Microemulgel formulation of *Kepok* banana peel extract (*Musa paradisiaca* L) as an antioxidant

F F Sriarumtias¹, A Najihudin¹, I R Putri¹, A Akmal² and S Hamdani¹

¹Program Studi Farmasi, Fakultas MIPA, Universitas Garut, Jl. Raya Samarang No. 52A Garut, Indonesia
²Lembaga Farmasi Direktorat Kesehatan Angkatan Darat, Jl. Gudang Utara No. 26 Merdeka, Sumur Bandung, Kota Bandung, Jawa Barat

*framesti@uniga.ac.id*

**Abstract.** The idea to utilize banana peel which had only become organic waste so far, led the researchers to conduct this study. The purpose of this study was to utilize *Kepok* banana peel into microemulgel which had stable characteristic and antioxidant activity. The peel of *Kepok* banana was extracted using maceration method with methanol solvent. The resulting extracts were then tested for antioxidant activity with the DPPH (1,1-diphenyl-2-pikrilhidrazil) method, obtained IC50 values of 659,544 ppm. Concentration extracts in microemulgel formulation were 1X IC50 (F1), 2X IC50 (F2), 3X IC50 (F3) and positive controls containing vitamin C (F4). All formulas were evaluated including organoleptic, pH, viscosity, centrifugation, dispersion, irritation test and freeze and thaw. The evaluation results showed that only formula F3 changed organoleptically and decreased viscosity. The testing of antioxidant activity microemulgel containing banana peel extract revealed that F2 was the best formula on pharmaceutical requirements with the IC50 was 638 ppm and had good stability. For all formulas after an irritation test, no erythema or edema was found. Therefore, the irritation index was zero. The benefits of this study could provide an alternative source of phytocosmetic preparations as antioxidants and utilize organic waste into something useful.

1. Introduction

*Kepok* banana peel (*Musa paradisiaca* L.) which is usually a waste turned out to be used as an alternative treatment, such as being a mosquito repellent, smoothing facial skin, preventing premature aging, eliminating chicken pox scars and acnes [1-2]. Banana plants have pharmacological effects such as wound healing, antidote to snake bites, hypoglycemic and antioxidants. There are even several studies that state that banana leaves have antibacterial activity in nosocomial infections [3]. Banana peel contains several flavonoid compounds, namely catechins, galokatecin and epikatekin [4-5]. On the peel of *Kepok* banana, two isolate compounds are obtained, namely 5,6,7,4-tetrahidroxy -3,4-flavandiol and 2-cyclohexene-1-on-2,4,4-trimethyl-3-0-2-hydroxypropyl ether [6-7].

Antioxidants are compounds that can overcome or neutralize free radicals so that the oxidation process in body cells is inhibited. The function of the antioxidant itself is to reduce the occurrence of skin damage process, loss of sensory quality and skin nutrition due to free radicals [8,9]. Preparation form commonly used for skin is cosmetic preparations for skin care sourced from nature, namely phytokometrics. One source of antioxidants that can be used as phytocosmetics is *Kepok* banana peel.
In the previous studies, *Kepok* banana peel extract had not been used as cosmetics. Research on banana peel only revolved around the study of phytochemicals. In this study, a product containing banana peel extract which had the potential as an antioxidant was developed. The form of preparation used was a microemulgel preparation. Microemulgel was a composite preparation of microemulsions and gels.

Microemulsions are transparent colored preparations, thermodynamically stable and consist of two phases, the oil phase and the water phase [10-11]. Microemulsions are excellent carrier systems for lipophilic drugs or hydrophilic drugs which are not stable to water or easily hydrolyzed. The system of microemulsions has an oil system in water and water in oil. Colored microemulsions are transparent due to the effect of adding surfactants in a great quantity until micelles are formed. Due to its small size microemulsion is a good carrier system for drugs penetrated through the skin [12-13].

This study aimed to make microemulgel preparations from methanol extract of *Kepok* banana peel which is stable and comfortable to use [10,14]. In addition, this study also attempted to prove that the methanol extract from *Kepok* banana peel in microemulgel preparations had antioxidant activity [15-16]. The benefits of this study were to provide an alternative source of phytocosmetic preparations as antioxidants and to utilize organic waste to be of value to use.

