Inornatus: Biology Education Journal
Volume 2, Issue 2 (2022): 61 – 68
DOI: 10.30862/inornatus.v2i2.354

The combination tea of corn silk (*Zea mays* L.) and rosella flowers (*Hibiscus sabdariffa* L.): Antioxidant levels using different drying methods

Aulia Ulmillah*, Intan Mulia Suri, Marlina Kamelia, Suci Wulan Pawhestri

Universitas Islam Negeri Raden Intan Lampung, Indonesia
*Corresponding author, email: aulia@radenintan.ac.id

Submitted: 23-10-2022
Accepted: 07-11-2022
Published: 09-11-2022

Abstract: Corn silk and rosella flowers are plants whose utilization can still be developed, especially in the food sector. The secondary metabolites found in both plants serve as a source of natural antioxidants to combat free radicals. This study aims to examine the effect of variations in drying methods on the antioxidant activity content of a combination tea of corn silk and rosella flower. Antioxidant level test using the DPPH method. Analysis of antioxidant data in the form of determining the IC50 value using probit linear regression analysis. The study results show that drying using the oven method has an IC50 of 83 ppm while drying in the sun has an IC50 of 121 ppm. Research findings indicate high antioxidant levels in a combination of corn silk and rosella flower tea through oven drying and moderate antioxidants in direct drying in the sun.

Keywords: Antioxidant, corn silk, drying method, *Hibiscus sabdariffa L, tea, Zea mays L*

Abstrak: Rambut jagung dan bunga rosella termasuk jenis tanaman yang pemanfaatannya masih dapat dikembangkan lebih banyak lagi terutama di bidang pangan. Metabolit sekunder yang terdapat pada kedua tanaman tersebut berfungsi sebagai sumber antioksidan alami untuk memerangi radikal bebas. Penelitian ini bertujuan untuk menguji pengaruh variasi metode pengeringan terhadap kandungan aktivitas antioksidan teh dari kombinasi rambut jagung dan bunga rosella. Uji kadar antioksidan menggunakan metode DPPH. Analisis data antioksidan berupa penentuan nilai IC50 menggunakan analisis regesi linier probit. Hasil penelitian menunjukkan bahwa pengeringan menggunakan metode oven memiliki IC50 sebesar 83 ppm, sedangkan pengeringan di bawah sinar matahari memiliki IC50 sebesar 121 ppm. Temuan penelitian menunjukkan kadar antioksidan yang tinggi dalam teh kombinasi rambut jagung dan bunga rosella melalui pengeringan oven dan antioksidan sedang dalam pengeringan langsung di bawah sinar matahari.

Kata kunci: Antioksidan, rambut jagung, metode pengeringan, *Habiscus sabdarifa L, teh, Zea mays L*

INTRODUCTION

Antioxidant compounds are found in natural materials such as plants. Several types of plants that have the potential as antioxidants are corn silk and roselle flowers. In general, the use of these two types of plants is only the fruit of corn and the hair of corn is often thrown away. Corn silk is considered food industry or household waste (Garnida et al., 2018; Singh et al., 2022). Some references state that corn silk has the potential as a medicine. Corn silk contains antioxidants (flavonoids) which are thought to lower blood sugar levels, so it can be used as a substitute for drinks. The combination of corn silk tea and stevia leaf

contains 0.03N flavonoids, making it a potential alternative to beverages. This is considered appropriate to meet the needs of 51.7% of men's flavonoids and 37.5% of women's (Akbar et al., 2019).

Not only corn silk but rosella flowers can also be used as a substitute for natural antioxidants. Roselle flowers, especially flower petals are generally used in society. This is because the rosella flower petals are bright red and have a sour taste. Chemical components that act as antioxidants in rosella flowers are anthocyanins which belong to the flavonoid compound group (Agustiarini & Wijaya, 2022; Aisiyah et al., 2017; Imran et al., 2022; Tungadi et al., 2022).

