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Antioxidant Screening and Sunscreen Activity of Nanocream of Purified Extract of Kenikir Leaves (ETDK) and Tampoi Fruit Peel Extract (EKBT)

Skrining Antioksidan dan Aktivitas Tabirsurya Nanokrim Ekstrak Terpurifikasi Daun Kenikir (ETDK) dan Ekstrak Kulit Buah Tampoi (EKBT)

Ika Ristia Rahman*, Dian Kartikasari, Erwan Kurnianto, Sulastri Herdaningsih

[*]Akademi Farmasi Yarsi Pontianak, Pontianak, Indonesia
[*]E-mail: ika.ristia.apt@gmail.com

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Corresponding Author:
Ika Ristia Rahman
Akademi Farmasi Yarsi Pontianak
78232
Pontianak
Indonesia
email: ika.ristia.apt@gmail.com

ABSTRACT

Background: UV lights are free radicals that can cause damage to the skin, such as redness, burning, pigmentation, and even cancer. Kenikir leaf purified extract (ETDK) and Tampoi fruit peel extract (EKBT) contain flavonoid compounds. Flavonoid compounds can be antioxidants and sunscreens due to the presence of chromophore groups that can absorb UV rays to reduce exposure to the skin. **Objectives:** This study aims to determine the antioxidant activity and the ability of sunscreen of nanocream of purified extract of Kenikir leaves and Tampoi fruit peel extract. **Materials and methods:** Nanocream was made with 3 ETDK-EKBT combination formulas, II ETDK formulas, III EKBT formulas. The antioxidant activity test was carried out using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method and the sunscreen activity test by using the UV-Vis spectrophotometric method to calculate the sun protection factor (SPF) value of the preparation (Mansur's method). **Result:** The results showed that the nanocream formula had a strong antioxidant activity with the percent inhibition of formula I 78.28%, formula II 68.49%, and formula III 73.00%. The activity test results as a sunscreen formulation of purified extract nanocream from Kenikir leaves and nanocream from Tampoi fruit peel extract had extra protection ability with a sun-protecting factor value of 7 while the nano cream formula combined extract with an SPF value of 10 gave the maximum protection category. **Conclusion**: Nanocreams have potential as antioxidants and sunscreens.

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ABSTRAK

Sinar UV merupakan salah satu radikal bebas yang dapat menyebabkan kerusakan pada kulit seperti kulit kemerahan, terbakar, pigmentasi bahkan dapat menyebabkan kanker. Ekstrak terpurifikasi daun kenikir (ETDK) dan ekstrak kulit buah tampoi (EKBT) mengandung senyawa flavonoid. Senyawa flavonoid memiliki kemampuan sebagai antioksidan dan tabir surya karena adanya gugus kromofor yang dapat menyerap sinar UV sehingga dapat mengurangi paparan pada kulit. Penelitian ini bertujuan untuk mengetahui aktivitas antioksidan serta kemampuan tabir surya nanokrim ekstrak terpurifikasi daun kenikir dan ekstrak kulit buah tampoi. Nanokrim dibuat dengan 3 formula kombinasi ETDK-EKBT, formula II ETDK, formula III EKBT. Uji aktivitas antioksidan dilakukan dengan metode DPPH (1,1-diphenyl-2- picrylhydrazyl) dan pengujian aktivitas tabirsurya dengan metode spektrofotometri UV-Vis menghitung nilai *sun protecting factor* (SPF) sediaan (metode Mansur). Hasil penelitian menunjukan bahwa formula nanokrim memiliki aktifitas antioksidan yang kuat dengan persen inhibisi formula I 78.28%, formula II 68.49%, dan formula III 73.00%. Hasil pengujian aktifitas sebagai tabir surya formulasi nanokrim ekatrak terpurifikasi daun kenikir dan nanokrim ekatrak kulit buah tampoi memiliki kemampuan proteksi ekstra dengan lilai SPF 7 sedangkan pada formula nanokrim kombinasi ekstrak dengan nilai SPF 10 memberikan kategori proteksi maksimal. Kesimpulan: sediaan nanokrim yang diperoleh memiliki potensi sebagai antioksidan dan tabirsurya.

