

Natural Nanoencapsulant Antioxidants Based on Kecombrang Fruit (*Nicolaia speciosa*)

Rifda Naufalin¹⁺ and Herastuti Sri Rukmini²

¹ Dept. of Agricultural Technology, University of Jenderal Soedirman, Kampus Karangwangkal dr Soeparno street, Purwokerto 53123, Indonesia

² Dept. of Agricultural Technology, University of Jenderal Soedirman, Kampus Karangwangkal dr Soeparno street, Purwokerto 53123, Indonesia

Abstract. Kecombrang Fruit has a bioactive compound as antioxidant; however the extract of kecombrang fruit has many weaknesses such as volatile and less stable in light and oxygen. Furthermore, it need expand of extraction in case of nanoencapsulant. It is a closure to get more stable product and easier to apply in food product. The research aims to produce practical nanoencapsulant antioxidants, stable and can be applied to food products. The method used is the extraction and formulation nanoenkapsulation extract. The results showed that the formulas based nanoencapsulant kecombrang fruit extract with fillers maltodextryn and soy protein and tween 20 has potential as a natural antioxidant, with the total phenolic content of 289.86 mg/100 g and antioxidant activity of 32.165%.

Keywords : kecombrang, extraction, formulation, nanoencapsulation, antioxidants

1. Introduction

Taking kecombrang (*Nicolaia speciosa*) as an antioxidant because it has bioactive components. Each plant has different bioactive compounds. kecombrang Fruit is a part growth from flower and content of bioactive compounds contained in fruit at the flower, and contain phenolic and triterpenoid (Naufalin et al., 2010) [1]. Part of fruit has not been optimally utilized by the society. Therefore, this study examined kecombrang fruit as a natural antioxidant technology through nanoencapsulation.

Nanoencapsulation done through the formation of particle size 1-1000 nm with a payload of active ingredients in them (Reis et al., 2006) [2]. Particles with nano size allow for a better distribution of the product as well as to expand the contact surface of the particles with the material. In addition, allowing the active ingredient to nanoencapsulation off periodically through encapsulant layer, it can also improve the efficiency of the use of the active ingredient (Won et al., 2008) [3]. Utilization of fruit extracts in the form nanoenkapsulant kecombrang gives opportunities produced a practical antioxidant and stable by heat, light and oxygen.

The purposes are to find the type of material that is capable of reaction as encapsulant protective kecombrang fruit extract and to assess the proportion of the optimal kecombrang fruit extract encapsulant to produce nanoencapsulant with the ability as an antioxidant.

2. Methodology

The experiment was conducted at the Laboratory of Agricultural Technology Faculty of Agriculture UNSOED. Materials needed research consisting of: kecombrang fruit. Chemicals used among other technical

⁺ Corresponding author. Tel: +6281 626 945; fax: +6281 626 945
E-mail address: rnaufalin@yahoo.co.id

solvents, namely ethanol 96 %; encapsulant (maltodextrin and soy protein), ethanol 99.8 % (PA), linoleic acid, distilled water, ammonium thiocyanate , 0.02 M FeCl₂ tetrahydrate, concentrated HCl, N₂ gas. Other materials needed include a coarse filter paper, Whatman No. 41 paper, plastic, paper label, paper towels and aluminum foil.

The tools used in this research that Cabinet Dryer dryers, blenders, analytical scales, rotary evaporator (Bibby RE 200), shaker, oven (Memmert, Japan), desiccators, pipettes (Pyrex, Germany), pH meter. Tool for the analysis of total phenol and antioxidant activity consists of spectrophotometers, centrifuges, glass tools (Pyrex, Germany), vortex, Fial tubes, micropipette (Gilson), and bath tobacco leaf waste, ie shaker, rotary, tube N₂. Tool to extract formulation, a set of tools for testing antimicrobial activity glasses, vortex, micro pipettes, incubator 37°C, desiccator, refrigerator and vacuum pump.