Roselle flower was chosen as a mixture of Corn Silk tea, because roselle flower contains citric acid and malic acid, has a sweet and sour taste that is fresh and distinctive with an attractive natural red color due to its anthocyanin content. In a study that combined Corn Silk tea and rosella flower with a concentration ratio of 55:45 it produced high antioxidant activity and was preferred based on sensory tests (Rohmadianto et al., 2019). The presence of secondary metabolites and antioxidant levels in a sample will be affected by the method of sample drying used. During drying, polyphenol molecules in fruits and vegetables are sensitive to oxidative destruction by polyphenol oxidase, resulting in an intermolecular condensation process and lower levels (Bernard et al., 2014).

The use of various methods is needed to find out which method is more effective for testing antioxidants in the two combinations of tea leaf samples. The use of an oven to dry the test sample has several advantages including a constant dry weight of the sample obtained quickly, the drying temperature can be well controlled and the drying time is efficient (Winangsih et al., 2014). Drying method effect to bioactive compounds and antioxidant activity contained in avocado leaf extract which generated. Dried old leaves with using the oven produces antioxidant activity with the highest water content, total phenol, total flavonoid, and specific total tannins (Widarta & Wiadnyani, 2019). Greater degradation can occur not only due to polyphenol oxidase but also due to long heating time (Richard et al., 2015).

This study uses two variations of drying methods, namely drying in direct sunlight and drying using an oven. Changes in dryness are believed to also affect antioxidant levels. This study aims to examine the effect of variations in drying methods on the antioxidant activity content of a combination tea of corn silk and rosella flower.

METHOD

This study was carried out at the Biology Laboratory II, Biology Department at Universitas Lampung. The tools used in this research are a cutter, digital scale (Mettler Toledo), oven, blender (Philip), knife, spoon, basin, baking sheet, scissors, petri dish (Pyrex), spatula, filter paper, aluminum foil, dropper, measuring cup (Pyrex), test tube (Pyrex), beaker glass (Pyrex), cellphone camera (Xiaomi), erlenmeyer flask (Iwaki), rotary evaporator (IKA RV 10 Basic), UV-Vis spectrophotometer (Shimadzu 1800), label paper and stationery. The

materials used were corn silk from corn farmers in Pasar Baru Village, Kedondong District, Pesawaran Regency, rosella flowers from gardens in Pasar Baru Village, Kedondong District, Pesawaran Regency, 2,2-diphenyl-1-picrylhydrazyl (DPPH) crystals, 96% ethanol (Merck), ascorbic acid (vitamin C), and aquades. This study uses 2 treatments, namely samples of Corn Silk and rosella flower petals dried by natural drying method (under the sun) and by artificial drying method (oven) with a concentration ratio of Corn Silk and rosella flower 55:45 with a total requirement of 2g (SNI). Oven drying 1.1g corn silk and 0.9g rosella flower oven drying. Sun drying 1.1 g corn silk and 0.9 g rosella flower sun drying.

Research Procedure

Sample Preparation

The samples used were 3 kg each. Sweet corn silk with 75 days of harvest. Young corn silk has higher antioxidant activity than old age (Hartanto et al., 2018). Fresh rosella flower petals with a picking age of 3-4 months (harvest age) (Winarti1 et al., 2015). Then each sample was sorted and washed with running water to remove other impurities that were still attached. After that, the corn silk and rosella flower petals were drained to remove water after washing (Akbar et al., 2019).

Sun Drying

Corn Silk and rosella flower petals are sliced into small pieces so that they dry evenly when dried in the sun. Drying is done by drying in direct sunlight for 5 hours/day within 2-3 days. Drying starts at 10:00 to 15:00. This is due to heating with direct sunlight at that time around 35-40o C in normal weather/full sun. Drying aims to reduce the water content so that microbes cannot grow (Akbar et al., 2019).

Drying with Oven

Corn Silk and rosella petals are sliced into small pieces. Then dried in an oven for 2.5 hours at a temperature of 55°C. Based on previous research that the highest antioxidant activity was in the treatment of the concentration of corn silk and rosella flower petals 55:45 which was dried for 2.5 hours at a temperature of 55°C using an oven (Rohmadianto et al., 2019).

Making Simplicia

Making simplicia is done by taking each sample as much as 3 kg. Then blended until it becomes a powder. This aims to uniform the sample size and reduce the sample surface area which can cause the cell wall to break by the solvent more rapidly and simultaneously, to maximize the extraction process (Akbar et al., 2019). The powdered sample is stored in a dry place and will be continued with the extraction process.

