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ARTICLE REVIEW: ANTIOXIDANT POTENTIAL OF HERBAL PLANTS OF OUTER BADUY COMMUNITY IN BANTEN AS COSMETIC RAW MATERIALS

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ABSTRACT

Antioxidants can bind free radicals, inhibit oxidative stress, stimulate oxygen and tighten the skin so as to prevent premature aging. An increase in the number of free radicals, an increase in age, and excessive exposure to ultraviolet light can accelerate the aging process or cause premature aging. Premature aging can be prevented by using cosmetics that contain natural antioxidants derived from plants. There are many herbal plants that are empirically used by the Baduy community as potential antioxidants. Proof of antioxidant activity can be done by testing the effects on each herbal plant conducted by several previous researchers. The purpose of this article is to provide information about what plants have the potential as antioxidants as cosmetic raw materials. The Literature Review Article (LRA) method involves the process of searching for data and sources through Google Scholar and Pubmed that match the inclusion criteria. Screening of journals obtained with inclusion

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criteria in the form of research articles on the Antioxidant Potential of Herbal Plants of the Outer Baduy Community as Cosmetics published in 2019 - 2024. The conclusion of this literature review is that some herbal plants in Baduy outside are obtained including Carica papaya L., Orthosiphon stamineus B., Coleus scutellarioides (L.) Benth, Imperata cylindrica (L) Beauv., Kaempferia galanga, Psidium guajava, Zingiber officinale var. Rubrum, Piper bettle, Caesalpinia sappan L. and Etlingera elatior (Jack) R.M. Sm have antioxidant activity. Secondary metabolites in plants that are most influential as antioxidants in cosmetics include flavonoids and phenolics.

INTRODUCTION

Baduy is one of the local wisdoms in Banten province. The Baduy tribe is a traditional community located around the forest area and still maintains ancestral cultural values. As it is known, forest plays a role in food security, livelihood, agriculture, source of biodiversity. Baduy is very interesting as an object of research to explore the existing knowledge of the Baduy community and make it a scientific knowledge. Some studies on Baduy community include ethnobotany study of Baduy people.

Biodiversity is a great potential possessed by a forest area. From the forest, it produces medicinal compounds, foodstuffs, timber trees. The role of plants in the traditional life of local communities in Mount Halimun National Park, West Java, shows that some plants can be grouped based on their utilization, among others, as food-producing materials, buildings, medicines and cosmetics, ceremonial complements, main energy sources, ropes and plaits and other materials.

Free radicals are one of the occurrences of the aging process which comes from the UV rays of the sun. Free radicals produced from these rays will result in photo oxidation and photo isomeration. Photo oxidation reactions occur due to the release of Reactive Oxygen Species (ROS) which can be in the form of hydrogen peroxide (H_2O_2), superperoxide anion (O_2), and hydroxyl radicals (OH) by chromophores that absorb UV light (Imrawati et.al, 2023).

The mechanism of antioxidants is to accumulate free radicals by directly neutralizing free radicals, reduce peroxide concentration and repair oxidized membranes, quench Fe (iron) to reduce ROS production, through lipid metabolism, short-chain free fatty acids and cholesterol esters neutralize ROS. Antioxidants of natural origin, such as vitamin C, vitamin E, phenolic groups, such as flavonoids, tannins, and polyphenols, can bind free radicals, inhibit oxidative stress, stimulate collagen formation, and tighten the skin, thereby preventing premature aging (Santi et.al, 2021).

METHODS

The article review process was carried out by searching journal literature through electronic databases on the internet in the form of Google Scholar and Pubmed. The search was conducted using the keyword "Antioxidant". The main data sources used included research journals published in national and international journals. Screening of journals obtained with inclusion criteria in the form of research articles on the Antioxidant Potential of Herbal Plants of the Outer Baduy Community as Cosmetics published in 2019 - 2024 and

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exclusion criteria in the form of herbal plants that are not found in Indonesia and articles that are not suitable by not including test results.

