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By asmiyenti djaliasrin djalil

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Asmiyenti Djaliasrin Djalil, Auliyaa Zahra Supriyatna, Arif Budiman

Faculty of Pharmacy, Universitas Muhammadiyah Purwokerto,
Jl. Raya Dukuhwaluh PO. Box 202 Purwokerto, 53182
(Email:asmiyentidjaliasrindjali@ump.ac.id)

ABSTRACT

The interest in the replacement of synthetic cosmetic antioxidants by natural ones has been increasing exponentially during recent years. Eggplant (*Solanum melongena* L.) peel contains chlorogenic acid and nasunin that have significant activity against free radicals. The objective of present study involves preparation, evaluation, and its free radical scavenging activity of herbal lip gloss containing different formulations of eggplant peel extract. Several lip gloss formulation containing 4% (F1), 6% (F2), and 8% (F3) eggplant peel extract was designed. These lip gloss were subjected to physical studies such as, viscosity, homogeneity, organoleptic, and stability. Antioxidant activity of the formulation was evaluated by DPPH (1,1-diphenyl-2picryl hidrazyl) assay method. The results showed that the extract and formulation have strong antioxidant activity. Lip gloss formulations containing eggplant peel extract have pronounced free radicals scavenging activity.

Keywords: Eggplant (*Solanum melongena* L.), free radicals scavenging, lip gloss, peel extract.

INTRODUCTION

Woman use cosmetics to enhance a persons's natural beauty, thus triggering a sense of pleasure and confidence. One of the most popular cosmetic is lip gloss that lends the lips a shiny, slick appearance, and sometimes add a subtle color (Williams dan Schmitt, 1993). Lip gloss is often used when a woman wants to have some color on their lips, but does not want an intense color effect as lipstick.

Many chemicals, chemical toxins, microorganism, infections present in atmosphere cause damage to skin. Cosmetics alone are not sufficient to take care of skin, it requires an active ingredients to minimize the skin defects to a considerable extent (Kapoor, 2005). The usage of herbal product has been increased in cosmetics, all this happen due to the synthetic based product can cause various adverse effects on human health (Kole et al., 2005; Gediya et al., 2011; Pandey et al., 2010). Bioactive phytochemicals influence

biological functions of skin and provide nutrients for the healthy skin including vitamins, antioxidants, essential oils, hydrocolloids, protein, terpenoids (Kapoor, 2005).

Purple eggplants (*Solanum melongena* L.) can be found in abundance in tropical and sub-tropical areas around the world, especially in Indonesia. It originates from China. The nutritional value of eggplants is well recognized with its high content of carbohydrats (73.5% by dry weight) protein (12-25 %), fat (2.3%), vitamins, minerals, and other nutrients (San Jose et al., 2014). According to Martiningsih's research, phytochemical screening of the ethanolic extract of eggplant fruit indicate the presence of alkaloids and flavonoids (Martiningsih et al., 2014), saponins, steroids, and tannins (Tiwari et al., 2009). The purple color of eggplants peels is due to the anthocyanine nasunin (Noda et al., 2000; Gallo et al., 2014), anthocyanins delphidin-3-rutinoside (Todaro et al., 2009). Anthocyanins are flavonoids that soluble in water and found in large quantities in fruits and vegetables. Anthocyanins can be used as natural dye (Sahar et al., 2012). The previous study shows that nasunin, chlorogenic acid, and delphidin-3-rutinoside in eggplants have significant activity against free radical and play a central role in phenomena as inflammation, aging, cancer, cardiovascular disease (Noda et al., 2000; Gallo et al., 2014; Dewana and Rochmani, 2014; Jung et al., 2011; Todaro et al., 2009). The objective of the present work was to develop cosmetic lip gloss by mixing the acidified ethanol extract of eggplant peel in order to produce antioxidant effect on lips.

EXPERIMENTAL METHODS

2.1 Materials

The peels of *Solanum melongena* L. was collected in Banyumas, Central Java, Indonesia and authenticated by taxonomist at the Faculty of Biology, Universitas Jenderal Soedirman, Indonesia. Butylated hydroxytoluene (BHT), 2,2-diphenyl-1-picrylhydrazyl (DPPH) were obtained from Sigma-Aldrich.

2.2 Preparation of extracts

Eggplant peel extraction was carried out using acidified alcoholic solvent (ethanol:water:HCl=70:30:1), solvent to solid ratio was 2:1 (v/w), and extraction at room temperature. The extract was transferred into a dark glass bottle, and then stored at 4 ^{o}C (Todaro et al., 2009).

2.3. *Antioxidant activity of Solanum melongena* L.

The antioxidant activity of *Solanum melongena* L. extract on DPPH radical was investigated following a method previously reported (Pathiranan and Shahidi, 2005). Briefly, to a methanolic solution of DPPH (400 µg/mL, 2 mL), 2 mL of test sample dissolved in methanol was mixed at different concentrations (8-20 µg/mL). Equal amount of methanol was added to the control. The reaction mixture left in the dark at room temperature for 30 min. The absorbance of the mixture was measured spectrophotometrically at 516 nm (Shimadzu UV-1801). Ascorbic acid was used as a reference. The ability to scavenge DPPH radical was calculated by the following equation:

$$\%\, inhibition = \frac{(A_0 - A_1)}{A_0} x\, 100$$

A_0 is the absorbance of DPPH radical + methanol;
A_1 is the absorbance of DPPH radical + sample extract/reference.