Making Tea Combination of Corn Silk and Rosella Flower Petals

Simplicia corn silk and rosella flower petals were taken according to treatment. Each treatment with five ratios of corn hair-rosella flower petals with a total requirement of 2 g (SNI) with a concentration ratio of 40:60, 50:50, 55:45, 60:40, and 65:35. Corn Silk tea powder-rosella flower petals were put into the glass according to the treatment. As much as

200 mL of water is brought to a boil, then pour water into a glass that already contains corn silk hair powder-rosella flower petals, closed and left for 5 minutes then filtered (Rohmadianto et al., 2019).

Antioxidant Activity Test with DPPH Method

1 mL of filtrate of steeping Corn Silk tea which was dried in the sun. Then from each concentration series (25, 50, 75, 100, and 125 mg/L) 2 mL of 2,2-diphenyl-1-picrylhydrazyl (DPPH) solution and tris-HCl buffer was added and then vortexed for 2 minutes. The solution's change from violet to yellow reflects the effectiveness of free radical scavengers. Furthermore, the absorbance was measured at 517 nm using a UV-Vis spectrophotometer in the last 5 minutes before 30 minutes of incubation. Test the antioxidant activity of the tea sample filtrate which was dried in an oven and dried in the sun respectively in the same way. Free radical scavenging activity was calculated as the percentage of DPPH color reduction using the equation: (Hartanto et al., 2018). Absorbance can be measured using spectrophotometry. IC_{50} is calculated by probit analysis using a linear regression equation. From the equation y = a + bx the IC_{50} value can be calculated using the formula: (Rahman et al., 2016)

$$y = a + bx$$
$$50 = a + bx$$
$$(x)\ IC_{50} = \frac{50-a}{b}$$

The following is Table 1 regarding the classification of antioxidant activity: (Tristantini et al., 2016)

Table 1. Classification of antioxidant activity

IC_{50} value	**Antioxidant**
50 ppm≤	Very Strong
50-100 ppm	Strong
100-150 ppm	Medium
150-200 ppm	Very
Weak 200 ppm	Weak

RESULTS AND DISCUSSION

Table 2 presents the results of the antioxidant content test of the combination of corn silk and rosella flower tea using the oven drying method and sunlight. The results showed that the IC_{50} value in the tea sample of the combination of corn silk and rosella flower by oven drying method was 83 ppm and included in the category of strong antioxidants. It can be seen that drying with the oven method has a high antioxidant value compared to drying in direct sunlight. This is because drying with direct sunlight causes

sunlight to contain UV rays which can damage the chemical compounds in the dried material (Dharma et al., 2020).

Table 2. Antioxidant test results of combination of corn silk and rosella tea with variationsof drying method

Concentration (ppm)	Log Concentration	Average Absorbance	Inhibition	Probit	Linear Equation	IC_{50} value
Tea Combination of Corn Silk and Rosella Flowers Oven Temperature 55^0 C (2, 5 hours)						
25	1.40	0.244	40.5	4.77	y = 0.5521x + 3.9647 R^2 = 0.9464	83 ppm
50	1.70	0.228	44.4	4.86		
75	1.88	0.210	48.8	4 ,97		
100	2.00	0.194	52.6	5.07		
125	2.10	0.179	56.4	5.16		
Tea Combination of Corn Silk and Sun Rosella Flowers (2-3 days)						
25	1.40	0.223	56	4.88	y = 0.377x + 4.4262 R^2 = 0.61	121 ppm
50	1.70	45.82	0.171	5.21		
75	1.88	0.186	61.27	5.12		
100	2.00	0.180	45.45	5.15		
125	2.10	0.175	53	5.19		

Antioxidant levels are seen from the percentage of inhibition, if the inhibition value is higher, the antioxidant activity is also greater. Percent inhibition showed antioxidant compounds capable of binding free radicals at the concentration of the test solution. The increase in the percentage of inhibition was influenced by the decreasing value of DPPH absorbance in the sample. This is because the higher the sample concentration, the smaller the absorbance value, increasing the percentage of inhibition. Figures 1 and 2 show that the sample concentration is directly proportional to the percent inhibition value, meaning that the higher the concentration value, the higher the percent inhibition value will also be. This can be seen in the following linear regression equation curve.