RESULT AND DISCUSSION

As a country with enormous biodiversity, Indonesia is blessed with rich natural resources including traditional medicinal materials as national assets that need to be explored, researched, developed and optimized. Aside from the Amazon rainforest, Indonesia has the second largest biodiversity in the world as indicated by the high number of indigenous medicinal plants. (Utami, 2021).

Unique small molecules called secondary metabolites perform a variety of functions and roles. Plant secondary metabolites function as antioxidants, tumors, antibiotics, and dampen carcinogenic effects. Flavonoids, alkaloids, terpenoids, steroids, saponnins, tannins, etc. are some types of secondary metabolites (Tandi et.al, 2020).

Secondary metabolites play an important role in determining the biological activity used in herbal medicine. More than 24,000 secondary metabolite structures have been isolated and evaluated for biological activity, and at least 119 bioactive compounds from plant secondary metabolites have been utilized as traditional medicine, such as kaempferol, quercetin, lutein, coumarin, piperine, andrographolid, curcumin, etc. The most common secondary metabolites found in plants with antioxidant and anti-aging properties are (Utami, Mubarak, et.al, 2023).

Pepaya (*Carica papaya* L.)

Ethanol extract using ethanol solvent on the skin of papaya fruit (*Carica papaya* L.), then obtained the same results, namely strong antioxidant activity. The research that has been done shows that from papaya fruit peel extract with IC_{50} value of 95.824 µg/mL which shows its antioxidant activity is included in the strong category because IC_{50} is between 50-100 µg/mL. The research obtained IC_{50} value is 13.769 µg/mL which shows the antioxidant activity is included in the very strong category because IC_{50} is less than 50 µg/mL. These results are in accordance with the statement of Aravind, et al, stating that phenolic compounds can be efficacious as a source of antioxidants found in plants (Santi et.al, 2021).

Research using methanol extract in the flesh of papaya fruit (*Carica papaya* L.), obtained the same results, namely strong antioxidant activity. The results are that the research that has been done shows that the methanol extract of papaya fruit meat with IC_{50} value is 99.8599 µg/mL. The research conducted obtained an IC_{50}value of 80.52 µg/mL. both studies show antioxidant activity including strong categories because IC_{50} 50-100 µg/mL. Based on the four journals that examined the flesh of papaya fruit (*Carica papaya* L.), it can be concluded that the flesh of papaya fruit has strong antioxidant activity. This is because papaya fruit (*Carica papaya* L.) is very useful as an antioxidant that can ward off free radicals in the body because of its phenolic compound content (Santi et.al, 2021).

From the results of studies conducted in several journals, it was found that the parts of papaya (*Carica papaya* L.) that have antioxidant activity are in the flesh of papaya fruit, papaya fruit skin, and papaya leaves and parts of papaya plants (*Carica papaya* L.) which have the highest antioxidant activity of all parts, namely the skin of papaya fruit from ethanol extract obtained IC_{50} value of 13,769 µg/mL (Santi et.al, 2021).

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For the first time, a DPPH· kinetic method was put out to distinguish between ripe and unripe papaya (*Carica papaya* L.) fruit ethanolic extracts. It is evident that the ripe and unripe papaya extracts have different capacities for scavenging radicals in all of the fruit sections that were examined, including the peel, pulp, seed, and pulp from the seed area. At the conclusion of antioxidant activity monitoring, the ripe papaya pulp extract had by far the highest antioxidant activity, measuring 1.2–1.4 times greater than the other ripe papaya extracts. When the values for the ripe and unripe papaya extracts' radical scavenging capacity are compared, the ripe instances' values are consistently higher (1.5–2.3 times higher), with the largest difference occurring for the seed extracts. When the antioxidant components from the ripe and unripe papaya extracts interact at the start of the reaction, the DPPH· response rates differ noticeably. The extracts from ripe papaya pulp had the highest mean DPPH· response rates overall. According to prior research, they can be compared to the DPPH· response behavior of common antioxidant compounds that are found in papaya fruit (quantification of particular antioxidant compounds was not the aim of the current work) (Iordănescu et.al, 2021).

