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Theme: Advanced Research Development Base on Local Resources

Bengkulu, 27 – 28 November 2018

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Theme: Advanced Research Development Base on Local Resources

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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 Proceeding 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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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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Production of Nanoemulsion from *Moringa oleifera* Extract

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**Abstract.** Antioxidants are organic compounds that can reduce free radicals in the human body. One of the plants that has antioxidant activity is *Moringa oleifera* Lamk. The aim of this study was to make nanoemulsion from *Moringa oleifera* extract with a combination of *Moringa* leaf extract and test the effectiveness of nanoemulsion of *Moringa oleifera* as an antioxidant. This study consisted of two stages, the first step is making extracts and making nanoemulsions using a homogenization method with a speed of 22,000 rpm for 2 minutes and extract concentrations of 20 and 30%. The results of the study were nanoemulsion with an average droplet size of 44 and 28 nm with a viscosity of 2 cP and 2.5 cP. This condition is said to be best because it has produced nanoemulsion with granular size <100 nm.

**Keywords:** *Moringa oleifera*, extract, nanoemulsion.

**A. Introduction**

*Moringa* (*Moringa oleifera* Lamk.) is a nutrient-rich plant and is often called the "miracle tree" because all parts of the *Moringa* plant are very beneficial to people's lives. Nutrient content is spread in all parts of the *Moringa* plant, starting from the leaves, bark, flowers, fruit (pods), to the roots and is widely known as a medicinal plant. *Moringa* root is used to treat beri-beri disease, and the leaves are used for medicinal skin. While for internal medicine, it is often used for rheumatic diseases, epilepsy, vitamin C deficiency, urinary tract disorders or infections, even to venereal disease "gonorrhoea" [1]. *Moringa* contains more vitamins, minerals, antioxidants, essential amino acids and other useful compound.

One of the most prominent of *Moringa* plants is the content of antioxidants, especially in the leaves. Based on phytochemical tests, *Moringa oleifera* leaves contain tannin, steroids and tripernoid, flavonoids, saponins, interquinones, alkaloids, all of which are antioxidants [2]. According to the research, fresh *Moringa* leaves have antioxidant activity seven times more than vitamin C [3]. One of the flavonoid groups possessed by *Moringa* is quercetin, where quercetin has antioxidant strength 4-5 times higher than vitamin C and vitamin E.

Nanoemulsion has a greater surface area and free energy, these advantages include preventing creaming, flocculation, coalescence and sedimentation. In addition, nanoemulsions can also be formed in various formulations, such as foam, creams, liquids and sprays [4]. Therefore, in this study nanoemulsion of *Moringa* extract are expected to be better absorbed by the body (100%) and a better solubility. Nanoemulsion can be used in the pharmaceutical industry, perfumes, cosmetics, food and beverage, aromatherapy and others. In this study, nanoemulsion of *Moringa* extract was carried out using the homogenization method. The homogenization process to reduce particle size needs to be done to obtain a stable emulsion [5].

**B. Result and Discussion**

2.1 Moringa Extract

The solvent used in the maceration process is ethanol. Ethanol has advantages, there are relatively low boiling points (78 °C) and volatile, thus reducing the amount of ethanol carried in the extract. The characteristics of *Moringa* extract can be seen in Table 1 and Table 2. The yield of *Moringa* leaf extract produced was 15.985% lower than the results of research conducted by Saputra (2013), which was 39.797%. The difference is caused by the difference in the ratio of *Moringa* leaf powder to the solvent used, where Saputra (2013) uses a 1:40 ratio [6].

2.2 Nanoemulsion Dropet Size

The stability of nanoemulsion depend on the droplet size, type of emulsifier (surfactant) and ratio of oil in solution. The physical observations showed that the nanoemulsion of *Moringa* extract were clear and transparent (Figure. 1). However, the use of low stirring speed was fail to produce a homogenous emulsions [7].
Some of the factors that influence droplet size produced by the homogenization that is the type of emulsion used, the temperature and energy [8]. Increased the rotation will be proportional to the impact energy released. This increase in impact energy directly affects the size of the droplets formed [9]. High speed in making nanoemulsion can be reduced by increasing the emulsifier concentration and/or adding another type of emulsifier used.

Table 1. The Characteristics of Moringa Extract

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>Form</td>
<td>Viscous liquid</td>
</tr>
<tr>
<td>Flavour</td>
<td>Leaves Flavour</td>
</tr>
<tr>
<td>Rendement (%)</td>
<td>15.895</td>
</tr>
<tr>
<td>pH</td>
<td>6.18</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>8.24</td>
</tr>
<tr>
<td>Viscosity</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 2. Phytochemical Content of Moringa Extract

<table>
<thead>
<tr>
<th>No</th>
<th>Phytochemical Content</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alkaloid</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Saponin</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Tannin</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Phenolic</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Flavonoid</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>Triterpenoid</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Steroid</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Glycoside</td>
<td>+</td>
</tr>
</tbody>
</table>

Note: (+) is content the secondary metabolite

Fig. 1. Nanoemulsion of 20% Moringa Leaves Extract

Collision energy reduces particle size as long as enough emulsifiers are available to cover the droplet surface. The results of research conducted by Mc Clements (2011) on the manufacture of corn oil nanoemulsion with high pressure homogenization method showed a decrease in the size of droplet diameter from 131 nm to 110 nm with an increase in Tween 20 concentration from 1% to 10% [10]. This is because the higher concentration of surfactant will protect the droplet surface during the homogenization process. The small size of the droplet can increase the dispersed phase so that the viscosity increases and the absorption of emulsifiers can increase. The insufficiency of the emulsifier in covering the surface of the droplets will cause coalescence.

