Test Stability Of Natural Color Dyes From The Lether Fruit Of Palm's Waste

R.T.D. Wisnu Broto, Edy Supriyo, Isti Pudjihastuti* and Fahmi Arifan

Vocational School of Chemical Engineering of Diponegoro University
Jl. Prof. Soedarto, Tembalang, Kota Semarang, Jawa Tengah 50275, Indonesia
Email : istipudjihastuti@gmail.com

Abstrak

Uji Stabilitas Zat Warna Alami dari Limbah Kulit buah Siwalan

Buah siwalan (Borassus flabilifer) adalah salah satu buah lokal produk asli Indonesia yang dihasilkan dari tanaman lontar sangat melimpah karena tidak mengenal musim. Selama ini kulit buah siwalan masih belum banyak dimanfaatkan dan hanya dianggap sebagai limbah. Kulit buah siwalan mempunyai kandungan zat warna antosiaanin yang merupakan zat warna alami berwarna kemerah-merahan. Kulit buah siwalan di ekstraksi dengan menggunakan berbagai jenis solven antara lain air, campuran air etanol, campuran air – propanol, campuran air-etanol-propanol, etanol, campuran etanol – propanol dan propanol. Hasil ekstraksi terbaik didapatkan dengan menggunakan solvent etanol. Selanjutnya dilakukan uji stabilitas ekstrak zat warna kulit buah siwalan (antosianin) terhadap pH, suhu, sinar, dan warna dengan menggunakan spektrofotometer UV-Vis pada panjang gelombang maksimum 520 nm. Pada uji stabilitas ekstrak zat warna kulit buah siwalan (antosianin) terhadap pH, rentang pH 0-6 dengan interval 1 didapat pH terbaik 1 dengan nilai absorbansi 0,3965. Uji stabilitas suhu dengan rentang suhu 50 -100^oC dengan rentang 10^oC menghasikan suhu terbaik 50^oC dengan nilai absorbansi 0,387. Hasil uji stabilitas ekstrak zat warna kulit buah siwalan (antosianin) terhadap sinar menunjukkan penurunan nilai absorbansi berbanding lurus dengan lamanya penyinaran. Uji stabilitas zat warna alami antosianin yang berasal dari kulit buah siwalan menunjukkan ekstrak dengan total antosianin paling besar memiliki intensitas warna yang besar pula.

Kata kunci: *kulit buah siwalan, solven, uji stabilitas*

Abstract

The leather fruit of palm (Borassus flabilifer) is one of the local fruit native to Indonesia produced from palm plants are very abundant due to not knowing the season During this leather palm fruit is still not widely used and is only regarded as wastes. The leather palm fruit color has anthocyanin substances which are natural pigments reddish color. The extraction of the leather palm by using different types of solvents include water, ethanol water mixture, the mixture of water - propanol, a mixture of water-ethanol-propanol, ethanol, a mixture of ethanol - propanol and propanol. The best extraction results were obtained by using ethanol solvent. Furthermore, stability test of pigment extract's the leather fruit of palm (anthocyanin) to pH, temperature, light, and color was done by using UV-Vis spectrophotometer at maximum wavelength 520 nm. In the stability test of pigment extract's the leather palm fruit (anthocyanin) to pH, pH range 0-5 with interval 1 obtained the best pH 1 with absorbance value 0,3965. Temperature stability test with temperature range 50 -100^oC with 10^oC range gives best temperature 50^oC with absorbance value 0,387. The results of stability test of pigment extract's the leather fruit of palm (anthocyanin) to light showed decrease of absorbance value directly proportional to duration of irradiation The natural anthocyanin dye stability test derived from siwalan peel shows the extract with the greatest total anthocyanin having a large color intensity as well.

Keywords: *the leather fruit of palm, solvent, stability test*

Diterima : 08-03-2018
Disetujui : 10-05-2018

INTRODUCTIONS

The dye is an additive and can be extracted well in an acid solvent. One of the pigments that can be extracted from natural sources is anthocyanin which belongs to the flavonoid compound group. These pigments contribute to the appearance of red to purple, bias seen in some flowers, or fruit (Burdock, 1996).

Natural dye sources come from plants, animals, and microorganisms (Aberoumand, 2011; Rymbai *et al*., 2011). Visalakshi and Jawaharlal (2013) states that natural dyes can be obtained from plants, animals or minerals. Rymbai *et al*. (2011) states that there are three groups of natural dyes are the most important namely; tetrapyrrols, tetraterpenoids, and flavonoids. The use of artificial dyes more than natural dyes. The use of artificial dyes is often excessive than it should be caused by people's ignorance of the type of dye that is allowed. (Winarno, 1997).