The kinetics approach on the first time range of DPPH· reaction can be useful for a quick and easy evaluation of the overall antioxidant properties of fruit extracts designed for food, pharmaceutical, or cosmetic applications (such as non-alcoholic and alcoholic beverages, food supplements, antimicrobial, anti-inflammatory, or antioxidant products, anti-aging, anti-acne, and natural skincare products). These parallels were found for gallate and hydroxycinnamic acid moieties, which resemble the antioxidant flavonoids (e.g., myricetin) and caffeic/ferulic acids found in papaya fruit (Iordănescu et.al, 2021).

Kumis Kucing (*Orthosiphon stamineus* B.)

Testing the total flavonoid content of cat whisker leaf extract (*O. stamineus* B.) begins with a qualitative test of flavonoids using magnesium metal reagent and concentrated HCl. The test results obtained the formation of yellow color which indicates that in the extract of cat's whisker leaves (*O. stamineus* B.). Determination of total flavonoid content calculated as quercetin was done using $AlCl_3$ reagent. The yellow color that is formed is measured using a visible spectrophotometer. The test results obtained total flavonoid content calculated as quercetin of 7.34158 mg QE or 0.734158% in cat whisker leaf extract. This result shows that each gram of extract contains 7.34158 mg of quercetin (Salasa et.al, 2021).

Flavonoids are secondary metabolite compounds that belong to the group of polyphenolic compounds that are widely produced by plants. Flavonoids can also have potential as antioxidants due to their ability to provide hydrogen atoms or through the ability to chelate with metal compounds and capture oxygen. The results of antioxidant activity testing of cat whisker leaf extract obtained an average IC_{50} value of 65.62513 ppm and included in a strong antioxidant (concentration between 50 - 100 ppm). While quercetin as a comparison standard solution obtained a value of 13.84515 ppm and because the IC_{50} value is less than 50 ppm so that quercetin is classified as a very strong antioxidant (Salasa et.al, 2021).

The results showed yellow stains that appeared after spraying DPPH reagent on a purple background. DPPH is a stable free radical and is used to evaluate free radicals in natural materials. This method has the principle that DPPH will be reduced by hydrogen or

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electron donation so that the color changes from violet to yellow with a change in color intensity proportional to the number of electron donations followed by a decrease in absorbance, Rf value of *O.aristatus* extract is 0.86. The Rf range between 0.85-0.87 is considered flavonoids, because they appear green and emit yellow fluorescence after hydrolysis, and the suspected compounds are flavonols. Flavonoids act as antioxidants and protect the body against ROS. The results of in vitro testing using DPPH proved that *O.aristatus* has antioxidant activity. In in silico testing eupatorine, rosmarinic acid, and sinensetin showed oxidant activity as indicated by the number of amino acid residues that are the same as the comparator, namely the Glu 161, Pro 158, Arg 180, and Ser 160 proteins in the GPX receptor (Novita W & Amalia Falyani, 2021).

Orthosiphon aristatus is known as an herbal plant with diverse secondary metabolites, including phenolic compounds, flavonoids, and terpenoids that have pharmacological potential, especially as antioxidants. This study aims to determine plant part samples and flower color phenotypes with the best phytochemical content and antioxidant capacity, and identify potential secondary metabolite profiles in inhibiting prooxidant enzymes. The methods used include various antioxidant tests, metabolomic analysis using PCA and HCA, virtual screening, and molecular dynamics simulation. The results showed that the purple flower phenotype had the highest phytochemical content and antioxidant capacity, besides that the secondary metabolite profile showed significant differences between plant part samples with the highest concentration found in the flower and leaf parts for both flower color phenotypes, then based on virtual screening showed that orthosyphonone C had an affinity energy value of -9.7 kcal. mol-1 to the enzyme 5-Lipoxygenase (5-LOX), while salvianolic acid B has an affinity energy of -11.3 kcal.mol-1 to the enzyme inducible Nitric Oxide Synthase (iNOS), both showing good conformational stability in molecular dynamics simulations for 20 ns (Mahendra, 2024).