2.2 Viscosity of Nanoemulsion

The greater concentration of Moringa leaves extract, the viscosity was increased. Nanoemulsion with 20% Moringa leaves extract concentration has a viscosity of 2 cP, while the concentration of Moringa 30% leaves extract has a viscosity of 2.5 cP. This is because more droplets are dissolved, will increase the friction between droplets and also increase the viscosity. The factors that affect the viscosity of an emulsion include the viscosity of the dispersion medium, the percentage of dispersed volume, the dispersed phase particle size and the type and concentration of the emulsifier used [11].

Viscosity is related to concentration of the dispersed phase, an increase of the dispersed phase concentration will increased the viscosity [12]. The increase in viscosity is due to the greater concentration of Tween 80 which decreases the diameter of the droplet, thus increasing the surface area and increasing the resistance of the emulsion to flow and increasing viscosity [13].
2.3 The Stability of Nanoemulsion of Moringa Leaves Extract

High rotating speed will cause smaller droplet sizes. After the W/O emulsion is formed, the droplets will join each other through the flocculation process followed by coalescent [14]. Small droplet sizes will be relatively more stable than larger droplets. This is because big droplets have a smaller face tension when compared to smaller droplets [15]. This big droplet will attract smaller droplets to form a bigger droplet. In the O/W type nanoemulsion system, the addition of maltodextrin will increase viscosity, so that it can form a more stable nanoemulsion.

<table>
<thead>
<tr>
<th>Concentration of Moringa leaves extract (%)</th>
<th>Shelf Life (Weeks)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The concentration of Moringa leaf extract also affects the stability of the emulsion. The greater concentration of Moringa leaves extract will make the nanoemulsion more stable and will reduce the occurrence of coalescence [16]. Increasing the concentration of Moringa leaves extract will also reduce the size of the droplet emulsion which has an effect on stability.

C. Conclusion

Nanoemulsion of Moringa extract can be produced by a homogenization method with a speed of 24000 rpm for 20 minutes with an oil phase of 20 and 30%. This condition produces nanoemulsion with an average droplet size of 44 and 28 nm with a viscosity of 2 cP and 2.5 cP. The addition of high concentrations of Moringa oil phase prior to homogenization would reduce the droplet sizes, this may be related to dilatant rheology properties of the solution.

D. Experimental Section

4.1 Material and Equipment

Materials used were fresh Moringa Leaves, aquabidest, 96% ethanol, aquadest, NaOH, maltodextrin, Tween 80, and potassium dihydrophosphate.

The equipment used were blender (Panasonic), sieve 40 mesh, beaker glass, rotary vacuum evaporator, viscometer, homogenizer (Virtis), digital scale, measurement glass, pH meter, magnetic stirrer, thermometer, and Particle Size Analyser (Vasco).

4.2 The Extraction of Moringa Leaves

*Moringa oleifera* Lamk. leaves are cleaned and sliced into slices and then dried by aerating. Fresh leaves are then dried for 24 hours until the water content is less than 10%. After drying, the simplicia is then milled and sifted, so that the Moringa leaf powder is obtained with a size of 40 mesh.

Furthermore extraction is done by maceration method. 300 g Moringa leaves powder was put into a maserator container containing of 96% ethanol with a ratio of 1:5 (b/v). Soaking is left for 3 days in a closed container and protected from light while repeatedly stirring. After 3 days the simplicia is filtered and the pulp is soaked again with a new fluid extract, this is done 3 times. After extraction is complete, then filtered and concentrated to get extract with rotary vacuum evaporator at 40 °C until there is no dripping distillate. Analysis of Moringa leaf simplicia includes water content (modified SNI 01-3181-1992). Moringa leaf extract produced was characterized by color, flavor, specific gravity (SNI 06-4085-1996), pH (SNI 06-2413-1991), viscosity and phytochemical screening.

4.3 Preparation of Nanoemulsion

Oil-water nanoemulsions, containing Moringa extract dissolved into an aqueous emulsifier solution. The emulsifier solution contains 10% (v/v) Tween 80 (based on the oil phase) and maltodextrin (2% and 3%) that dissolved in phosphat buffer solution (PBS) at pH 7 and stirred for at least 15 minutes to ensure complete hydration. The homogenisation process using a variation of ratio extract Moringa and buffer fosfat solution i.e 20:80 and 30:70 percent, stirred for 20 min with the stirring speed of 24,000 rpm.

4.4 Nanoemulsion Measurement

4.4.1 Droplet Size Analysis

Droplet size analysis using Particle Sizer Analyzer that can measure size distributions in the range of 2 nm to 7000 nm using high scattering dynamic and Brownian motion. The droplet size is calculated based on the Stokes-Einstein correlation function and Brownian motion which is defined as a translation function. The resulting output is a system of statistical methods, commulants and laplace where each system produces a size distribution in intensity, number and volume.

4.4.2 Viscosity

The viscosity of Moringa extract nanoemulsion was measured by a rotary viscometer at room temperature (27 ± 0.2 °C).
4.4.3 Stability

The stability of nanoemulsion was analyzed by storing Moringa extract nanoemulsion nanogingerol for four weeks at room temperature (28 °C). Then visually or qualitatively observed changes in texture or appearance (homogeneity). The sediment is marked (+) and the absence of sediments is marked (-).

E. Acknowledgements

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F. References