PROCEEDINGS PAPERS OF

1st INTERNATIONAL CONFERENCE ON CHEMISTRY, PHARMACY AND MEDICAL SCIENCES (ICCPM)
Theme: Advanced Research Development Base on Local Resources

Bengkulu, 27 – 28 November 2018

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FOREWORD

Assalamu’alaikum warahmatullahi wabarakaatuh and greetings.

This proceeding contains selected papers of 1st International Conference on Chemistry, Pharmacy, and Medical Sciences (ICCPM) which held on November 26-27, 2018, Santika Hotel, Bengkulu-Indonesia. The conference which was organized by the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu.

The ICCPM 2018 is attended by more than 100 participants. In terms of origin, the participants of this ICCPM are coming from 6 countries i.e. Indonesia, Japan, US, Malaysia, Thailand, and India. The conference is the first international conference organized by the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu and is expected to be held continuously every three years.

The conference particularly encouraged the interaction of research students and developing academics with the more established academic community in an informal setting to present and to discuss new and current work. Their contributions helped to make the conference as outstanding. The papers contributed the most recent scientific knowledge known in the field of Organic Chemistry, Material Chemistry, Pharmacy, Agricultural Chemistry, and Miscellaneous topic related to chemistry.

Our deep gratitude is strongly forwarded to all individuals who took part in the conference, especially the keynote speakers, invited speakers, all the presenters and participants as well as all students and staffs who have been involved in the preparation and execution of the conference and the publication of the proceedings. Our deep gratitude also forwarded for all reviewers the manuscript for this proceedings.

These Proceedings will furnish the scientists with a good reference book. I trust also that this will be an impetus to stimulate further study and research in all these areas.

Bengkulu, 30 November 2018
General Chair of ICCPM
Prof. Dr. Morina Adfa, M.Si
Committee

1st International Conference on Chemistry, Pharmacy and Medical Sciences (ICCPM, Theme: Advanced Research Development Base on Local Resources

Santika Hotel, 27-28 November 2018

Organized by Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu

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2. Prof. Dr. Yun Hin Taufiq Yap (Universiti Putra Malaysia, MALAYSIA)
3. Assoc. Prof. Dr. Agung Nugroho (Lambung Mangkurat University, INDONESIA)
4. Assoc. Prof. Dr. Sirikantjana Thongmee (Kasetsart University, THAILAND)
5. Assoc. Prof. Dr. Mohammad Abrar Alam (United State of America, USA)

Invited Speaker

1. Assoc. Prof. Dr. Mohamad Rafi (Bogor Agricultural University, INDONESIA)
2. Assoc. Prof. Dr. Noor Haida Mohd Kaus (Universiti Sains Malaysia (USM), MALAYSIA)
3. Assoc. Prof. Dr. Akhmad Sabarudin, D.Sc. (Brawijaya University, INDONESIA)
4. Assoc. Prof. Dr. Oman Zuas (Research Center for Metrology - LIPI, INDONESIA)
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The Effect of Benzophenone-3 Concentration on Activity of Sunscreen Cream Using Coconut Oil as Raw Material

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Abstract. A research on the effect of benzophenone-3 concentrations on the activity of sunscreen cream using coconut oil as the raw material has been done. The purpose of this research was to study the effect of benzophenone-3 concentrations on ultraviolet (UV) radiation absorption, sun protection factor (SPF) value, and activity of coconut oil cream as a sunscreen. Sunscreen cream was prepared by emulsifying the oil phase (coconut oil, stearic acid, lanolin, and cetyl alcohol) and water phase (distilled water, glycerine and triethanolamine (TEA) and it was added benzophenone-3 in various concentrations. The result showed that the cream made of coconut oil absorbs the UV C radiation. If the benzophenone-3 concentration is increased, the UV radiation absorption, SPF value, and effectiveness of cream will also increase. This means that the concentration of benzophenone-3 affects the activity of the cream made of coconut oil as a sunscreen.

Keywords: Benzophenone-3, coconut oil, sunscreen cream, sun protection factor, effectiveness of cream

A. Introduction

Coconut oil is oil made of the coconut flesh. This oil contains 92% saturated fatty acids [1], most of which are included in medium-chain fatty acids (MCFA) with 10-12 carbon atoms [2]. Based on the study results, MCFA from coconut oil has many health benefits, including being easily absorbed by the human skin, so that it can maintain skin elasticity and softness [3]. In the human body, lauric acid (a member of MCFA), can be converted into mono laurin which functions as an antibacterial, antimicrobial and antiviral [4]. Coconut oil is a natural lotion so it can prevent the skin from forming free radicals and protect the skin from the dangers of free radicals [5]. Coconut oil is a good sunscreen, also can prevent skin from sunburn, especially if this oil is consumed. This oil has a Sun Protection Factor (SPF) value of 7.119, so it is recommended as sunscreen ingredient [6]. Coconut oil is also suitable as cosmetics ingredient because it contains a high percentage of saturated fatty acids [7].

At present, many studies have been conducted on the manufacture and determination of SPF from several sunscreen emulsions containing raw materials derived from nature, such as Ocimum basilicum leaf oil, Linn [8], Moringa oleifera oil, Lam [9] and activity evaluation as sunscreen from cream containing Butea monosperma leaves extract [10]. From the study results, it can be seen that many chemical compounds found in nature have activities as sunscreens so that they can be used as raw materials to make sunscreens [11, 12]. One of the natural ingredients that can be used as raw material for the manufacture of cosmetic emulsions is coconut oil [7]. The results of the study by Widyatyi (2017) show that coconut oil cream has ultraviolet (UV) radiation absorption in the UV-C region and does not have UV radiation absorption in the UV-B and UV-A regions, therefore the SPF value is low [13]. To increase the SPF value, active ingredients such as benzophenone-3 can be added as an organic sunscreens [14]. To find out the effect of benzophenone-3 concentration on the activity of sunscreen cream made of coconut oil, it is necessary to do this research.

