# Antioxidant Activity of Peel Off Mask Preparation with Green Apple (*Malus domesticus*) Juice and Ultrasonic Extraction

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**Abstract.** Apple is a plant that has the potential of antioxidant activity. Apples contain antioxidants which are good for skin health. Green apples contain lots of vitamins, such as vitamins A, B, C, minerals, and fiber. Green apple containing phytochemical compounds in the form of catechins, epichatechins, ploridzin, quercetin, ellergic acid, and colorogenic acid. Peel-off gel mask is a skin care cosmetic preparation in gel form and after being applied to the skin for a certain time until it dries, this preparation will form a transparent, elastic film layer, so that it can be peeled off. Pharmaceutical preparations in gel form are widely used in cosmetic preparations. Gel is preferred because the water content is large enough, so it feels cold on the skin, easy to apply, not greasy, easy to wash, elastic, and has good drug release. The peel off mask product from green apple extract is expected to be useful in preventing aging because it can function as an antioxidant. This study used an experimental method from gel mask formulation with juice and ultrasonic extraction of green apple fruit. Each peel-off gel base mask is added with 2 g of green apple juice extract and 2 g of green apple maceration extract. Then stir until homogeneous. The peel off mask was tested for antioxidant activity by Uv-Vis Spectrophotometry with the DPPH method. The antioxidant activity of the peel off mask from green apple ultrasonic extract obtained IC50 value was 30,544 ppm and the peel off mask from green apple juice extract obtained IC50 was 9,771 ppm where IC50 value of quercetin was 6,989 ppm. According to the parameter IC50 value, it indicates that the peel off mask formula has a very strong antioxidant (IC50 value $< 50$).

**Keywords:** Green apple · Peel off mask · Antioxidant · DPPH

## 1 Introduction

Fruits are a source of natural ingredients that contain high levels of antioxidant compounds. Compared to synthetic antioxidants, natural antioxidants are generally safer for consumption and can improve the body's health status. Indonesia is one of the eight centers of plant genetic diversity in the world, especially tropical fruits which have the potential as a source of natural antioxidants [1]. One of the plants that have the potential


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of antioxidant activity are apples [2]. Apples contain antioxidants which are very good for skin health [3]. Green apples contain lots of vitamins, such as vitamins A, B, C, minerals, and fiber [4]. In green apples, there are phytochemicals in the form of catechins, epichatechins, ploridzin, quercetin, ellergic acid, and colorogenic acid [5].

Face masks are very popular beauty care cosmetics to improve skin quality. The peel off face mask is one type of face mask that has the advantage of being used, which it can be easily removed or lifted like an elastic membrane [6]. At present, many face mask preparations available in the market are combined with natural ingredients which can add to the useful value of these mask preparations. Based on the results of preliminary survey, face mask products containing apple extracts are still limited on the market, while apples have good benefits for the skin and face because of their antioxidant content, the authors write scientific papers about making peel off masks and the activity of their antioxidant compounds. Therefore, it is necessary to develop products containing green apples into pharmaceutical preparations such as peel off masks.

## 2 Material and Methods

### 2.1 Material

Green apple, polyvinil alcohol, carboxymethyl cellulose glyserin, benzoic acid, distilled water, DPPH, quercetin, ethanol.

### 2.2 Extraction

Ultrasonic extraction using ultrasonic appliance. Green apples are thinly sliced and oven-dried at 45 °C for 24 h. Crushed dry green apples to a powder. Green apple powder in the amount of 100 g then add 600 mL of 70% ethanol. Stir for 5 min and digest with a 50 kHz ultrasonic appliance at 35 °C for 30 min. The extract was concentrated using a rotary evaporator at 50 °C and followed by water bath at 60 °C until thick. Juice extract obtained by destructing 100 g of green apple in juicer to extract the juice.

**Table 1.** Formulation.

| Compound | Concentrations (%, b/v) | |
|---|---|---|
| | Formula I | Formula II |
| Polyvinil alcohol (PVA) | 7 | 7 |
| Carboxymethyl cellulose (CMC) | 1,5 | 1,5 |
| Glyserin | 4 | 4 |
| Benzoic acid 0,25% | 8 drops | 8 drops |
| Green apple juice extract | 2 | - |
| Green apple ultrasonic extract | - | 2 |
| Water q.e.f. | 100 | 100 |

### 2.3 Formulation

Although the concentrations of some compounds varied according to the experimental design (Table 1), the preparation procedure was the same for every formulation. Initially, PVA was dispersed in 80% of heated water (80 °C) used to produce the formulation. The dispersion was constantly homogenized until total dissolution. Carboxymethyl cellulose were dissolve with the remaining amount of water (20%). The solutions were mixed, then added with glyserin, benzoic acid. Last, extract were added and stirred until homogeneous.