In Indonesia, the leather fruit of palm (*Borassus flabellifer*) is easy to obtain because it does not recognize the season. It is produced from palm trees belonging to the palm family. In the world there are about 2800 species of palm trees, 460 of which are palms and palm trees growing in Indonesia (Bessy, 2002).

Currently the utilization of the leather fruit of palm only on the fruit alone while the skin is still considered as waste. The leather fruit of palm'skin that has a mixture of red purple color indicates the content of anthocyanin dyes and antioxidant phenolic compounds. The anthocyanin pigment is a natural dye that causes the reddish color present in plant cell fluids and is water soluble (Fennema, 1985)

Anthocyanins are glycosides of anthocyanidins are phenolic classes giving a blue-red-orange-purple color. To date, more than 540 anthocyanin pigments have been identified, largely a structural variation of the glycosidic substitution at positions 3 and 5 and possibly acylation of sugar residues with organic acids (Rymbai *et al*., 2011). The anthocyanin purple color on the skin of the palm fruit (*Borassus flabellifer*) is produced from cyanidin-3-sophoroside and cyanidin-3-glucoside compounds which play an important role in the skin of the palm fruit coloring (Brouillard, 1982).

To determine the stability characteristics of anthocyanin produced in the highest yield, the anthocyanin stability test was done to pH, temperature, oxidizer, and ray (Puspita *et al.,* 2004). The use of natural dye in foods can replace synthetic dyes. Synthetic dyes may cause toxic and carcinogenic because they contain azo dyes which can cause liver cancer (Cahyadi, 2006). Natural dyes in the industry for food should be food grade. In the food industry used as additives, color boosters, antioxidants (Malik *et al*., 2012).

The anthocyanin molecule is composed of an esterified aglycone (anthocyanidin) with one or more sugars (glycine). There are 5 types of sugar commonly found in antocyanin molecules, namely glucose, rhammose, galactose, xylose, fructose and arabinose. In plants usually anthocyanins are in the form of glucose ie esters with one molecule monosaccharide called monoglukosa, biocide if it has two molecules of sugar, and triosida if it has three sugar molecules (Markakis, 1982). The extraction of anthocyanins directly creates directly formed solutions of red, purple, orange to blue in color according to the anthocyanin pigment contained in the material (Francis, 1982).

In general anthocyanins are more stable in acidic conditions, oxygen-free media, in cold, dark temperature conditions (Nollet, 1996). The use of skin of the palm fruit as an alternative raw material in the manufacture of natural dyes is more advantageous because it utilizes waste so the price is cheaper. The purpose of this study was to determine the method and type of solvent used to extract the anthocyanin dye from the skin of the palm's fruit resulting in the highest yield (Bridle & Timberlake, 1997) to determine the stability of the anthocyanin dye from the skin of the palm fruit to pH, temperature and light.

The target of the research is the availability of natural dyes derived from the processing of the palm fruit's husk so that the fruit processing technology can increase the economic value and the benefits of the palm fruit's commodity. The benefits of the results of this study can overcome the problem of the palm fruit's skin waste into natural dyes in the food and beverage industry.

METHODOLOGY

The initial stage of the survey and observation in the form of direct observation to the production center of the palm fruit in Rembang district and surrounding areas. After that the selection of skin of the black purple the palm fruit is estimated to produce anthocyanin pigment with high rendement.

The second stage of the palm fruit's peel is separated with fibers, then dried in the sun without drying, cut into small pieces and mashed to form a powder. The palm fruit's bark powder is extracted using several solvents ie water, etaonol, iso propyl alcohol, a water-ethanol mixture with a certain ratio, a mixture of water-iso propyl alcohol in a certain ratio, a water-ethanol-iso propyl alcohol mixture and a mixture of ethanol-iso propyl alcohol . The next step is extracted with the best solvent with an extraction time of 15 minutes, 30 minutes, 45 minutes. Then the extraction results were tested for absorbance by spectrophotometer at 520 nm wavelength.

The third stage is continued by testing the stability of the palm fruit's extract to the effect of pH, temperature, oxidizer, and light. In the anthocyanin stability test the pH was performed at pH 1 to 5 at interval 1. On the test the stability of anthocyanin to temperature was carried out at 50, 60, 70, 80, 90 and 100°C for 30 minutes, 60 minutes and 90 minutes. On testing the stability of anthocyanin to light was done by using UV light and fluorescent light for 7 days. After each treatment was measured its absorbance by using spectrophotometer at 520 nm wavelength.