2.4. *Lip gloss formulation*

Several lip gloss formulation containing 4% (F1), 6% (F2), and 8% (F3) eggplant peel extract were designed. The herbal lip gloss was formulated as per method prescribed (Dhelia, 2015). The ingredients used in the formulation of herbal lip gloss are given in Table 1.

Table 1. Content of the formulations (%, w/w)

Ingredient	Control (-)	F1	F2	F3
Extract	0	4	6	8
Beeswax	1.5	1.5	1.5	1.5
Carnauba Wax	10	10	10	10
Lanolin	7	7	7	7
BHT	0.1	0.1	0.1	0.1
Nipagin	0.1	0.1	0.1	0.1
Tween 80	7.8	7.8	7.8	7.8
Oleum Rosae	9	9	9	9
Castor oil (ad)	100	100	100	100

2.5. *Evaluation of lip gloss*

There are some physical properties of the lip gloss measured on the parameters mentioned. The viscosity of the formulation was determined by Brookfield viscometer at 200 rpm, using the spindle No.4. The homogeneity test was determined as follow: a certain amount of lip gloss was applied on a piece of glass or other suitable transparent material. The normal stability test was evaluated which included organoleptic characteristics (color, odor, and appearance), over three weeks at room temperature (26 ±1 ^{o}C), elevated temperature (oven/40.0 ± 1 ^{o}C), and low temperature (refrigerator/ 4 ±1 ^{o}C) (Chairina et al., 2013). Accelerated stability test was performed to determine the stability of formulations F1, F2, and F3 under accelerated gravitational conditions by using centrifugation method (phase separation). The test was performed at 1500 g (~3750 rpm) at room temperature (25 ± 1 °C). Inspection was done for possible phase separation after 5 hours (Widayanti et al., 2014).

RESULTS AND DISCUSSION

The extraction yields of peel of eggplant by acidified ethanolic solvent is 15% (Fig 1). A previous study indicated that extraction with acidified ethanolic solvent showed the highest anthocyanine content and the strongest radical scavenging power than malic and tartaric acids solution. The combination of low extract pH, low temperature, protecion against light resulted in both extraction yield and antioxidant activity (Todaro et al., 2009).

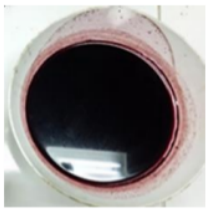

Fig 1. *Solanum melongena* L. peel acidified ethanolic extract.

Jung et al. (2011) reported that the peel ethanolic extract of *Solanum melongena* L. showed the highest anthocyanins content and antioxidant activity than ethanolic extract

of calyx, stem, leaf and pulp parts. This characteristic has been used the researchers for its possible formulation as a lip gloss consisting of the *Solanum melongena* L. peel extract as the main ingredient.

The lip gloss developed showed appropriate organoleptic characteristics (color pale pink to pink magenta), odor characteristic of oleum rosae, appearance pastes (Fig 2). The lip gloss showed a homogeneous composition and no visible coarse grains (Table 2). Tween 80, as emulsifier, prevent droplet aggregations and coalescence during formation of lip gloss, producing a homogeneous product. The viscosity values are practically dependent of extract concentration. The viscosity of lip gloss increases with increases *Solanum melongena* L. peel extract concentration (Table 2).

Fig 2. Formulated lip gloss eggplant peel *melongena* L. peel ethanolic extract.

Table 1· Physical characteristics of the formulations

Parameters	Control (-)	F1	F2	F3
Colour	Pale Yellow	Pale pink	Pink	Pink magenta
Viscosity	3344±48	4300±129	5056±37	5164±30
Phase separation	No change	No change	No change	No change
Homogeneity	homogeneous	homogeneous	homogeneous	homogeneous

The color of the formulations were changes under room, oven, and refrigerator conditions from light-yellow to darker yellow after three weeks. These results indicated the deleterious effects of lights on anthocyanin pigments. Coloration of anthocyanins varies with the pH of the environment. In aqueous environment, four types of

anthocyanins exist at equilibrium i.e., flavylium cation (red), carbinol base, quinoidal base, and chalcone (colorless) (Ozela et al., 2007).

The odor, characteristic of oleum rosae, remained stable throughout the 3 weeks of testing under all conditions evaluated. The homogeneity was considered good for the formulations stored at room temperature. They showed uniformity upon application without fragmenting or deforming of the pastes, throughout the stability Test. Under the oven and refrigerator condition, the lip gloss materials presented a change of consistency. The formulation of a lip gloss from *Solanum melongena* L. peel extract is relatively cheaper considering that the plant is found in abundance in Indonesia.

The results showed, both *Solanum melongena* L. peel extract and formulations showed a significant activity of free radicals scavenging (Table 3). The formulation F3 has better activity than other formulations. The formulation exhibited antioxidant activity that increased with increasing amount of extract concentration of lip gloss. It was observed that the DPPH radical scavenging ability of the extract (IC_{50} 26.8 µg/mL) or F3 (41.1 µg/mL) were less than those of ascorbic acid (IC_{50} 20.3 µg/mL).

Table 3. DPPH scavenging activities of natural lip gloss compared with ascorbic acid and the eggplant extract

Sample	IC_{50} (µg/mL)
Ascorbic acid (positive control)	20.3 ± 0.8
Eggplant peel extract	26.8 ± 0.2
Formula 1	42.3 ± 0.2
Formula 2	42.0 ± 0.2
Formula 3	41.1 ± 0.2

CONCLUSIONS

Based on the results of our study, it can be concluded that the lip gloss formulation studied showed a significant activity of free radicals scavenging activity. Further investigations should be considered for enhancing the stability of *Solanum melongena* L. peel extract in the formulation.

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