

Curcumin and Extract of *Plantago major*, L Increased SPF Value of Cold Cream Base

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Abstract

Octyl methoxycinnamate as the active material of the sunscreen would be degraded after being exposed to the sunlight. Curcumin, rice flour and the extract of *Plantago major*, L was the material that could function as the sunscreen. The aim of this research was to know the SPF value and the physical characteristics of cream of the sunscreen with the active material octyl methoxycinnamate after the addition of the optimum composition of curcumin and the extract of *Plantago major*, L and the optimum composition of rice flour and the extract of *Plantago major*, L. In this research three formulas was examined, i.e. the formula I with the active material octyl methoxycinnamate, the formula II with the active material octyl methoxycinnamate and the optimum composition curcumin and the extract of *Plantago major*, L, Formula III with the active material octyl methoxycinnamate and the optimum composition rice flour and the extract of *Plantago major*, L. SPF value of each formula was determined by using the Petro method (1981) using UV spectrophotometric method at a λ 290 nm-320 nm. The physical characteristics i.e. the power spread, the adhesiveness and the viscosity were also examined analysed with Anova one way at a confidence level 95%. Result of the research show that SPF value increased after the addition of the optimum composition of curcumin and the extract of *Plantago major*, L. The physical characteristics of cream of the sunscreen do not change after the addition of the optimum composition curcumin and the extract of *Plantago major*, L and the optimum composition rice flour and the extract of *Plantago major*, L.

Key words: Octyl methoxycinnamate curcumin, flour rice, extract of *Plantago major*, L, sunscreen

INTRODUCTION

Indonesia is a tropical country with two seasons, the rainy season and dry season. In dry season intensity of the sunlight is very high. The sunlight is really needed by all the living organism for continuation of his life. On the other hand the high intensity of sunlight could result in damage to some human bodies. The part of human body to protect from the effect of the sun light is the layer of skin. Skin could damage if skin get the sunlight in the high intensity in a long time.

To protect skin from the exposure of the sunlight, skin must be covered the material that could prevent direct exposure the sunlight onto skin. Such product is known as sunscreen. Based on the Diffey (2001) user of the sunscreen can reduce the risk of the skin cancer. The mechanism of the sunscreen is absorbing the sunlight and reflecting again the sunlight. Results of the Green research et al. (1999) said that the use of the sunscreen could reduce the probability of the skin cancer.

Plants that often are used in sunscreen are turmeric and rice flour. Turmeric contains

curcumin while rice flour contains amilum. Moreover extract of *Plantago mayor*, L contains antioxidan which is very useful to protect skin from the effect of the free radical (Hertiani, 2000). The compound could increase effectivity of sunscreen based on the value of percent of the transmission eritema and pigmentation (Sugihartini, 2004). Each of this material can be used as the active material of sunscreen.

Black (1990) reported that antioxidan had the potential as photoprotector. The UV light could encourage the formation of free radical compounds in the skin. The compound that had the capacity as antioxidan be able to compete with the target molecule to reduce the damaging effect of the skin. Whereas rice flour that contained amilum could reflect the sun light.

Hadiyanti *et al.* research (2004) showed that the increasing concentration of curcumin increased the potential of sunscreen with the active material octil methoxycinamat in protecting skin from eritema and pigmentation.

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Nasrudin research (2009) indicated that 30% rice flour and 70% extract *Plantago major*, L is the optimum composition to increase the effectivity of octyl methoxycynamat based on % transmission of erythema and pigmentation. Sulistiyono research (2009) showed that 80% curcumin and 20% extract *Plantago major*, L was the optimum composition to increase effectivity of octyl methoxycynamat base on % transmission of erythema and pigmentation

Based on the potential of those three materials, it was important to develop formulation of sunscreen based on SPF parameter to give protection on the skin. SPF was the parameter to determine the effectivity of the sunscreen to protect skin from the exposure of the sunlight. Sunscreen with high value of SPF is expected to give high protection to skin. The sunscreen was made in the cold cream base in order to give comfortability to consumen.

MATERIAL AND METHOD

Materials and Instrumentation

I. Materials

Rice flour from Beringharjo market, curcumin (Merck), simplisia of *Plantago major*, L leaf, silica gel G, aquades and aquabides (pharmaceutical grade). Methanol dan ethanol (p.a E.Merck), Whatman paper (no 40).