Miana (*Coleus scutellarioides* (L.) Benth)

The miana plant is an ornamental plant that has a purple color with a single leaf type, the purple color in the miana plant is an indicator of the presence of anthocyanin pigments that have antioxidant activity, with the activity possessed so that this plant can be utilized as a plant that can help overcome cell disorders due to free radicals, The results of qualitative tests of ethanol extract of miana leaves contain antioxidant compounds characterized by changes in purple to yellow color and quantitative tests have the potential for antioxidant activity classified as strong, namely with an IC_{50} value of 54.39 µg/mL (Purnama Aji et.al, 2022).

The results of qualitative analysis of ethanol extract of miana leaves (*Coleus atropurpureus* Benth) contained secondary metabolite compounds namely flavonoids, saponins, tannins, alkaloids and polyphenols. The average value obtained is the total content of secondary metabolite compounds flavonoids 0.2673% b/b, saponins 0.5510% b/b, tannins 0.9152% b/b and alkaloids 12.66% b/b. The results of antioxidant activity testing of ethanol extracts of miana leaves (*Coleus atropurpureus* Benth) and quercertin as a comparison have antioxidant activity against DPPH, the average IC_{50} results are 56.96 ppm and quercertin IC_{50} 17.20 ppm, classified as strong antioxidants (Tobondo, 2023).

The results of the antioxidant activity test of the miana leaf fraction and vitamin C show that vitamin C as a positive control has an IC_{50} value of 14.535 ppm which is classified

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as very strong, while the IC_{50} value of the aquadestilate fraction is 79.943 ppm which is classified as strong, the ethyl acetate fraction is 111.55 ppm which is classified as moderate, the n-hexane fraction is 240.48 ppm which is classified as moderate. So with the results of the acquisition of the IC_{50} value, it can be seen that the aquadestilata fraction has the best antioxidant activity compared to the ethyl acetate fraction and the n-hexane fraction. So with the IC_{50} results, the aquadestilata fraction of miana leaves has the potential as an antioxidant (Muadifah et.al, 2024).

Ilalang (*Imperata cylindrica* (L) Beauv.)

According to the research conducted, previous research by Saleh et.al, (2023) about phytochemical screening showed that methanol extract of alang-alang (*Imperata cylindrica* Linn.) leaves contains flavonoids, phenolics, and steroids. Flavonoids can capture free radicals by donating electrons or reducing substances. It stabilizes them and prevents the chain reaction of free radicals because its hydroxyl group is bound to the carbon of the aromatic ring.

Phenolic compounds and flavonoids, found in thatch rhizomes, can be used as a source of antioxidants. Because they have a hydroxyl group attached to the carbon of the aromatic ring, flavonoids have the ability to function as antioxidants. They can capture free radicals by donating electrons, or reductants, which results in more stable products and stops the chain reaction of free radicals. Because they have a hydroxyl group attached to the carbon of the aromatic ring, flavonoids have the ability to function as antioxidants. They can capture free radicals by donating electrons, or reductants, which results in more stable products and stops the free radical chain reaction (Wiadnyani, 2019). The 70% ethanol solvent treatment, thatch rhizome extract had the highest content in the following test parameters: 14.13% yield, 129.57 mg GAE/g extract, 90.91 mg QE/g extract, and 56.03% DPPH radical inhibitory activity with IC_{50} 0.098 mg/ml (Wiadnyani, 2019).