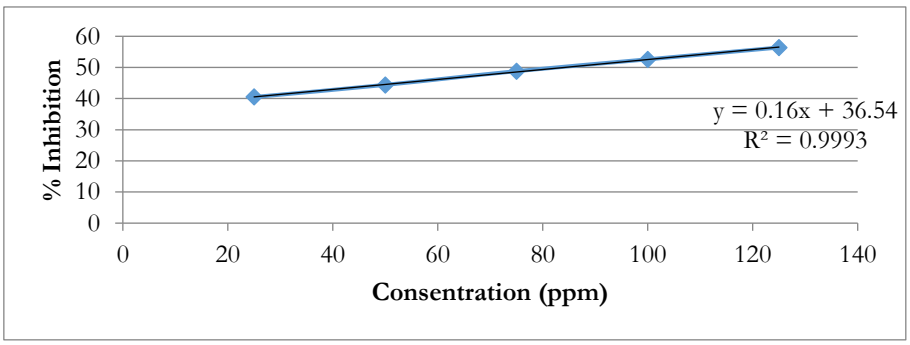

Figure 1. Graph of the linkage between concentration and percentage of inhibition of combination tea of corn silk and rosella flower using oven drying method

Calculation of antioxidant levels by calculating the amount of reduction in the intensity of purple light 2,2-diphenyl-1-picrylhydrazyl (DPPH) which is proportional to the reduction in DPPH concentration. The attenuation is produced by the reaction of the

diphenylpicrylhydrazyl molecule with the hydrogen atoms released by the sample component molecules to form a diphenylpicrylhydrazine compound which causes color decay of 2,2-diphenyl-1-picrylhydrazyl (DPPH) from purple to yellow.

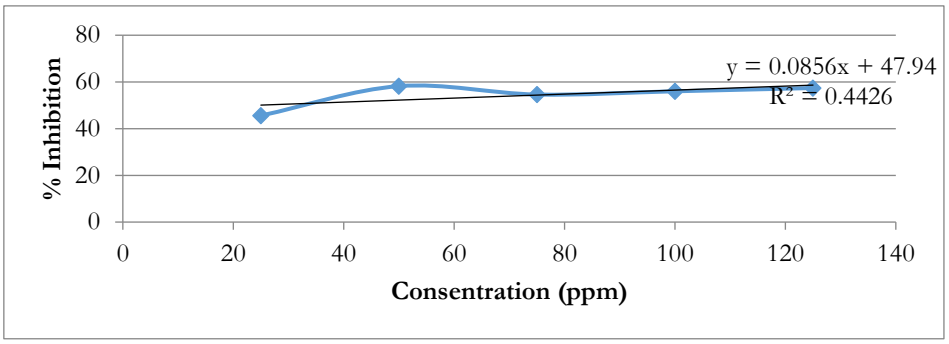

Figure 2 Graph of the linkage between concentration and percentage of inhibition of combination tea of corn silk and rosella flower using sunlight drying method

The indicator to determine the antioxidant activity used is IC_{50}. IC_{50} is the concentration of an antioxidant that can cause 50% 2,2-diphenyl-1-picrylhydrazyl (DPPH) to lose its radical character or the concentration of an antioxidant that shows a 50% inhibition percentage. After that, making a linear regression equation between the concentration as the abscissa (x-axis) and the value of % inhibition of antioxidant activity as the ordinate (y-axis) from the linear regression equation, the IC_{50} value in each sample can be determined (Huliselan et al., 2015). In a study on the antioxidant activity of the combination of corn silk and rosella flower tea, the % inhibition value was 90.63%. The cause of the high antioxidant activity in the combination of corn silk and rosella flower tea is that rosella contains nutrients and bioactive compounds in the form of phenolic acids, pigments, and heat-resistant flavonoids (Rohmadianto et al., 2019).

