidant. The concentration 2mg/L – 0.5 mg/L cannot be used for measurement because of very high antioxidant concentration. Started from 0,125mg/L for PMm and 0,25mg/L for Ppm can be used for antioxidant measurement with DPPH. Pmc have the lowest antioxidant activity compared with PMm and Ppm. PMm have the highest antioxidant among others. Mm extract is safe even at a high dose of 5 mg/Kg and has no oral toxicity. It was found that Mm suggest the excellent medicinal bioactivity and explain the popularity as folk medicine [17].

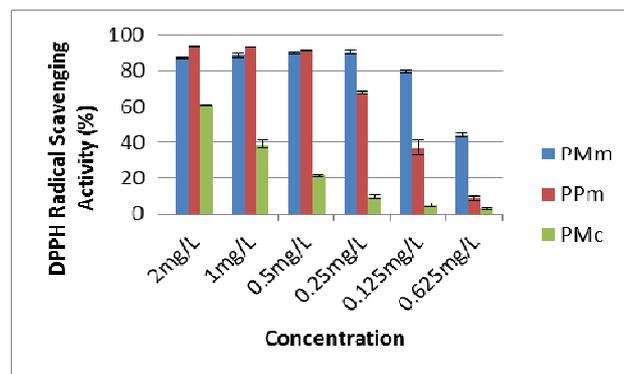


Fig.3. Dpph Radical scavenging activity of Ppm (Powder of *Phaleria macrocarpa*), Pmc (Powder of *Morinda citrifolia*), PMm (Powder of *Melastoma malabathricum*). I : Standard deviation of triplicate.

Compared three kinds of the unique plants Mm have the greatest potential as antioxidant than Pm and Mc. Mc have the lowest antioxidant activity among others.

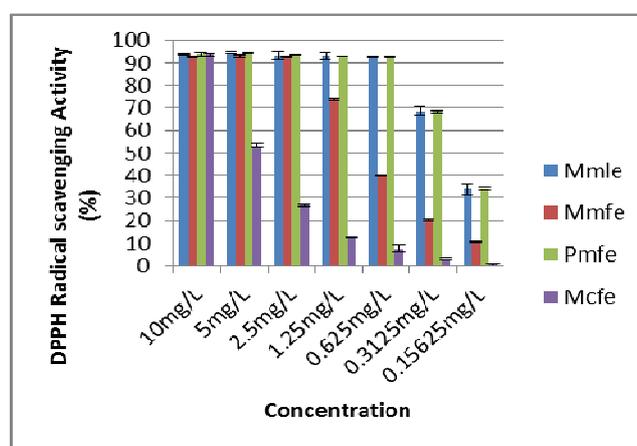


Fig.4. Dpph Radical scavenging activity of Pmfe (*Phaleria macrocarpa* fruit extract), Mcfe (*Morinda citrifolia* fruit extract), Mmle (*Melastoma malabathricum* leaf extract) and Mmf (*Melastoma malabathricum* fruit). I : Standard deviation of triplicate.

The same result with the dried fruit of Pm, Mc and Mm leaf extract, Mm was the highest antioxidant activity. Because the concentration in a very high concentration, the measurement for antioxidant begin from 0,3125 mg/L for MM and PM. Concentration 5mg/L for Mc for antioxidant measurement with DPPH methods.

Unmature white hard Mc had ORAC values of 1880 μ Mol Trolox, total phenols of 285 mg gallic acid and ascorbic acid of 224 mg per 100 g. Matured white hard Mc have high antioxidant capacity, total phenols and ascorbic acid content. [18]. According to Kamiya [19], potent antioxidants from noni fruits are neolignan, americanin A, 3,3'-bisdemethylpinoresinol, morindolin and isoprincepin.

C. Total Polyphenol

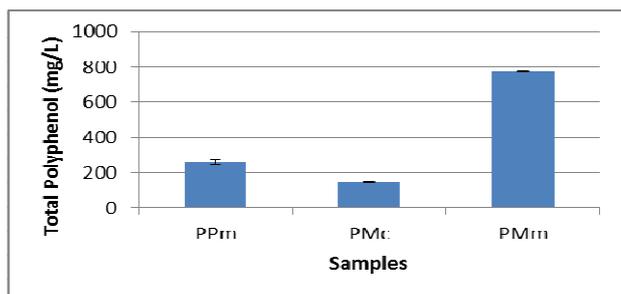


Fig. 5. Total Polyphenol of PPm (Powder of *Phaleria macrocarpa*), PMc (Powder of *Morinda citrifolia*), PMm (Powder of *Melastoma malabathricum*). I : Standard deviation of triplicate.

Figure 6 showed that the dried leaf of Mm have the highest polyphenol. Interestingly dried fruit of Pm have total polyphenol three times low than dried leaf of Mm, which means, there is another compounds act as antioxidant besides polyphenol. The compound must be very reactive with oxygen or easily to oxidated, as shown in Figure 6, total polyphenol of Pmfe not so differ with Mmle. Quercetin was found to be the most active as radical scavenger in DPPH method with IC_{50} of $0,69 \mu\text{M}$. α -Amyrin and kaempherol-3-O-(2'', 6''-diO-p-trans-coumarol) glycoside demonstrated the strongest activities in the anti-inflammatory assay of TPA mouse ear oedema with IC_{50} of $0,11$ and $0,31 \text{ mM/ear}$ respectively in Mm [12].

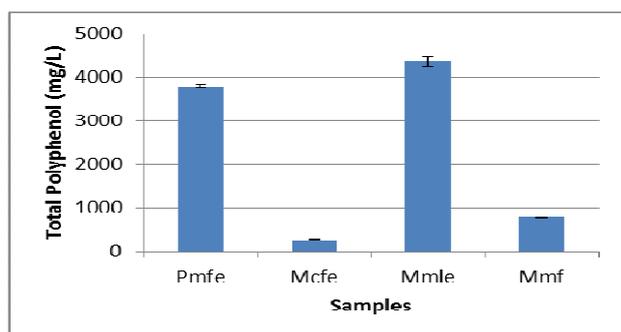


Fig. 6. Total Polyphenol of Pmfe (*Phaleria macrocarpa* fruit extract), Mcfe (*Morinda citrifolia* fruit extract), Mmle (*Melastoma malabathricum* leaf extract) and Mmf (*Melastoma malabathricum* fruit) I : Standard deviation of triplicate.

Some compounds successfully isolated from Mm by using spectroscopic techniques, resulted in the isolation of a series of flavonoids, triterpenoids and alkaloids. These compounds are α -amyrin, patriscabratine, auranamide, quercetin, quercitrin and kaempherol-3-O-(2'', 6''-diO-p-trans-coumarol) glycoside [12],[20]. The major flavonoid compounds in Pm were kaemferol, myricetin, naringin and rutin [21].

IV. CONCLUSIONS

The kinds of the unique plant of Indonesia *Phaleria macrocarpa*, *Morinda citrifolia* and *Melastoma malabathricum* were the potent antioxidant. Interestingly

Melastoma malabathricum leaf have the highest antioxidant activity and polyphenol compared to others.

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