2.1. Fruit Powder Sample Preparation Kecombrang (Naufalin, 2013) [4]

Kecombrang fruit are selected. Material selection results cleaned with water, then dried in a dryer at a temperature of 50°C until the moisture content of 8-10%. Furthermore simplicia dry milled to obtain a homogeneous powder.

2.2. Extraction Process of Kecombrang Fruit Powder (Naufalin et al., 2013)

Kecombrang fruit powder was extracted twice with ethanol (1:4 w / v). The extraction process is done by maceration at 37 °C, with a rotation speed of 150 rpm for 24 hours every level. Filtrat separated from the solvent by evaporation in a rotary evaporator until no solvent dripping again. The solvent was evaporated at a temperature of 50°C. Residual solvent is removed with nitrogen gas to produce an essential oil

2.3. Nanoencapsulation of Kecombrang Fruit Extract (Naufalin, 2013).

Making nanoenkapsulan formula made by: 1 unit of experiments using 20 grams of concentrated fruit extracts kecombrang to nanoencapsulation and 60 grams encapsulant. 60 grams enkapsulan made from gelatin composition: β-cyclodextrin with a ratio of (1:2 1:1 and 2:1) and the composition of gelatin: maltodextrin with a ratio (1:2 1:1 and 2:1). Coupled with 300 ml of deionized water and mixed evenly by means of stirring at a temperature of 50 °C for 30 minutes. 20 grams of concentrated extract was added, the mixture was homogenized at 40°C for 30 minutes, so as to form an emulsion. Furthermore done diminution emulsion particles into nanoparticles by using a dispersing machine (Ultra-Turrax) 22,000 rpm for 30 minutes.

2.4. Determination Procedure

Measurement of Total Phenol, Othman *et al.* (2007) [5] were modified. Activity of antioxidant formulas were analyzed using modified iron thiocyanate method (Yurttas et al., 2000) [6]. This determination is based on the formation of peroxide as a product of oxidation of linoleic acid. Percent oxidation was calculated by comparing the absorbance value of the test sample (A_s) with control absorbance value (A_{ctrl}) multiplied by 100%, which is expressed by the formula:

$$\text{Oxidation Percent (\%)} = \frac{A_s}{A_{ctrl}} \times 100\%$$

$$\text{Antioxidants activity} = 100\% - \text{oxidation percent}$$

3. Result And Discussion

3.1. Total Phenol

Formula kecombrang extract made from fruit extracts kecombrang with fillers maltodextrin, soy protein, Tween 80, NaCl and NaOH 10% (to adjust pH). According Afeli (1998) [7], encapsulant materials that can be used to convert fractions into solid particles. Encapsulant material can be proteins or polysaccharides. Encapsulant protein materials can be vegetable protein such as soy protein or animal protein such as gelatin, egg and milk proteins. Encapsulant material which is included as polysaccharide is potato starch, corn starch, tapioca starch, maltodextrin, cyclodextrin, amylopectin and cellulose.

The results of this study indicate that the total phenol of formula nanoencapsulant between 216.21 to 289.86 mg / 100 g (Figure 1).

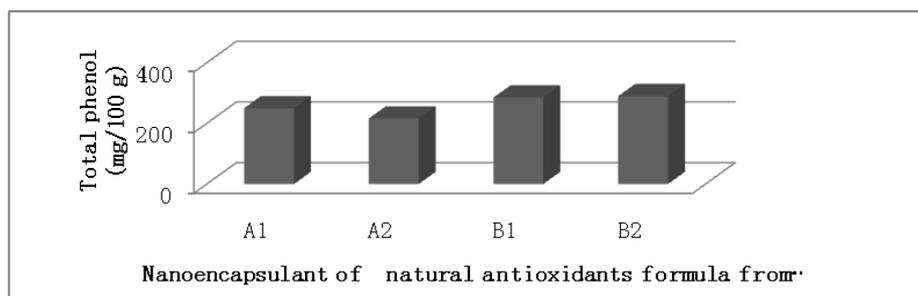


Fig. 1: Total phenol content of nanoencapsulant antioxidant formula

Note:

A1=0,2 g material with formula malto:soy protein=2:1 (5%) tween 80 (2%); A2=0,4 g material with formula malto:soy protein =2:1 (5%) tween 80 (2%); B1=0,2 g material with formula malto:soy protein =2:1 (5%) tween 20 (2%); B2=0,4 g material with formula malto:soy protein =2:1 (5%) tween 20 (2%)

The content of total phenolics was detected in the formula derived from phenolic compounds in kecombrang fruit extracts as the main component of the formula. It is as stated by Tampubolon et al. (1983) [8], that the chemical components found in kecombrang fruit are phenolic compounds such as alkaloids, flavonoids, polyphenols, steroids, saponins, and essential oil.

3.2. Antioxidant Activity

Measurement of antioxidant activity is done in feritiosianat method based on the formation of peroxide as a result of oxidation of linoleic acid. The peroxide will oxidize ferrous ions into the ferry Form complexes feritiosianat because of thiocyanate ions, which can be measured absorbance at a wavelength of 500 nm. The higher absorbance peroxide indicates the higher amount of peroxide, which means the higher the oxidation of linoleic acid (Lestario et al., 2005) [9].



According Kikuzaki and Nakatani (1993) [10], the peroxide value of absorbance is inversely proportional to its antioxidant activity that is the higher mean absorbance value the lower antioxidant activity. It can be formulated with % antioxidant activity = 100 -% oxidation.

The results of absorbance measurements kecombrang extract formulation, formula antioxidant activity of extracts obtained kecombrang shown in Figure 2. The results of measuring the antioxidant activity of kecombrang fruit nanoencapsulant formula, the formula B is given kecombrang fruit extract fillers maltodextrin and soy protein with tween 20 has the highest antioxidant activity of 32.165% than the antioxidant activity of the fruit extract formula A is given kecombrang fillers maltodextrin and soy protein with tween 80.

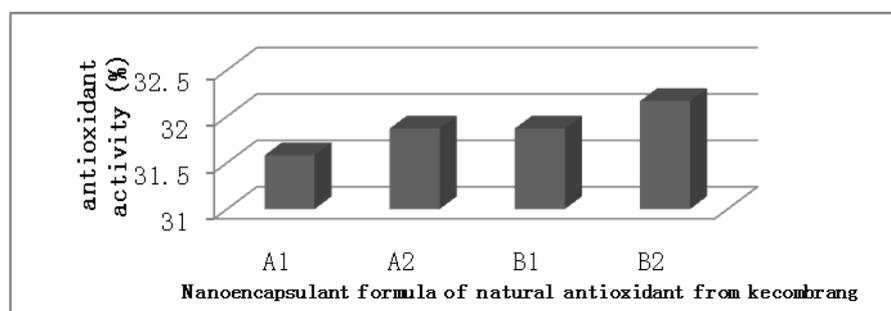
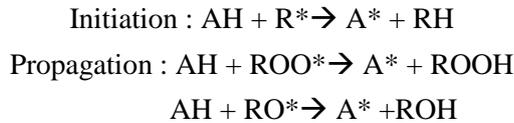


Fig. 2: Antioxidant Activity (%) Nanoencapsulant of Kecombrang.