RESULTS AND DISCUSSION

Anthocyanin stability against pH

Anthocyanin stability testing of pH results using potassium chloride buffer solution and sodium acetate buffer solution with pH range 1-5. Changes in absorbance value due to pH increase were measured using spectrophotometer at 520 nM wavelength.

The results show that the increase in pH leads to an increase in absorption (absorbance) as shown in Figure 1. At low pH color the concentrate is getting red and stable. This is due to the pigment form of the anthocyanin under acidic conditions or at low pH is the flavium cation, whereas the flavium cation nucleus of the anthocyanin pigment is electron deficient so it is highly reactive (Francis, 1982)

The stability of anthocyanin to temperature

The anthocyanin stability test of the research result on temperature was done by adding potassium chloride buffer solution. The solution mixture is inserted into dark colored bottles and incubated at 50 °C, 60 °C, 70 °C, 80 °C, 90 °C and 100 °C for 4 hours. Furthermore, the measurement of absorbance by using a spectrophotometer at wavelength 520 nM.

Figure 1. The palm's tree (Heyne, 1987)

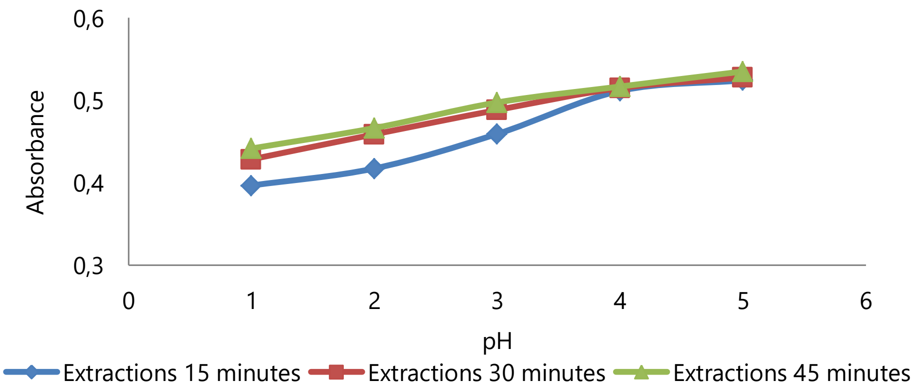

Figure 2. Anthocyanin stability against pH

The results showed that there was an increase in temperature and absorbance value because of the high temperature of the anthocyanin decomposition of the aglycone form into kalkon (colorless) and finally forming a brown alpha ketone (Bridle & Timberlake, 1997), so that at high temperature there was a decrease in the stability or coloring of the color anthocyanin from the palm fruit's speel, between the temperatures studied, the best temperature of the above six temperatures is 50 ° C.

The stability of anthocyanin against light

The anthocyanin stability test of the research result on temperature was done by measuring the absorbance of the extract at maximum wavelength. In this study used anthocyanin extract from the palm fruit's husk added pottasium chloride buffer solution. The mixture is inserted in a clear bottle and irradiated with UV light and fluorescent light (11 watts) in a dark box for 7 days (Figure 6).

From the Figure 7 and Figure 6 shows that the absorbance decreases because the longer time used for irradiation the retention value tends to experience increase, This is caused by the more acidic conditions will make the dye more stable, so that the color retention is higher and the color is also graded the less.

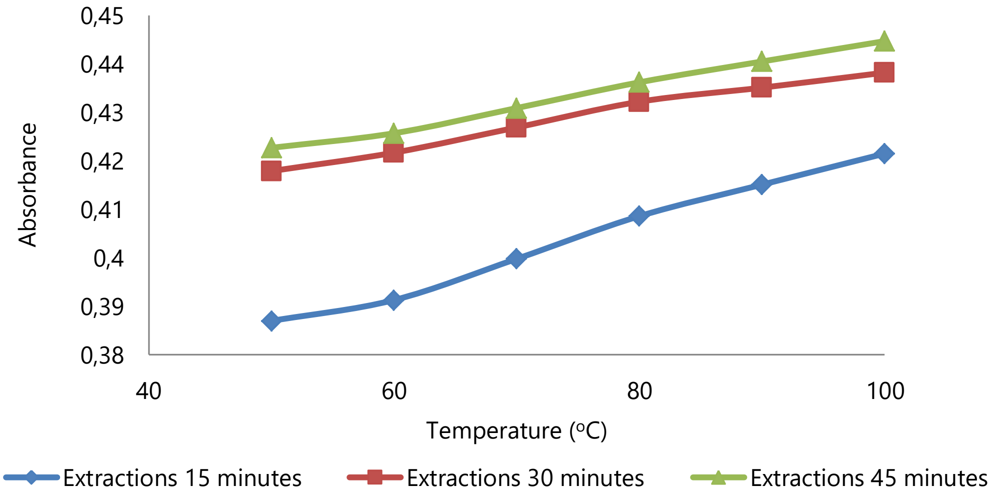

Figure 3. The stability of anthocyanin against temperature with 30 minutes heating time