B. Results and Discussion

2.1. Effect of benzophenone-3 concentration on the cream’s UV radiation absorption

The UV spectrum produced is presented in Figure 1. From Figure 1, it can be seen that cream made of coconut oil and benzophenone-3 absorb UV radiation in the UV-B and UV-A regions. The first absorption peaks with high intensity in the UV B region is at a wavelength of 287 nm with a wide absorption up to 309 nm and a second absorption peak with a moderate intensity in the UVA region, i.e. at a wavelength of 325 nm.

If the concentration of benzophenone-3 added to the cream is increased, the cream’s UV radiation absorption will also increase. This is because benzophenone-3 (oxybenzone) is a derivative of benzophenone
(diphenylketone). Benzophenone compounds can absorb UV radiation at a maximum wavelength of 252 nm, and it causes a transition of $\pi \rightarrow \pi^*$ this compound also can absorb UV radiation at 325 nm wavelengths and there is a transition n $\rightarrow \pi^*$ [15]. Accompanied by the electron donation groups, namely the hydroxyl group (-OH) and the methoxy group (-OCH$_3$) as the electron receiving group in benzophenone participates in the resonance delocalization process. As a result, benzophenone absorbs UV radiation at long wavelengths, i.e. at 320 nm so that it can be used as a UVA sunscreen [14].

![UV spectrum of cream made of Coconut oil and benzophenon-3 with a concentration of 2-2.6% w/w.](image)

2.2. Effect of benzophenone-3 concentration on SPF of Cream

The cream’s UV radiation absorption produced is used to calculate the SPF value using a formula developed by Petro (1981) [16]. The results of the SPF calculation are presented in Figure 2. From Figure 2 it can be seen that the higher the concentration of benzophenone-3 is added to the cream, the higher the absorption intensity of cream UV radiation. This causes the results of the calculation of the SPF value to be even greater.

![SPF value of cream made of coconut oil and active ingredients benzophenone-3 with a concentration of 2-2.6% w/w.](image)

The effectiveness of sunscreens can be known from the SPF value resulted. The higher the SPF value of a cream, the higher the UV radiation protection of cream would be. Therefore, in this study, sunscreen made of coconut oil and benzophenone-3 as an active compound with a concentration of 2.6% w/w had the highest activity compared to cream with benzophenone-3 concentrations below that concentration.

C. Conclusion

If the concentration of benzophenone-3 is increased, the intensity of UV radiation absorption will also increase, so that the SPF value of cream also increase. This condition causes, the activity of cream made of coconut oil and active benzophenone-3 as a sunscreen also increases, too. This means that the concentration of benzophenone-3 affects the absorption of UV radiation, SPF value and activity of cream as a sunscreen.

D. Experimental Section

4.1. Materials and apparatus

The materials used included coconut oil, stearic acid, lanolin, cetyl alcohol, glycerin, triethanolamine (TEA), benzophenone-3 and distilled water.

The apparatus used included laboratory glass equipment such as glass cups, stirring rods, measuring cups, watch glasses, thermometers, digital scales, electric stoves, and UV-vis spectrophotometers.

4.2. Preparation of cream made of coconut oil and Benzophenone-3 as the active ingredient in varied concentrations

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>The chemical (% w/w)</td>
<td></td>
</tr>
<tr>
<td>Oil phase:</td>
<td></td>
</tr>
<tr>
<td>Coconut oil</td>
<td>10</td>
</tr>
<tr>
<td>Stearic acid</td>
<td>8</td>
</tr>
<tr>
<td>Lanolin</td>
<td>1</td>
</tr>
<tr>
<td>Cetyl alcohol</td>
<td>1</td>
</tr>
<tr>
<td>Water phase:</td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td>8</td>
</tr>
<tr>
<td>Distilled water</td>
<td>81.25</td>
</tr>
<tr>
<td>TEA</td>
<td>0.75</td>
</tr>
<tr>
<td>Benzophenone-3</td>
<td>2</td>
</tr>
</tbody>
</table>

By using formulas in Table 1, the cream was made by weighing a certain amount of water phases (glycerin, TEA and distilled water), put in a 500 mL beaker glass, and heated on an electric stove. Subsequently weighed a certain amount of oil phases (coconut oil, steaic acid, lanolin, and cetyl alcohol), put in a 500 mL beaker glass, and heated on an electric stove too, until the two phases reached 70 °C. Then, in the oil phase, benzophenone-3 was added, the mixture was stirred and the water phase added little by a little while stirring until homogeneous and reached a temperature of approximately 35 °C.
4.3. Determination of cream’s UV radiation absorption

As much as 100 mg of cream with benzophenone-3 concentration according to Formula Table 1, each cream was dissolved with isopropanol solvent until a cream solution of 100 mL (concentration of 1000 ppm) was obtained. The coconut oil cream solution was determined the UV absorption at a wavelength of 200-400 nm, by using a UV-Vis spectrophotometer. The absorbance obtained was used to calculate the SPF value using a formula developed by Petro (1981) [16].

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F. References