Kata Kunci: Antioksidan, Tabir surya, *Cosmos caudatus*, *Baccaurea macrocarpa*, Nanokrim

INTRODUCTION

The harmful effects of solar radiation are mainly caused by the ultraviolet (UV) region of the electromagnetic spectrum, which can be divided into three areas: UV-A (320- 400nm); UV-B (290-320nm) and UV-C (200-290nm). UV-C radiation can be filtered out by the atmosphere before it reaches the earth, so it is harmless. The ozone layer does not completely filter UV-B radiation so it can cause skin damage due to sunburn (Lolo et al., 2017; Walters et al., 1997). The negative effects of UV-B rays can be prevented by protection both physically and chemically using sunscreen. UV-A radiation can reach deeper layers of the epidermis and dermis and cause premature skin ageing. Excessive ultraviolet radiation is one of the causes of skin cancer. The solution to this problem is antioxidants that can counteract the formation of free radicals (Siampa et al., 2020). Skin changes such as skin redness, pigmentation, and even for a long time cause the risk of cancer generally occurs due to the oxidative process caused by UV-A rays. The use of topical antioxidants will be beneficial to deal with this problem. The challenge is that antioxidants are difficult to penetrate the skin, so they need to be formulated into a topical preparation that will help penetrate the skin (Poljsak et al., 2013).

According to Cheng (2016), kenikir (*Cosmos caudatus*) leaves contain phenol, flavonoid and ascorbic acid, which have antioxidant activity (Cheng et al., 2016). Tampoi fruit peel (*Baccaurea macrocarpa*) extract contains alkaloids, polyphenols, and flavonoids (Yunus et al., 2014). Secondary metabolites in plants that act as antioxidants are phenol and flavonoid group compounds (Loho et al., 2021). Besides having antioxidant activity, flavonoids also have chromophore groups that can absorb UV light and convert it into heat energy, so that it is suspected to have sunscreen activity.

The small nanoparticle size of 20-500 nm is an advantage of the nano cream dosage form because it can increase the absorption of active substances in the skin. Nanocream can also contain many components

of the active substance so that it becomes an option in cosmetic formulations. Purified kenikir leaf extract nano cream, tampoi fruit peel extract nano cream and nano cream with various combinations of kenikir leaf purified extract and tampoi fruit peel extract possessed particle sizes in the range of 300nm. The preparation of the nano cream provides physical properties that meet the requirements of nano cream, including pH, type of nano cream, dispersion, adhesion and per cent transmittance (I. R. Rahman & Herdaningsih, 2021). Therefore, it is interesting to test the antioxidant activity (per cent inhibition) and sunscreen activity by calculating the sun protecting factor (SPF) value of nano cream preparations of purified extract of kenikir leaves and tampoi fruit peel extract.

MATERIAL AND METHODS

Materials

Kenikir leaf was collected from Pontianak (West Borneo) and tampoi fruit peel was from Melawi (West Borneo), The purified extract of kenikir leaf and tampoi fruit peel extract were obtained from our previous research (Hermanto, 2016; I. R. Rahman & Herdaningsih, 2021)**,** 96% ethanol (Merck®), virgin coconut oil (King VCO®), Tween 80 (Brataco), PEG 400(Brataco), BHT(Quadrant), Aquadest, DPPH (Sigma Aldrich).

Methods

The production of nanocream

The production of nano cream is refers to our previous research (Hermanto, 2016; I. R. Rahman & Herdaningsih, 2021). The production of nano cream was done by using a mixer with formula composition as shown in Table 1. The oil phase (vco, tween 80 and peg 400) was homogenized by using a mixer for 15 minutes. Then added the active substance and mixed for 30 minutes. The last, aquadest was added and mixed for 30 minutes. Then, the nano cream was packaged and ready to be tested.

Table 1. The nano cream formula of kenikir leaves purified extract and tampoi fruit peel extract

Material	Formulas		
	I	II	III
Kenikir Leaves Furified Extract (gram)	1	1	-
Tampoi Fruit Peel Ekstract (gram)	1	-	1
Virgin Coconut Oil (VCO) (gram)	20	20	20
TWEEN 80 (gram)	30,4	30,4	30,4
PEG 400 (gram)	7,6	7,6	7,6
Aquadest (mL)	40	41	41

Antioxidant Activity

The nano creams of FI, FII and FIII (3 replications) were weighed 1g each, dissolved with 10 mL of ethanol p.a, filtered, and then 1 ml was taken, added with 2 ml of 2,2-diphenyl-1-picrylhydrazyl (DPPH) solution. The mixture was shaen until homogeneous and left for 30 minutes in a dark place. The

absorption was measured with UV-Vis spectrophotometry at the maximum wavelength of DPPH The antioxidant activity of the sample by the amount of DPPH radical absorption inhibition can be determined by calculating the percentage of DPPH absorption inhibition using the formula (Kartikasari et al., 2018).