The methanol extract of thatch leaves has a greater polarity than the n-Hexan fraction, because the characteristics of the compounds contained in thatch leaves are flavonoid compounds that tend to be polar in nature. According to Research Saleh dkk., (2023) stated that the thatch leaves extracted with methanol contain flavonoid compounds. While the flavonoids contained in the n-Hexan fraction of the methanol extract of thatch leaves are compounds that are nonpolar, which are still bound to the glycoside group so that they inhibit the binding of DPPH radicals and result in lower antioxidants produced than the ethanol fraction. Flavonoid compounds act as antioxidants because they have hydroxyl groups that can donate hydrogen atoms to DPPH free radicals to produce reduced DPPH compounds. This can affect the antioxidant activity in a sample. The more the number of hydroxyl groups that can donate hydrogen, the higher the antioxidant activity. Based on the results of the study, it can be concluded that methanol extract of thatch leaves (*Imperata cylindrica* Linn.), n-Hexan fraction and ethanol fraction have IC_{50} values of 14.786 µg/mL, 100.371 µg/mL and 11.588 µg/mL, respectively (Munadi et.al, 2024).

Kencur (*Kaempferia galanga*)

Plant secondary metabolites have an important role in balancing intracellular redox status and antioxidant function. The bioactivity of plants as antioxidants is related to

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flavonoid compounds. KG (*Kaempferia galanga*) flavonoids showed a very strong correlation (R2 = 0.985, $p < 0.05$) with nitric oxide scavenging activity. The activity of KG as an antioxidant is influenced by the type of organ used and the content of its phenolic compounds. KG leaves have higher anti-free radical and metal ion-chelating activities compared to rhizomes. The TPC (total phenolic content) and TFC (total flavonoid content) of KG were strongly associated with its antioxidant activity (Silalahi, 2019)

According to KGEO's chemical analysis, it contains hydrocarbons, aliphatic acid esters, phenylpropanoids, monoterpenoids, and sesquiterpenoids. The main constituents of these were found to be n-pentadecane, trans ethyl p-methoxycinnamate, and trans ethyl cinnamate. In vitro and in vivo antioxidant activity experiments demonstrated that KGEO could efficiently remove various free radicals and shield zebrafish embryos from oxidative damage brought on by H_2O_2. These results suggested that KGEO possessed strong antioxidant qualities. It established a strong basis for future investigations to elucidate the fundamental mechanisms and signaling pathways responsible for KGEO's protective properties, and it has promise for advancement as a functional component in the food, cosmetic, and pharmaceutical sectors (Wang et.al, 2023).

Jambu Biji (*Psidium guajava*)

Active compounds in guava leaves that act as antioxidants derived from phenolic groups include protocatechuic acid, ferulic acid, quercetin, guavin B, ascorbic acid, gallic acid, and caffeic acid. In addition, in the flavonoid group there are isoflavonoids, flavonols, katein and chalcones. These antioxidant compounds from polyphenolics have a role as reducers, free radical catchers, and inhibit the process of ROS formation by binding metal ions needed to catalyze ROS generation (Ramadani, 2024).

From the results of several review articles above, it can be concluded that the guava leaf extract (*Psidium guajava* L.) has different antioxidant activity in each journal by looking at the IC_{50} value obtained, the results in 50% ethanol extract with maceration method have an IC_{50} value of 5.02 ppm, where the extract means it has very strong antioxidant activity, 70% ethanol extract has an IC_{50} value of 0.2 µg/mL with maceration extraction method (the smallest IC_{50} value), which means it has very strong antioxidant activity, then 70% ethanol extract using maceration extraction which is 4.68 ppm means it has very strong antioxidant activity, 70% ethanol extract with maceration method which has IC_{50} value of 22.39 µg/mL and 37.39 µg/mL means it has strong antioxidant activity, 70% ethanol extract by maceration method using n-butanol fraction has IC_{50} value of 37.14 µg/mL, ethyl acetate fraction has IC_{50} value of 29.072 µg/mL, hexane fraction 34.546 µg/mL meaning all three IC_{50} value of 23.453 µg/mL which has strong antioxidant activity, the hexane fraction 53.693 µg/mL has moderate antioxidant activity, the soxhlet method does not have high free radical inhibiting activity where this method is a hot extraction method, because high temperatures can denature antioxidant components so that they are not effective in inhibiting free radicals (Ramadani, 2024).