### 2.4 pH Test

As much as 1 g of cream dissolved in 10 mL of distilled water. Then stir until homogeneous. And the pH is measured with a pH meter.

### 2.5 Antioxidant Activity Test

Antioxidant activity test were obtained from peel of mask preparation. Radical scavenger antioxidant activity test in apple extract was carried out using the DPPH method with spectrophotomers. Each sample was diluted in ethanol (1 mg $mL^{-1}$) at different concentrations (5, 10, 15, 20 and 25 ppm). Each 2 mL of the final solution consists of 1 mL of extract and 1 mL of DPPH solution (125 μM in ethanol). The solution was then mixed and rested at 37 °C for 30 min in a dark room. The light absorption by the solution was measured at a wavelength of 517 nm using spectrophotometry. DPPH solutions were used as controls. Quercetin is used to create standard curves. Concentrations were made (2, 4, 10, 20, 30 ppm). DPPH radical scavenging activity is expressed as % inhibition against DPPH radicals. The percentage of inhibition is calculated equation:

$$\%\ of\ inhibition = \frac{\left(A_{blank} - A_{sample}\right)}{A_{blank}} \times 100\% \tag{1}$$

and then the linear plot of %inhibition versus concentration was analyzed using equation:

$$y = bx + a \tag{2}$$

where x is the concentration of the measured substance and y is the % inhibition. Meanwhile, the IC50 value was determined as the x value of this equation when y was equal to 50%. Antioxidant characteristic depicted in Table 2.

**Table 2.** Antioxidant characteristic based on IC50 values [7].

| The IC50 Value | Antioxidant Characteristic |
|---|---|
| 200 ppm–150 ppm | Less |
| 150 ppm–100 ppm | Moderate |
| 100 ppm–50 ppm | Strong |
| <50 ppm | Very strong |

# 3 Results and Discussion

## 3.1 Results

See Figs. 1, 2 and 3.

## 3.2 Discussion

Polyvinil alcohol (PVA) in this formulation plays a role in providing a peel off effect because it has adhesive properties so that it can form film layer which is easy to peel off

**Table 3.** The pH value of peel off mask preparation.

| Treatment | pH Value |
|---|---|
| Formula I | 6,00 |
| Formula II | 4,93 |

**Table 4.** Percentage inhibition of dpph radical by quercetin and peel off mask.

| Treatment | Concentration (ppm) | % of inhibition |
|---|---|---|
| Quercetin | 2 | 33,611 |
| | 4 | 44,654 |
| | 10 | 61,805 |
| | 20 | 80,922 |
| | 30 | 89,101 |
| Formula I | 5 | 8,408 |
| | 10 | 16,617 |
| | 15 | 20,320 |
| | 20 | 32,533 |
| | 25 | 40,941 |
| Formula II | 5 | 0,700 |
| | 10 | 10,110 |
| | 15 | 15,415 |
| | 20 | 18,118 |
| | 25 | 21,421 |

**Table 5.** IC50 Value and actioxidant characteristic of quercetin and peel off mask.

| Treatment | IC50 (ppm) | Antioxidant Characteristic |
|---|---|---|
| Quercetin | 6.989 | Very Strong |
| Formula I | 30,544 | Very Strong |
| Formula II | 9,771 | Very Strong |