Based on the result, the antioxidant activity of the combination of corn silk and rosella flower tea using the sun-drying method was lower than the oven-drying method. It can be said that oven drying significantly impacted antioxidant levels in the sample. The oven drying method produces higher antioxidant levels than the direct this is possible because using an oven, the drying temperature can be constant without destroying the antioxidant compounds present in the sample. This cannot be done if the drying is done using direct sunlight. The direct sunlight used cannot be controlled. Temperatures that cannot be controlled will affect the class of compounds that are easily damaged by high temperatures, one of which is a class of antioxidant compounds, such as flavonoids and phenolics. This is consistent with the findings of Ling et al. (2015); oven-drying was the best technique for retaining total phenolics. Other findings by Widarta and Wiadnyani (2019) research support our study. According to them, the drying procedure may affect the amounts of bioactive components in avocado leaf extract and its anti-free radical activity. In addition, the IC_{50} value is inversely proportional to the ability of the compound to act as an antioxidant. The smaller the IC_{50} value, the stronger the antioxidant power (Yamin et al., 2017).

CONCLUSION

Variations in drying methods affect the antioxidant content of the tea combination of corn silk and rosella flowers. The antioxidant content dried by the oven method has an IC_{50} value of 83 ppm which is classified as a strong antioxidant, while the direct sunlight drying method has an IC_{50} value of 121 ppm which is classified as a moderate antioxidant.

REFERENCES

Agustiarini, V., & Wijaya, D. P. (2022). Uji aktivitas antioksidan ekstrak etanol-air (1:1) bunga rosella (Hibiscus sabdariffa L.) dengan metode DPPH (1,1-difenil-2-pikrilhidrazil). *Jurnal Penelitian Sains*, *24*(1), 29. https://doi.org/10.56064/jps.v24i1.679

Aisiyah, S., Harjanti, R., & Nopiyanti, V. (2017). Pemanfaatan bunga rosella (Hibiscus sabdariffa L) sebagai bahan alami untuk upaya preventif dan promotif kesehatan bagi masyarakat Nusukan Banjarsari Surakarta. *Abdimas Unwahas*, *2*(1), 5–8. https://doi.org/10.31942/abd.v2i1.1786

Akbar, C. I., Arini, F. A., & Fauziyah, A. (2019). Teh rambut jagung dengan penambahan daun stevia sebagai alternatif minuman fungsional bagi penderita diabetes melitus tipe 2. *Jurnal Aplikasi Teknologi Pangan*, *8*(2), 67–73. https://doi.org/10.17728/jatp.3122

Bernard, D., Kwabena, A., Osei, O., Daniel, G., Elom, S., & Sandra, A. (2014). The effect of different drying methods on the phytochemicals and radical scavenging activity of ceylon cinnamon (Cinnamomum zeylanicum) plant parts. *European Journal of Medicinal Plants*, *4*(11), 1324–1335. https://doi.org/10.9734/EJMP/2014/11990

Dharma, M. A., Nocianitri, K. A., & Yusasrini, N. L. A. (2020). Pengaruh metode pengeringan simplisia terhadap kapasitas antioksidan wedang uwuh. *Jurnal Ilmu Dan Teknologi Pangan (ITEPA)*, *9*(1), 88–95. https://doi.org/10.24843/itepa.2020.v09.i01.p11

Garnida, Y., Suliasih, N., & Ismaya, P. L. (2018). Pengaruh suhu pengeringan dan jenis jagung terhadap karakteristik teh herbal rambut jagung (Corn silk Tea). *Pasundan Food Technology Journal*, *5*(1), 63. https://doi.org/10.23969/pftj.v5i1.811

Hartanto, G. N., Pranata, F. S., & Swasti, Y. R. (2018). Kualitas dan aktivitas antioksidan seduhan teh rambut jagung (Zea mays) dengan variasi lama pelayuan dan usia panen. *Biota : Jurnal Ilmiah Ilmu-Ilmu Hayati*, *3*(1), 12–23. https://doi.org/10.24002/biota.v3i1.1889

Huliselan, Y. M., Runtuwene, M. R. J., & Wewengkang, D. S. (2015). aktivitas antioksidan ekstrak etanol, etil asetat dan n-heksan dari daun sesewanuwa (Clerodendron squamatum vahl.). *PHARMACON Jurnal Ilmiah Farmasi*, *4*(3), 155–163. https://doi.org/10.35799/pha.4.2015.8855