2. Instrumentation

Spectrophotometer UV Vis-1601PC (Shimadzu, Japan), Analitical balance (AR2140 Ohaus, New York), filter (Whatman 0,45 µm nylon), and Sonicator (LC 304, Jerman).

Method of Research

I. Extraction of simplisia of *Plantago major*, L leaf

Dry leaves was infundated for 15 minutes at the 90⁰ C degree temperature. The filtrate was evaporated with waterbath until thick. Afterthat it was added with ethanol until the solution was not coloured and then was centrifuged. The filtrate was evaporated until almost dry (the ethanolic fraction).

2. Sample of cream

Weight of sample was one gram. Table I show composition of each material in formula. Sample from each formula was getted with procedure :

Firstly *Na Tetraboras* solved with aquadest. Others materials (*cetaceum*, *cera alba*, *paraffin liq*) was melted and then mixture with solution of *Na Tetraboras* until homogen. Finally curcumin, extract of *Plantago major*, L and rice flour was added to the each of mixture of the formula according to the each composition.

Table I. Composition of rice flour, curcumin and extract of *Plantago major*, L in cold cream base

Materials	Formula I	Formula II	Formula III
Octyl metoxycynamat	0.5 g	0.5 g	0.5 g
Rice flour	0	0 g	0.15 g
Extract of <i>Plantago major</i> , L	0 g	0.1 g	0.35 g
Curcumin	0 g	0.4 g	0 g
Cetaceum	12.5 g	12.5 g	0 g
<i>Cera alba</i>	12 g	12 g	12 g
<i>Paraffinum liq</i>	56 g	56 g	56 g
<i>Natrii Tetraboras</i>	0.5 g	0.5 g	0.5 g
<i>Aqua Destillata</i>	18.5 ml	18 ml	18 ml

Formula I : Sunscreen with active material octyl methoxycynamat

Formula II : Sunscreen with active material octyl methoxycynamat and optimum composition of extract *Plantago major*, L and curcumin

Formula III : Sunscreen with active material octyl methoxycynamat and optimum composition of extract *Plantago major*, L and rice flour

3. Measurement of SPF value

Sample solved in ethanol and then measurement of SPf value base on Petro method (1981). Absorbance read at λ 290 nm - 320 nm with minimal absorbance 0.05. Value of SPF calculated with abbreviation:

$$\text{Log SPF} = \frac{\text{AUC} \times 2}{\lambda_n - \lambda_l}$$

Value of SPF calculated with divided area under curve of absorbance at λ with difference of highest and lowest of λ and then multiply twice. Replication of each formula is 3.

4. Evaluation of physical characteristic of sunscreen

a. Spreadability test

Cream 0.5 g was put on the circle of glass which it was adhered with graphic paper. Cream covered with glass and then 1 gram of load put on it. After 5 menit diameter of spreadability was noted. Load was added until constant. Spreading of cream was calculated as wide of circle.

b. Adhesivity test

Cream 0.5 g was put on dekglass and then cover it with the other dekglass. One kg of load put on it until 5 minutes and then removed of load. Time to dekglass detached was noted.

c. Viscosity test

Cream 10 mg was put in cone viscosimeter *Brookfield* and then viscosity was noted.

C. Analysis Data

Data were analysed with Anova one way and continued with t test if there was significant difference at 95% confidence level.

RESULTS

SPF value of octyl methoxycinamat after addition of the optimum composition of rice flour and extract *Plantago major*, L and optimum

composition of curcumin and extract *Plantago major*, L show in table II.

Data SPF was analysed with Anova one way at 95% level confidence. Result of analysis show that there is significant difference between formula. Analysis continued with T test. Result of T test show in table III.

Result of evaluation of physical characteristic of cream show in table IV. Data of physical characterisyc of cream was analysed with Anova one way at 95% confidence level. Result of analysis show there was not significant difference between formulas.

DISCUSSION

A. SPF Value

This research examined 3 formula. There were Formula I with the active materials octyl methoxycinamat, Formula II which used octyl methoxycinamat and optimum composition of curcumin and extract *Plantago major*, L as active materials and Formula III which used octyl methoxycinamat and optimum composition of rice flour and extract *Plantago major*, L. Protection of sunscreen to skin from exposure of sunlight will increased with addition of these materaials.