The findings showed that the highest levels of total phenolic, flavonoid, and carotenoid contents are found in ripe fruits (methanolic extract) (417.36 ± 2.63 µg GAE/gm of FW, 711.78 ± 0.70 µg QE/gm of FW, and 0.683 ± 0.06 µg/gm of FW), followed by

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hexane, ethyl acetate, and aqueous. According to DPPH (61.55 ± 0.91%), FRAP (31.83 ± 0.98 mM Fe(II)/gm of FW), ORAC (17.19 ± 0.47 mM TE/gm of FW), and ABTS (41.31 ± 0.99 µmol Trolox/gm of FW) assays, the methanolic extract of the ripe fruits exhibited the best antioxidant activity (Bano et.al, 2023).

Jahe Merah (*Zingiber officinale* var. Rubrum)

Red ginger has the advantage of chemical compounds compared to elephant ginger and emprit ginger as ginger varieties in Indonesia. The chemical compounds of red ginger rhizomes provide antioxidant activity of 57.14 ppm (Herawati & Saptarini, 2020). Red ginger provides a specific aroma caused by the content of essential oils and oleoresins that cause a spicy flavor. Another group of compounds from ginger that are terpenoid derivatives produce a warm sensory on the body (Verenzia et.al, 2022).

Based on the results of research and discussion, it can be concluded that red ginger rhizome extract (*Zingiber officinale* Rosc. var rubrum) contains tannins, flavonoids, saponins, alkaloids and terpenoids and has very strong antioxidant activity with an IC_{50} value of 10.35 µg/mL. Vitamin C is used as a comparator because vitamin C is more practical, safe, water soluble and a natural antioxidant compound that has very strong antioxidant activity when compared to vitamin A and vitamin E. Based on the results of the study, the IC_{50} value for vitamin C was 1.785 µg/mL (Munadi, 2020).

The antioxidant activity of red ginger rhizome extract using maceration and ultrasonication maceration methods with 70%, 80% and 96% ethanol had strong antioxidant activity, but the ultrasonication method had higher activity. The highest antioxidant activity occurred in 80% ethanol solvent with ultrasonication method. The IC_{50} value of vitamin C served as a comparison of 2.08 ppm. The IC_{50} values of maceration of red ginger extract using 70%, 80%, 96% ethanol are 92.38%, 81.11 and 86.58 ppm, while in ultrasonication maceration are 90.14ppm, 72.86ppm, 85.81ppm (Setyawati et.al, 2024).

Red ginger extract has very strong antioxidant activity supported by the active compound components present in red ginger extract which are dominated by flavonoids and phenolic compounds such as gingerol, shagaol, zingeron which provide antioxidant activity. The mechanism of action of flavonoid compounds in DPPH silencing is the presence of hydroxyl groups that are able to entangle -ROS and - RNS because they form hydroxyl, peroxyl, peroxynitrite radicals. In addition, flavonoid compounds are also able to balance radicals and increase the relative stability of flavonoid radicals. Saponin and alkaloid compounds contained in red ginger extract also contribute in providing very strong antioxidant activity, because they are able to reduce superoxide with the formation of hyperoxide intermediates that prevent biomolecular damage by free radicals (Dewi et.al, 2024).

Data obtained from the results of the study showed that ethanol extract of red ginger has the potential as a very strong natural antioxidant with an IC_{50} value of 46.91 ppm and an AAI (Antioxidant Activity Index) value of 2.3. So that the ethanol extract of red ginger can be used as herbal medicine and as raw material for phytopharmaceutical drugs. (Dewi et.al, 2024).

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Sirih (*Piper bettle*)

One of the medicinal plants that thrives in Indonesia and has been used empirically (for generations) is red betel with the Latin name *Piper ornatum* N.E.Br or Piper crocatum Ruiz & Pav. The part of the red betel plant that is widely used is the leaves. Red betel contains alkaloid compounds, polyphenols, tannins, flavonoids, steroids, monoterpenes and sesquiterpenes (Lukmayani et.al, 2024).