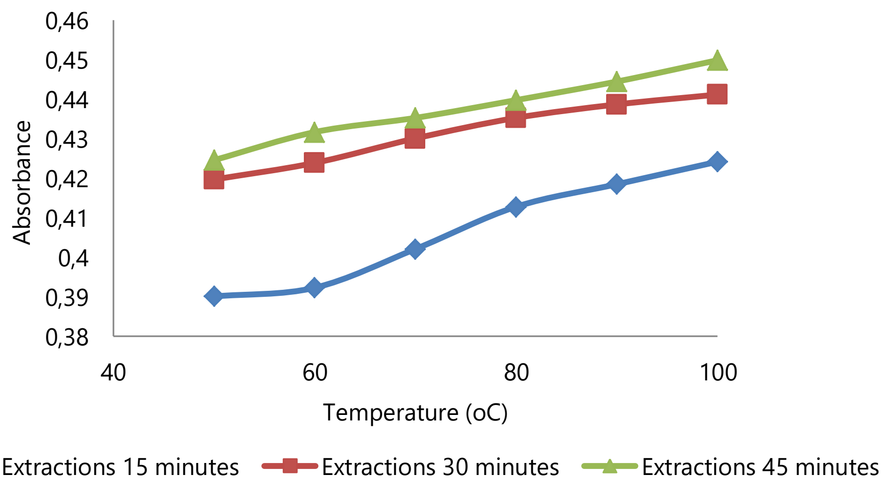

Figure 4. The stability of anthocyanin against temperature with 60 minutes heating time

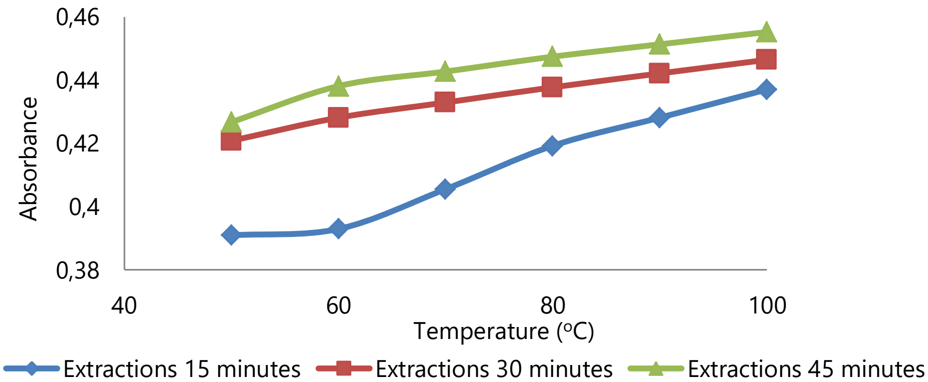

Figure 5. The stability of anthocyanin against temperature with 90 minutes heating time