Octyl methoxycinamat protect skin from side effect of UV B which it can make sunburn on the skin. Extract of *Plantago major*, L have maximum absorption in range UV A so it can protect skin from pigmentation. Curcumin as antioxidant protects octyl methoxycinamat from degradation making protection of skin from the side effect of sunlight more longer. Rice flour as sunscreen can reflect sunlight. Octyl methoxycinamat as active material in sunscreen which was added with extract of *Plantago major*, L, curcumin and rice flour therefore will protect skin more effectively. SPF (*Sun Protection Factor*) is the parameter to know the potenton of sunscreen to protect skin. High value of SPF show the high potenton of sunscreen. SPF value of octyl methoxycinamat after addition of the optimum composition of rice flour and extract *Plantago major*, L and optimum composition of curcumin and extract *Plantago major*, L show in table II.

Data SPF was analysed with Anova one way at 95% level confidence. Result of analysis show that there is significant difference between

formula. Analysis continued with T test. Result of T test show in table III.

Tabel II. SPF value of octyl methoxycinamat after adding of the optimum composition of rice flour and extract *Plantago major*, L and optimum composition of curcumin and extract *Plantago major*, L

Formula	SPF Value ($\bar{X} \pm SD$)
Formula I	4,81 \pm 0,71
Formula II	17,65 \pm 5,04
Formula III	5,65 \pm 0,95

Tabel III. Result of T test on SPF value

Formula	Significancy
Formula I-II	Significant
Formula I-III	No Significant
Formula II-III	Significant

Table IV. Result of evaluation of physical characteristic of cream with active material octyl methoxycinamat after adding of the optimum composition of rice flour and extract *Plantago major*, L and optimum composition of curcumin and extract *Plantago major*, L

Formula	Spreadability (mm ²)	Adhesivity (second)	Viscosity (cPoise)
Formula I	18.74 \pm 3.55	3.78 \pm 0.65	1517.33 \pm 47.01
Formula II	17.11 \pm 0.86	3.60 \pm 0.34	1675.67 \pm 190.12
Formula III	13.7 \pm 0.47	3.89 \pm 0.34	1777.67 \pm 83.90

Result of T test show that there is significant difference between Formula I and Formula II. This may indicated that curcumin and extract *Plantago major*, L increased capability of octyl methoxycinamat. Curcumin as antioxidant could protect octyl methoxycinamat from degradation because exposure of sunlight so it can protect skin longer. Extract *Plantago major*, L completed to protect because it have absorption at UV A area and its activity as antioxidant protect octyl methoxycinamat from degradation.

Result of T test show that there is not significant difference between Formula I and Formula III. It means that rice flour did not increase capability of octyl methoxycinamat.

Rice flour reflected sunlight so did not effective protect skin. Eventhough in Formula III contain

extract *Plantago major*, L but it can not increase capability of octyl methoxycinamat to protect skin.

Result of T test show that there is significant difference between Formula II and Formula III. Formula II have the highest value of SPF. It's mean that curcumin increased capability of octyl methoxycinamat more effective than rice flour.

B.Physical characteristic of sunscreen

Evaluations of physical characteristic of cream were spreadability, adhesivity and viscosity tests. Spreadability test show potentation of cream to cover skin. Cream would protect skin better if have wider spreadability. Adhesivity show potentation of cream to adhesive on skin. Cream would more protect skin if have longer adhesivity. Viscosity influenced spreadability and adhesivity of cream. Result of evaluation of physical characteristic of cream show in table IV.

Data of physical characterisyc of cream was analysed with Anova one way at 95% confidence level. Result of analysis show there was not significant difference between formulas. This could indicate that optimum composition of curcumin and extract *Plantago major*, L in Formula II and optimum composition of rice flour and extract *Plantago major*, L in Formula III did not influence physical characteristic of cream.

Cream in this research used base of Cold cream. This base give cold effect on skin so consumen would feel more comfort.

There is difference in physical characterictic between cream in this research and market. Cream in market have spreadibility 10-20 cm² and adhesivity 30-240 second. Cream in this research have spreadibility and adhesivity lower than cream in market. This could be due to the higher viscosity of cream in this research.

CONCLUSION

1. Optimum addition of curcumin and extract of *Plantago major*, L more effective increased SPF value of cream ($p < 0,05$).
2. Optimum addition of curcumin and extract *Plantago major*, L and optimum composition of rice flour and extract *Plantago major*, L did not influence physical characteristic of cream.

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