2. Research method

2.1. Materials

2.1.1. Instruments. The instruments used in this study were 50 mL beaker, 250 mL and 500 mL (Pyrex), 100 mL measuring cup (Pyrex), 50 mL and 100 mL volumetric flask (Pyrex), glass funnel (Pyrex), analytic balance (Mettler Toledo AG245), maceration container, filter paper, rotary evaporator (B-One), drip pipette, stirring rod, crucible cup, oven (Tomori), micropipette (Dragonlab), UV-Vis spectrophotometer (Shimadzu UV-1800), Brookfield viscometer, pH meter (Bench), centrifugation (Kubota 5100), ultra turrax (IKA).

2.1.2. Materials. The materials used in this study were simplicia of *Kepok* banana peel (Musa paradisiaca L), carbopol 940, liquid paraffin (Brataco), tween 20 (Brataco), span 20 (Brataco), propyleneglycol (Brataco), propyl paraben (Brataco), methyl paraben (Brataco), ethanol 96% (Brataco), aquadest (Brataco), DPPH (Sigma Aldrich Singapore), vitamin C (Sigma Aldrich, Singapore), methanol p.a (J.T. Baker), as well as the animal testing.

2.2. Methods

2.2.1. Antioxidant activity. The methanol extract of *Kepok* banana peel was made into a solution concentration of 100 ppm; 200 ppm; 300 ppm; 400 ppm; 500 ppm and 600 ppm. For comparison, one of the antioxidant sources was Vitamin C with a concentration of 10 ppm; 20 ppm; 30 ppm; 40 ppm; 50 ppm; and 60 ppm. Measurements were made by mixing DPPH with a sample of 1: 1, incubated for 30 minutes then measured by visible light spectrophotometry at a wavelength of 516 nm. Then the absorbance results were calculated to get % inhibition, by calculation [8]:

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\% \text{Inhibition} = \frac{\text{Abs control} - \text{Abs sample}}{\text{Abs control}} \times 100\%
\]

2.2.2. Mikroemulgel formulation. Making microemulgel was carried out in two stages. The first step was to make oil-type microemulsions in water. The second stage was to mix the microemulsion with a gel base. After making the gel phase and microemulsion phase and microemulgel formed, methanol
extract of banana peel was added [16]. Five formulas were made with extract concentrations of 1X IC50, F0 2X IC50, F3 3X IC50 and F4 as positive controls containing vitamin C.

2.2.3. Evaluation. Evaluations carried out including organoleptic observations in the form of colors, smells and shapes [14,17,18]. Measurement of pH, viscosity, centrifugation test, Freeze and Thaw test for 5 cycles [19]. All evaluations were carried out for 28 days with observations on days 1, 7, 14, 21 and 28 days. And the irritation test was carried out on 3 guinea pigs.

3. Result and Discussion
The results of the determination stated that the plants used in this study were Kepok banana peel (Musa paradisiaca L) (Figure 1). The antioxidant activity test was tested using the DPPH (1,1-diphenyl-2-pikrilhidrazil) method. DPPH was a free radical or a stable antioxidant that had one excess electron in its structure. The principle of this DPPH method was the presence of antioxidant compounds which donated H+ to DPPH so that it converted purple DPPH free radicals to non-radical compounds which were pale yellow or the color was disappeared.

According to the results of measurements using the DPPH method (Table 1), it was revealed that IC50 from the methanol extract of Kepok banana peel was 651,445 ppm while the IC50 of vitamin C was 39,872 ppm. The optimization results of the emulgel base obtained the most stable base, namely B2 with a clear or transparent physical appearance, formed base and no separation occurred after centrifugation.