Betel leaf has potential as an antioxidant with an IC_{50} value of 53.91 ppm (Januarti et.al, 2019). Based on the antioxidant activity test of red betel leaf simplisia powder particles (*Piper crocatum* Ruiz & Pav) on mesh size 40/60 has an IC_{50} value of 5.96 ppm which has antioxidant activity in the very strong category. Based on the mesh size 60/80 has an IC_{50} value of 2.74 ppm which has antioxidant activity in the very strong category, which is antioxidant activity with a high IC_{50} value on mesh 60/80 (Oktavia et.al., 2023)

Penelitian yang dilakukan oleh This study compared alternative extraction techniques, namely microwave-assisted extraction (MAE), pressurized liquid extraction (PLE), supercritical fluid extraction (SFE) and ultrasonic-assisted extraction (UAE) on the levels of phenolic compounds. The results showed that MAE and UAE are shorter extraction methods than PLE and SFE. The ethanol extract of red betel leaf using maceration method gave antioxidant activity with IC50 value of 36.54 and flavonoid content of 4.07 mgQE/g while the extract using Ultrasound-assisted extraction (UAE) method for 20, 30 and 40 minutes gave antioxidant activity with IC50 value of 34.22; 32.00 and 30.76 and flavonoid content of 4.22; 4.27 and 4.32 mgQE/g extract, respectively. UAE extracts of 20, 30 and 40 minutes showed higher antioxidant activity and flavonoid content than macerated extracts. However, based on statistical tests, differences in extraction methods can have a significant effect on flavonoid levels, but are not significantly different from antioxidant activity. Based on the above statement, ethanol extract of red betel leaf has a very strong antioxidant activity, with the correct sample handling and the right extraction method and time will produce maximum activity (Lukmayani et.al., 2024).

Secang (*Caesalpinia sappan* L.)

Spices are aromatic plants that can be added to food for flavor. Parts of spices that contain phytochemicals from plant metabolic products include stems, roots, leaves rhizomes tubers, seeds, bark and flowers (Huda, 2022). Indonesia has a variety of medicinal spice plants rich in antioxidants, including secang wood (*Caesalpinia sappan* L.) from the Caesalpiniaceae family. The wood part of the secang plant contains high antioxidants and compounds such as alkaloids, tannins, and saponins (Permadi et. al, 2022).

One of the flavonoid compounds in secang wood is anthocyanin. Anthocyanins are the glycosidic forms of anthocyanidin compounds and belong to the secondary metabolism group of flavonoids. Anthocyanins are compounds that enhance health due to their antibacterial, anti-inflammatory, antioxidant, anticancer, and lipid peroxidation properties. The antioxidant activity of anthocyanins is related to the number of free hydroxyl groups around the pyran ring. The more hydroxyl groups, the higher the antioxidant activity. The easier a compound is to oxidize, the better its antioxidant capacity, because the molecule can donate free electrons or hydrogen to active free radicals (Hadi et. al., 2023).

The IC_{50} value of the ethanol extract of secang wood is 56.32 µg/mL, which is classified as a very strong antioxidant and is characterized by the presence of orange-colored

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flavonoids (Nurullita & Irawati, 2022). The isolated antioxidant compounds are alpinetin with an IC_{50} value of 20.11 µM and 3-deoxysappanone B with an IC_{50} value of 15.28 µM (Hadi et.al., 2023). Antioxidant activity using the DPPH method yielded IC_{50} values of 1.75 ppm for the methanol extract and 0.88 ppm for the Ethyl Acetate Fraction(Laksmiani et. al, 2020). The extract of secang wood contains antioxidants classified as strong antioxidants and has an IC_{50} value of 55.018 ppm(Prabawa dkk., 2019). Antioxidant extract in water heating at a temperature of ±95°C for 30 minutes obtained an antioxidant value of 1601.7 ppm (Mardhiyyah et.al., 2019). The antioxidant activity of secang wood is 85.58% (Tahir dkk., 2019). Flavonoid analysis on secang plants using UV-Vis spectrophotometry showed a wavelength of 435 nm and secang antioxidant of 3.7 mg/g (Pradana et.al., 2019). The antioxidant activity value of secang wood is 164.782 ppm (Prahasti & Hidajati, 2019).