$$\%\ Inhibisi = \frac{Abs.blanko - Abs.sampel}{Abs.Blanko} \times 100\%$$

Sunscreen Activity

Sun protecting factor (SPF) testing on nanocream was carried out in vitro using a UV-VIS spectrophotometer. The preparations of nanocream FI, FII and FIII (3 replications) were dissolved with ethanol into a 100 ml volumetric flask. The solution was ultrasonicated for 5 minutes and then filtered. 5 mL of the filtrate was taken andput in a 50 mL volumetric flask and then diluted with ethanol. The solution was read at a 290-320 nm wavelength with ethanol as a blank.The absorbance result is calculated for the SPF value using the Mansyur equation (Mansur et al., 1986)(Rahman & Masykuroh, 2020)

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times \mathrm{I}(\lambda) \times abs(\lambda)$$

CF = correction factor

EE = Spectrum of erythema effect

I = Sun intensity spectrum

Abs = Absorbance of sample

RESULTS AND DISCUSSIONS

The manufacture of nanocream used the high-shear stirring high energy emulsification method because it is made by using a mixer. The nanocream formula met the requirements of the physical parameters and particle size of the nanocream preparation (I. R. Rahman & Herdaningsih, 2021).

The testing of antioxidant activity of nanocream was performed by DPPH method. The principle of this measurement is DPPH, a free radical, mixed with antioxidant compounds that can donate hydrogen to reduce free radicals. The test was carried out by reacting the preparation with a DPPH solution. The initial indication of antioxidant activity can be seen from the colour of the purple DPPH solution. After responding with the sample, it will turn to yellow. The colour change of DPPH indicates a reduction reaction of DPPH by antioxidants. The results of the antioxidant activity of the preparation in the form

of percent inhibition can be seen in table 2. The percentage of inhibition in preparations containing only one extract gives a lower value than nanocream preparations with a combination of extracts. The ability to inhibit free radicals is indicated by inhibition percentage that more than 50%. The three formulas were seen to have antioxidant activity but the nanocream formula with extracts combination gave the highest inhibition value. In line with Yulianti et al (2016), the combination of extracts will provide a synergistic effect to increase the inhibitory effect of free radicals compared to preparations with single extracts. The antioxidant activity of purified extracts of kenikir leaves and tampoi fruit peel extracts is suspected by the presence of flavonoids. Flavonoids have hydroxyl groups that can be donated to free radical compounds to be stable.

Table 2. Test results of antioxidant activity

Formulas	Antioxidant activity (% Inhibition)			Average ± SD
	1	2	3	
Nano cream combinationkenikir leaves purified extract and tampoi fruit peel extract	78.15	78.28	78.41	78.28±0.13
Nano cream kenikir leaves furified extract	68.66	68.27	68.53	68.49±0.20
Nano cream tampoi fruit peel extract	73.34	72.95	72.69	73.00±0.33

Table 3. Test result of Sunscreen activity of nanocream

Formulas	Sunscreen Activity (SPF Value)			Average ± SD
	1	2	3	
Nano cream combinationkenikir leaves purified extract and tampoi fruit peel extract	9.92	10.21	10.12	10.08±0.15
Nano cream kenikir leaves furified extract	7.05	7.79	6.94	7.26±0.46
Nano cream tampoi fruit peel extract	7.81	7.83	7.80	7.81±0.01

In the activity of sunscreens, the parameter used is the SPF value of the preparation which is calculated from reading the absorbance value using a UV-vis spectrophotometer. The SPF value measurement method was developed by Mansur (1986) by measuring the absorption value at a wavelength of 290-320nm. The results of the calculation of the SPF value of the preparation can be seen in table 3. The analysis of nano cream formula with a combination of extracts has an SPF value of 10 with the category

of the effectiveness of sunscreen preparations according to the FDA to provide maximum protection. The nanocream formula containing one extract has SPF value of 7 that providing extra protection capabilities. The sunscreen activity of the nanocream preparation is thought to originate from the secondary metabolite content contained in the purified extract of kenikir leaves and tampoi fruit peel extract. Both extracts contain secondary metabolites of flavonoids. Flavonoids have chromophore groups that can absorb UV light. In line with Widiyawati (2019) , flavonoid compounds can act as sunscreens.

CONCLUSION

The nano cream from combination extracts of kenikir leaves purified extract and tampoi fruit peel extract had higher antioxidant activity and SPF value than the nano cream with a single extract.

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CONFLICT OF INTEREST

Authors declare no conflict of interest

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