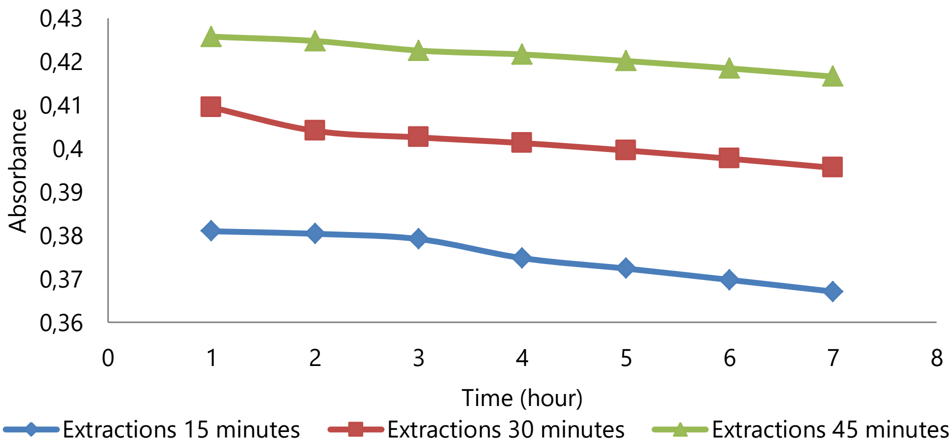

Figure 6. Stability of anthocyanin against neon rays

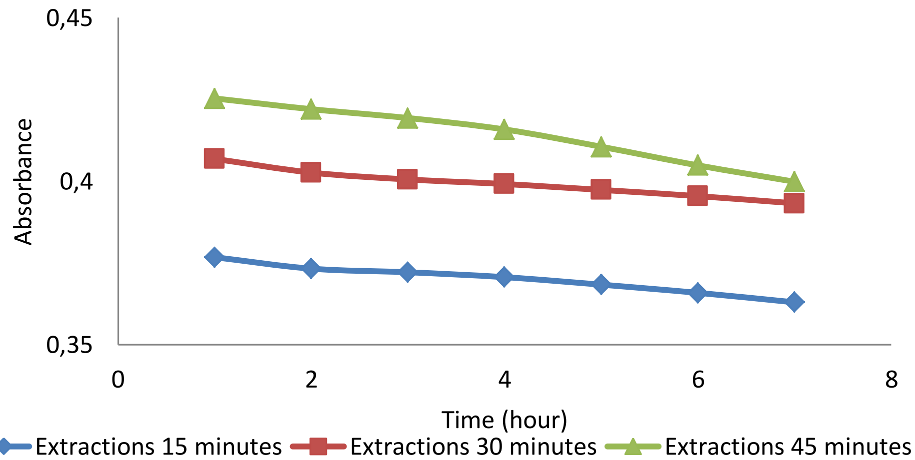

Figure 7. Stability of anthocyanin against UV rays

CONCLUSION

The results of anthocyanin stability test obtained by extraction of the palm fruit's skin husk using ethanol can be summarized as follow, anthocyanin stability test on pH change shows that at low pH the concentrate color is redder and stable. Anthocyanin stability test for temperature rise shows that at high temperatures there is a decrease in the stability or coloring of the anthocyanins from the skin of the the palm fruit. Anthocyanin stability test against neon and uv rays shows that absorbance value falls due to more acidic conditions will make dyes more stable

ACKNOWLEDGMENTS

The research team would like to thank the Dean of Vocational School Diponegoro University and Head of the Diploma III Chemical Engineering Study Program Diponegoro University, which has provided funding and laboratory facilities as well as all those who contributed to this research.

REFERENCES

Aberoumand, A., 2011. A review article on edible pigments properties and sources as natural biocolorants in foodstuff and food industry. *World J. Dairy Food Sci.* 6(1):71-78.

Bessy, F.S. 2002. Study on Making Nata de Lontar. Essay. Department of Agricultural Products Technology, Faculty of Agricultural Technology Untag Semarang

Bridle, P. & Timberlake, C.F., 1997. Anthocyanins as natural food colours selected aspects. *Food Chemistry*. 58(1-2):103-109.

Brouillard, R., 1982. *Chemical structure of anthocyanins* (Vol. 1). Academic Press: New York.

Burdock, G.A., 1996. *Encyclopedia of food & color additives*. CRC Press.

Cahyadi, W. 2006. *Analysis and Health Aspects of Food Additives*. PT Bumi Aksar, Jakarta. 61-62

Fennema, O.R. 1985. *Food Chemistry. Third Edition*. Marcell dekker, Inc. New York.

Francis, F.J. 1982. *Analysis of Antocianins*. Academic Press. New York.

Heyne, K., 1987. *Tumbuhan Berguna Indonesia*. Yayasan Sarana Wana Jaya. Jakarta. page 373-376

Malik, K., Tokkas, J. & Goyal, S., 2012. Microbial pigments: a review. *International Journal of Microbial Resource Technology.* 1(4):361-365.

Markakis, P. 1982. *Anthocyanins as Food Colors*. Academic Press. New York.

Nollet, L. 1996. Hand Book of Food Analysis. Second Edition. Marcell Dekker,Inc. New York.

Puspita S., Unus, Lindriati, T., Fauzi, M., Swadesi, D.L. & Komar, M. 2004. Extraction and Characterization of Anthocyanin Color Stability of Duwet Fruit (*Syzygium cumini*). *Proceedings of Seminar and PATPI Congress*, 17-18:120-128.

Rymbai, H., Sharma, R.R., & Srivasta, M. 2011. Bio-colorants and Its Implications in Health and Food Industry–A Review. *International Journal of Pharmacological Research*. 3(4):2228-2244.

Visalakshi, M., & Jawaharlal, M. 2013. Healthy Hues-Status and Implication in Industries – Brief Review. *Journal of Agriculture and Allied Sciences*, 3(2):42-51

Winarno, F.G. 1997. Food and Nutrition Chemicals. PT. Gramedia Pustaka Utama. Jakarta.