Antioxidant Secang in food and beverages review from several literatures using the DPPH method: The duration of boiling reduces free radical inhibition (Palimbong et.al., 2020). The addition of secang wood extract as a dye at a concentration of 10% is the best treatment (Thoyibi et. al., 2019). The highest antioxidant activity based on an IC_{50} value of 169.65 mg/ml and anthocyanin content of 0.40 mg/100 g. 1480.34 ppm is needed to eliminate free radicals (Masnar & Pinandoyo, 2020). The more secang wood extract is added per 10ml, the higher the total phenolic content and the percentage of free radical inhibition of secang rice (Pranata et.al., 2021). A significant increase in antioxidants is in line with the increase in the concentration of secang wood solution in the ku'u cake samples (Tolinggi, 2021).

Kecombrang patikala (*Etlingera elatior* (Jack) R.M. Sm.)

Several previous studies have been conducted on patikala leaf samples originating from Enrekang, including the standardization of simplicia and patikala leaf extracts. The simplicia contains terpenoids/steroids, flavonoids, tannins, and saponins.while the ethanol extract contains terpenoids/steroids, alkaloids, flavonoids, and tannins. The research results show that the ethanol extract of patikala leaves (*Etlingera elatior* (Jack) R.M. Sm.) from Enrekang has ABTS radical scavenging antioxidant potential with an IC_{50} value of 37.9823µg/mL, indicating very strong antioxidant potential (Utami, Yulianty, dkk., 2023).

The findings indicated that the highest and lowest values of total flavonoid content from *E. elatior* were found in fruit extract, leaf extract, and flower extract, respectively, with values of 8.38 ± 0.15, 4.86 ± 0.10, and 2.60 ± 0.04 percent w/w Catechin Equivalent (CE), and total phenolic content from *E. elatior* were found in fruit extract, leaf extract, and flower extract, respectively, with values of 54.48 ± 1.89, 46.20 ± 0.83, and 4.80 ± 0.53 percent w/w Gallic Acid Equivalent (GAE). The highest to lowest antioxidant activity values (IC_{50}) were found in leaf extract, with 58.82 ppm (strong activity), fruit extract, at 103.05 ppm (moderate activity), and flower extract, at 251.40 (weak activity) (Safrina dkk., 2022).

The ferric reducing antioxidant power (FRAP) method and the 2,2-diphenyl-1-picrilhydrazyl (DPPH) and 2,2'-azino-bis(3- ethylbenzothiazoline-6-sulfonic acid (ABTS) radical scavenging assays were used to evaluate the extract's antioxidant activity. The IC_{50} value for the DPPH radical scavenging activity was 42.45 ± 1.37 µg/mL, compared to 2.78 ± 0.01 µg/mL for vitamin C (Positive control); for the ABTS scavenging activity, it was 26.46 ± 0.09 µg/mL, compared to 0.15 ± 0.02 µg/mL for vitamin C (Utami dkk., 2024).

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CONCLUSION

Antioxidants as cosmetic raw materials through journal literature searches in electronic databases. Some herbal plants in Baduy outside are *Carica papaya* L, *Orthosiphon stamineus* B, *Coleus scutellarioides* (L.) Benth, *Imperata cylindrica* (L) Beauv., *Kaempferia galanga*, *Psidium guajava*, *Zingiber officinale* var. Rubrum, *Piper bettle*, *Caesalpinia sappan* L and *Etlingera elatior* (Jack) R.M. Sm. Secondary metabolites in plants that are most influential as cosmetics include flavonoids and phenolics.

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