Imran, H., Kurniawati, N., Amiruddin, A., Nurdin, N., Wirza, W., & Wilis, R. (2022). The effectiveness of vegetable starfruit juice (Averrhoa bilimbi) and rosella tea (Hibiscus sabdariffa L) against the inhibition of dental plaque formation. *Open Access Macedonian*

Journal of Medical Sciences, *10*(G), 599–602. https://doi.org/10.3889/oamjms.2022.8787

Ling, A. L. M., Yasir, S., Matanjun, P., & Abu Bakar, M. F. (2015). Effect of different drying techniques on the phytochemical content and antioxidant activity of Kappaphycus alvarezii. *Journal of Applied Phycology*, *27*(4), 1717–1723. https://doi.org/10.1007/s10811-014-0467-3

Rahman, A., Malik, A., & Ahmad, A. R. (2016). Skrining fitokimia dan uji aktivitas antioksidan ekstrak etanolik buah buni (Antidesma Bunius (L.) Spreng). *Jurnal Fitofarmaka Indonesia*, *3*(2), 159–163. https://doi.org/10.33096/jffi.v3i2.497

Richard, J. M., Bernadette, K. N., Trude, W., Lucy, M. C., & Bernard, E. C. (2015). Effect of solar drying methods on total phenolic contents and antioxidant activity of commonly consumed fruits and vegetable (mango, banana, pineapple and tomato) in Tanzania. *African Journal of Food Science*, *9*(5), 291–300. https://doi.org/10.5897/AJFS2015.1232

Rohmadianto, D., Suhartatik, N., & Widanti, Y. A. (2019). Aktivitas antioksidan teh rambut jagung (Zea mays L. sacharata) dengan penambahan rosela (Hibiscus sabdariffa L.) dan Variasi Lama Pengeringan. *Jurnal Teknologi Dan Industri Pangan*, *3*(2), 113–120. https://doi.org/10.33061/jitipari.v3i2.2693

Singh, J., Inbaraj, B. S., Kaur, S., Rasane, P., & Nanda, V. (2022). Phytochemical analysis and characterization of corn silk (Zea mays, G5417). *Agronomy*, *12*(4), 777. https://doi.org/10.3390/agronomy12040777

Tristantini, D., Ismawati, A., Pradana, B. T., Gabriel, J., & Jonathan. (2016). Pengujian aktivitas antioksidan menggunakan metode DPPH pada daun tanjung (Mimusops Elengi L.). *Prosiding Seminar Nasional Teknik Kimia "Kejuangan,"* 1–7. http://jurnal.upnyk.ac.id/index.php/kejuangan/article/view/1547

Tungadi, R., Madania, M., & Aini, B. H. (2022). Formulasi dan evaluasi sabun padat transparan dari ekstrak bunga rosella (Hibiscus sabdariffa L.). *Indonesian Journal of Pharmaceutical Education*, *2*(2), 117–124. https://doi.org/10.37311/ijpe.v2i2.14060

Widarta, I. W. R., & Wiadnyani, A. A. I. S. (2019). Pengaruh metode pengeringan terhadap aktivitas antioksidan daun alpukat. *Jurnal Aplikasi Teknologi Pangan*, *8*(3), 80–85. https://doi.org/10.17728/jatp.3361

Winangsih, W., Prihastanti, E., & Parman, S. (2014). Pengaruh metode pengeringan terhadap kualitas simplisia lempuyang wangi (Zingiber aromaticum L.). *Buletin Anatomi Dan Fisiologi*, *21*(1), 19–25. https://doi.org/10.14710/baf.v21i1.6268

Winarti, S., Sudaryati, S., & Usman, D. S. (2015). Karakteristik dan aktivitas antioksidan rosela kering (Hibiscus Sabdariffa L.). *Jurnal Teknologi Pangan*, *9*(2), 17–24. http://www.ejournal.upnjatim.ac.id/index.php/teknologi-pangan/article/view/506

Yamin, M., Ayu, D. F., & Hamzah, F. (2017). Lama pengeringan terhadap aktivitas antioksidan dan mutu teh herbal daun ketepeng cina (Cassia alata L.). *Jom Faperta*, *4*(2), 1–15. https://jom.unri.ac.id/index.php/JOMFAPERTA/article/view/17092