![Figure 1. Kepok banana peel (musa paradisiaca L).](image)

| Table 1. Base formula with various tween 20 concentrations. |
|----------------|----------------|----------------|----------------|
| Material       | B1  | B2  | B3  | B4  |
| Carboxol 940   | 2   | 2   | 2   | 2   |
| Liquid paraffin| 10  | 10  | 10  | 10  |
| Tween 20       | 25  | 30  | 35  | 40  |
| Span 20        | 20  | 20  | 20  | 20  |
| Propylenglycol | 10  | 10  | 10  | 10  |
| Propylparaben  | 0,1 | 0,1 | 0,1 | 0,1 |
| Methylparaben  | 0,05| 0,05| 0,05| 0,05|
| Ethanol 96%    | ad  | 15  | 15  | 15  |
| Aquadest       | ad  | 100 | 100 | 100 |
The next step was to make emulgel preparations with variations in the concentration of methanol extract of *Kepok* banana peel 1XIC50, 2XIC50, and 3XIC50 and vitamin C with a concentration of 1XIC50 was used as a positive control (Figure 2). Observation results of the five emulgel organoleptis with extract content varied at room temperature for 28 days revealed that F1, F2, and F4 preparations did not show changes in odor, color, and shape. Thus, it could be concluded that the three emulsions were physically stable at room temperature storage.

Antioxidant activity testing on day 1 in this study revealed that emulgel containing methanol extract of *Kepok* banana peel with various IC50 strength namely 1XIC50, 2XIC50, and 3XIC50 measured antioxidant activity with vitamin C as a comparison (Figure 3). Determination of antioxidant activity using the DPPH method was expressed by% inhibition. The greater the% inhibition obtained, the greater the antioxidant activity was. After making the emulgel preparation, antioxidant activity was measured by the DPPH method. It was found that IC50 values of each emulgel with the strengths of 1XIC50, 1XIC50, and 3XIC50, were respectively 646 ppm, 627 ppm and 603 ppm. Based on these data, it could be figured out that the emulgel of the methanol extract of *Kepok* banana peel with the strength of 3XIC50 had the strongest antioxidant activity among the emulsions of *Kepok* banana extract methanol with 1XIC50 and 2XIC50. Compared with emulsions containing vitamin C with obtained IC50 value was 46.94 ppm, the three methanol emulgel extracts of *Kepok* banana peel had lower antioxidant activity. This indicated that antioxidant activity of vitamin C emulgel was more powerful than other emulgels.

Then the measurement of antioxidant activity was carried out after 30 days of storage. This measurement was carried out to determine the resistance of antioxidant activity during storage. The IC50 results obtained from the three formulas were 688 ppm, 638 ppm and 612 ppm. IC50 value of vitamin C emulgel was 46.52 ppm. From these results indicated that there was a decrease in antioxidant activity
after the extract was formulated in the emulgel preparation. This occurred since the containers used were not airtight and dark. As a result, some of the emulgels were oxidized at room temperature and light. However, in the case of vitamin C emulgel, these results indicated that there was no decrease in antioxidant activity. Those, it could be concluded that by adding excipients did not affect the activity of vitamin C.

Observations on the emulgel irritation test were performed to find out whether the excipients used in the formulation had irritating properties to the skin. Observations were carried out by observing the presence of erythema and edema that occurred in the skin of guinea pigs. Then the erythema and edema scores were given, followed by calculating the irritation index. The irritant index results from the emulgel base revealed that the emulgels of the methanol extracts of *Kepok* banana peel with the strength of 1XIC50, 2XIC50, 3XIC50 and vitamin C 1XIC50 were not causing skin irritation problems.

4. Conclusion

From the results of research on emulgel preparations containing methanol extract of *Kepok* banana peel (Musa paradisiaca L) with various concentrations of 1XIC50, 2XIC50, and 3XIC50 used as antioxidants, it could be concluded that formula 2 was the formula that best met pharmaceutical requirements. The microemulgel formula on F3 had the strongest antioxidant activity with IC50 value of 612 ppm compared to the methanol emulgel of F2 *Kepok* banana peel extract with IC50 value was 638 ppm and emulgel of methanol extract of F1 *Kepok* banana peel with IC50 value was 688 ppm. Emulgel formula of methanol extract of *Kepok* banana peel did not show skin irritation reaction after use.

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