Note:

A1=0,2 % material with formula malto:soy protein=2:1 (5%) tween 80 (2%); A2=0,4 % material with formula malto:soy protein =2:1 (5%) tween 80 (2%); B1=0,2 % material with formula malto:soy protein =2:1 (5%) tween 20 (2%); B2=0,4 % material with formula malto:soy protein =2:1 (5%) tween 20 (2%)

Inhibition of the reaction of free radicals by antioxidants can be explained by the mechanism of inhibition at the stage of initiation or propagation. According to Gordon (1990) [11], phenolic antioxidants can stop or inhibit the initiation stage of the fatty acid radicals react with or inhibit the propagation stage by reacting peroxy radical or alkoxy radical reactions as follows:



Free radicals antioxidants would interfere with the propagation phase of the reaction to form peroxides antioxidant components as follows:



4. Conclusion

Nanoencapsulant formula made from kecombrang fruit extracts with fillers maltodextrin and soy protein and tween 20 has a total phenolic content of 289.86 mg/100 g and antioxidant activity of 32.165%. Nanoencapsulant formula made from kecombrang fruit extracts with fillers maltodextrin and soy protein and tween 20 has potential as a natural antioxidant.

5. Acknowledgement

Thanks to DP2M Dikti with The Competency Grant 2013 that support this research

6. References

- [1] Naufalin, R., Herastuti SR and Yanto T. 2010. Formulasi dan Produksi pengawet alami estrak kecombrang. Laporan Hibah Kompetensi Tahun II. DP2M Dikti.
- [2] Reis, C.P., R.J. Neufeld, A.J. Ribeiro, and F. Veiga. 2006. Nanoencapsulation I. Methods for preparation of drug-loaded polymeric nanoparticles. *Nanomedicine: Nanotechnology, Biology, and Medicine* 2: 8–21
- [3] Won J., M.-H. Oh, J.-M. Oh, M.-S. Kang, J.-H. Choy, and S. Oh. Stability Analysis of Zinc Oxide-Nanoencapsulated Conjugated Linoleic Acid and Gamma-Linolenic Acid DOI: 10.1111/j.1750-3841.2008.00924.x *Journal of Food Science*. Volume 73, Issue 8, pages N39–43, October 2008.
- [4] Naufalin, R., Herastuti, SR and R. Wicaksono. 2013. Encapsulation of Natural Antimicrobial Extraction From Kecombrang Flower (*Nicolaia speciosa*) Using Maltodextrin-Gelatin as Filler ingredient. 2nd International Food Safety Conference (IFSAC2013). Malaysia 2-3 Desember 2013 : 269-276
- [5] Othman, A., A. Ismail, Nawalyah A. G., and I Adenan. 2007. Antioxidant Capacity and Phenolic Content of Cocoa Bean. *Journal Food Chemistry* 100 (2007) 1523-1530
- [6] Yurttas, H.C., H.W. Schafer, and J.J. Warthesen. 2000. Antioxidant Activity of Nontocopherol Hazelnut (*Corylus spp.*) Phenolics. *J. Food Sci.* 65(2) : 276-280.
- [7] Afeli, R.1998. Studi Mikroenkapsulasi dan Stabilitas Minyak Kaya Asam Lemak Omega-3 dari Limbah Pengalengan Ikan Tuna (*Tuna Precook Oil*). *Skripsi*. IPB, Bogor.44 hal. (Unpublished).
- [8] Tampubolon, O.T., S. Suhatsyah, and S. Sastrapradja. 1983. Penelitian Pendahuluan Kandungan Kimia Kecombrang (*Nicolaia speciosa* Horan) Dalam Risalah Simposium Penelitian Tumbuhan Obat III. Fakultas Farmasi Universitas Gadjah Mada, Yogyakarta.
- [9] Lestario, L. N., S. Rahardjo and Tranggono. 2005. Perubahan Aktivitas Antioksidan, Kadar Antosianin dan Polifenol pada Beberapa Tingkat Kemasakan Buah Duwet (*Syzygium cumini*). *Jurnal Agritech* 25 (4) : 169-172 hal.
- [10] Kikuzaki, H. and K. Nakatani. 1993. *Antioxidant Effect of Some Ginger Constituents*. *Journal Food Science* 58 : 1407-1410.
- [11] Gordon, M. 1990. *The Mechanism of Antioxidant Action in Vitro*. Di dalam: Hudson, B. J. F. (Ed.) *Food Antioxidants*. Elsevier Applied Science. New York. Pp: 1-18.