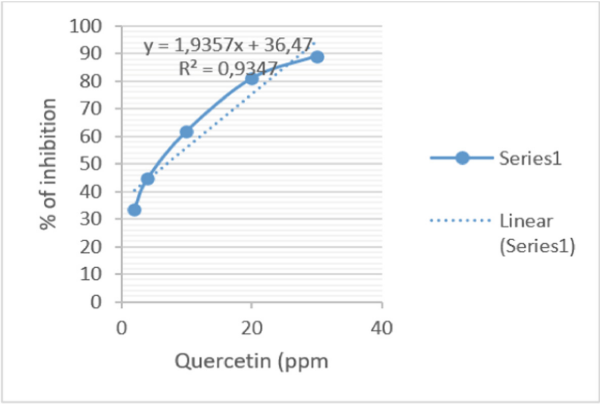


**Fig. 1.** Correlation curve of the percentage of antioxidant activity and concentration of quercetin.

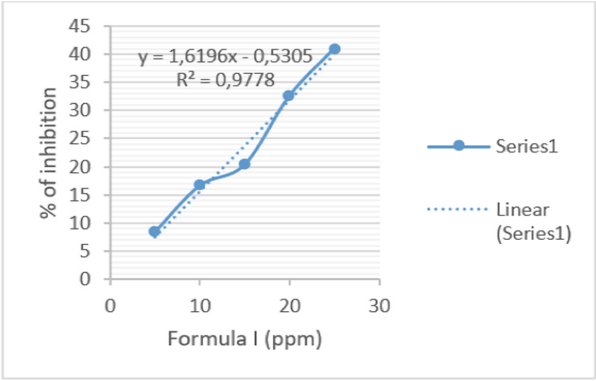


**Fig. 2.** Correlation curve of the percentage of antioxidant activity and concentration of Formula I.

after dry [8]. Peel off mask were made by dissolving PVA in 80% of heated water (80 °C) used to produce the formulation. The dispersion was constantly homogenized until total dissolution. Carboxymethyl cellulose were dissolve with the remaining amount of water (20%). The solutions were mixed, then added with glyserin, benzoic acid. Last, extract were added and stirred until homogeneous [9].

Carboxymethyl cellulose is a gelling agent, compounds that can increase fluid resistance or form the viscosity of the solution to form a mass compact gel [10]. Glycerine was added into the peel gel mask dosage formulation off as a humectant will keep stability of the preparation through moisture absorption of the environment and reduction evaporation of water from the preparation, so that apart keep stability, humectant too plays a role in maintaining skin moisture [11].

The pH test is carried out to find out the resulting cream is acidic or alkaline seen from its pH value obtained. In topical preparations, pH related to the taste when applied topically, pH that will be too acidic or alkaline cause irritation to the skin so need to

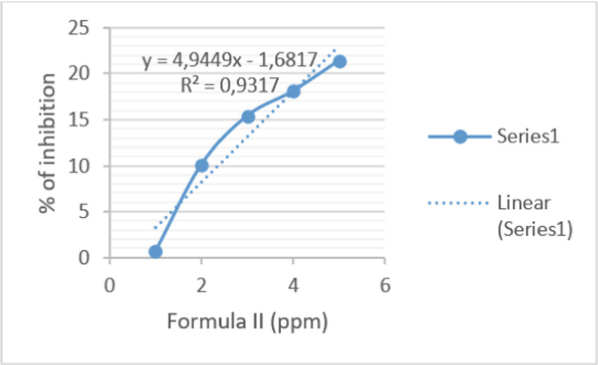


**Fig. 3.** Correlation curve of the percentage of antioxidant activity and concentration of Formula II.

match the cream preparation with skin pH. The skin is a covering layer the body surface of the dam has a function the main skin as a protection from various kinds of disorders and external stimuli with a pH range on topical preparations 4,5–6,5 [10]. The results of the pH test showed that the pH value of Formula I was 6 and the pH value of formula II was 4,93 (Table 3). This shows that the peel off mask formula meets the pH requirements so it can be used for the skin and does not cause irritation.

Peel off mask formula were subjected for the evaluation of antioxidant activity by using DPPH radical scavenging activity. DPPH radical scavenging activity is expressed as % inhibition against DPPH radicals. The percentage of inhibition depicted in Table 4. The IC50 value is the effective concentration of the formula needed to reduce 50% of the total DPPH [12]. Quercetin is a polyphenol usually used as standard for determination of radical scavenging property as positive controls [13].

Based on Table 5, the IC50 value of Quercetin was 6,989 ppm; Formula I (peel off mask with juice extract) was 30,544 ppm; and Formula II (peel off mask with ultrasonic extract) was 9,771 ppm. The smaller of the IC50 value means the stronger of the antioxidant activity [7]. This data showed that quercetin has the smallest IC50 value means the strongest antioxidant activity. Formula II has stronger antioxidant activity than Formula I. The result of all test samples shows that the IC50 value is less of 50. According to the parameter IC50 value in Table 2, it indicates that the quercetin and peel off mask formula has a very strong antioxidant (IC50 value $< 50$).

Formula II (peel off mask with ultrasonic extract) has stronger antioxidant activity than Formula I (peel off mask with juice extract). The classical techniques for juice method has deficiency is the resulting juice easily overgrown with microbes and not can be stored for a period of long time. The amount of juice produced in the form of a liquid extract not thick extract so that the volume which should be consumed large enough [14]. The mechanical effects of ultrasound provide a greater penetration of solvent into cellular materials and improves mass transfer. There is an additional benefit for the use of power ultrasound in extractive processes which results from the disruption of biological cell walls to facilitate the release of contents [15].

## 4 Conclusion

The antioxidant activity of the peel off mask from green apple ultrasonic extract obtained IC50 value was 30,544 ppm and the peel off mask from green apple juice extract obtained IC50 was 9,771 ppm where IC50 value of quercetin was 6,989 ppm. According to the parameter IC50 value, it indicates that the peel off mask formula has a very strong antioxidant (IC50 value $< 50$).

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