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Engineering Properties of Durian Seed Strach (*Durio zibethinus* Murr.) Resulted from Convection Oven Drying

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ABSTRACT

Durian seed is part of the durian fruit that has many benefits but are often considered useless. Durian seeds have the potential to be developed for its use because it contains high starch. This study analyzes the physical characteristics of durian seed starch from convection oven drying. This study used a completely randomized design with two factorials: deposition time (24 and 48 h) and drying temperature (60, 70, and 80°C). Durian seed starch was processed by drying and crushing, then sieved with 100 mesh size. The data analysis used was a two-way ANOVA test followed by Duncan's. The results of ANOVA analysis of different drying temperatures affect the value of water content, yellowness (b), grain average (D), water absorption (DSA), and yield. At the same time, the length of deposition in the process of making starch affects the value of yield variables. The results of durian seed starch characterization resulted in the highest moisture content value of 6.26%; brightness value of 92.92; reddish value of 2.06; yellowish value of 2.24; water absorption value of 1.28 ml/g; and yield value of b16.03%.

1. INTRODUCTION

Durian (*Durio zibethinus*) is a seasonal garden in Indonesia. Jember Regency has the potential to produce abundant durian fruit. Based on BPS (2022), durian fruit production in Jember in 2022 will be 35,315 tons. The abundant production of durian in Jember means that there is a lot of durian fruit trading activity on the side of the road. Many durian buyers enjoy durian fruit on the spot. In this case it can be concluded that the higher the production and sales of durian, the greater the amount of waste in the form of durian seeds and skin produced. The use of durian seed waste is still limited, this is due to limited information about the contents of durian seeds. Durian seeds have a starch content of around 43.6% (Haryati *et al*., 2017). Durian seed starch has a high binding capacity compared to starch produced from cassava and avocado plants, this is due to the amylopectin content in durian seed starch (Suarti *et al*., 2013). Durian seeds have a carbohydrate content, especially starch, of around 42.1% compared to sweet potato 27.9% or cassava 34.7% (Sabella, 2019). The process of making starch from durian seeds can be done using a settling and drying process. In research (Cornelia *et al*., 2013), extraction of durian seed starch was carried out by peeling, grinding, filtering, settling for 48 h, washing the sediment with distilled water, and drying. The settling process requires a certain amount of time for the starch to settle completely. Starch settling is the process of separating starch from water during settling. The settling method is carried out using free settling, that is, the starch solids are allowed to settle according to the length of settling that will be carried out. The resulting sediment is then dried to become flour.

Drying can be done using two methods, namely manual using sunlight and mechanical using a convection oven. The manual drying process in the sun is easy to do and economical but the quality of the product produced by the oven produces good products (Wahyuni *et al*., 2014). The advantage of drying using a convection oven is that the heat produced spreads more evenly, maintains the quality of the material and does not depend on the weather for drying time. The results of drying using a convection oven will dry the product more quickly, because there is a heating element which is widely used as a heat source in the drying process of industrial and food products (Rahman, 2021). The drying process is carried out to maintain quality and extend the shelf life of a material. Research on durian seed starch aims to analyze the effect of a combination of long settling treatment in the starch making process and drying temperature treatment using a convection oven on the physical characteristics of durian seed starch.

2. MATERIALS AND METHODS

2.1. Materials

The research was carried out at the Food and Agricultural Machinery Engineering Laboratory, Agricultural Engineering Study Program, Faculty of Agricultural Technology, Jember University from February to April 2024. Durian seeds were collected from local durian seller. Other materials included water and distilled water. The tools included crucibles, digital scale, convection oven, desiccator, colorimeter, standard Tyler sieves, test tubes, centrifuge, burette, and baking pan.

2.2. Design of Experiment

The experiment was arranged in a completely randomized design with two factors. The first factor was the settling time of durian seed pulp consisting of 24 h (T1), and 48 h (T2). The second factor was the drying oven temperature, namely 60°C (S1), 70°C (S1), and 80°C (S1). All treatment combinations were carried out with 3 replications.

2.2. Research Procedures

The research procedure was divided into two stages, namely the preparation of durian seed starch and analyzing for engineering properties including moisture content, color, yield, particle size distribution, and water absorption capacity.

Durian seeds were sorted first and washed using running water to clean dirt. Clean durian seeds were drained and then peeled from the epidermis. The seeds were crushed using a blender for 5 min with a ratio of seed-to-water 1: 10. The pulp was screened using a filter cloth to separate the dregs and filtrate. The filtrate was deposited for 24 (L1) and 48 h (L2) which will produce liquid at the top and solids at the bottom (sediment).

The sediment was separated and dried using a convection oven for 12 h. The drying was conducted at three different temperatures, namely 60℃ (S1), 70℃ (S2), and 80℃ (S3). The resulted starch was then ground using a blender to reduce the particle size to fine granules. The starch powder was then sieved using a Tyler mesh no. 100 sieve get uniform particle size.

2.3. Variable and Measurement

2.3.1. Water Content

Samples were heated in an oven for around 6 h at a temperature of 105℃. The water content (MC) was calculated using the following equation (AOAC, 2005).

$$MC(\%wb) = \frac{Mb-Mc}{Mb-Ma} \times 100\% \tag{1}$$

where *Ma* is weight of empty cup, *Mb* is weight of cup and fresh sample, and *Mc* is weight of cup and dry sample.

2.3.2. Yield

Yield was calculated from starch amount out of raw material (durian seeds) used during extraction process and was calculated according the following equation (Fauziah & Hariono, 2022).

$$Yield\ (\%) = \frac{y}{x} \times 100\% \tag{2}$$

where *x* is initial weight of durian seeds, and *y* is weight of durian seed starch.

2.3.3. Color (Hunter, 1958)

$$\Delta L^* = L^* + L^*_t \quad (3)$$

$$\Delta a^* = a^* + a^*_t \quad (4)$$

$$\Delta b^* = b^* + b^*_t \quad (5)$$

where L^* is L value of the sample, a^* is sample a value, and b^* is sample b value

2.3.4. Water Absorption Capacity

Starch is hygroscopic materials that easily absorbs moisture from the ambient air. The water absorption capacity (WAC) was calculated according to the following relation (Rieuwpassa *et al*., 2013; Traina & Breene, 1994).

$$WAC\ (ml/g) = \frac{c - a - b}{a} \quad (6)$$

where a is powder weight, b is weight of tube + powder, and c is weight of material after centrifugation

2.3.10. Data Analysis

The data obtained from the research was then analyzed using a two-way ANOVA (Analysis of Variance) to determine the effect of treatment combinations on the starch characteristics. Following is the hypotheses and decision making.

- H0: drying temperature and settling time do not significantly affect the starch characteristics of durian seeds.
- H1: drying temperature and settling time significantly affect the starch characteristics of durian seeds.

The Duncan test (DMRT) was carried out at the $p \leq 0.05$ level to determine the significant difference between treatment combinations.

3. RESULTS AND DISCUSSION

3.1. Process of Making Durian Seed Starch

The results of water content and yield in the drying process using drying temperatures of 60, 70 and 80°C can be seen in Table 1. It shows that the highest water content of 61.27% produces the lowest yield. This can be explained by the involvement of other factors such as the level of starch loss during settling which can influence the resulting yield. The greatest yield was at a temperature of 70°C with a settling time of 48 h. Based on the results of this research, it shows that the yield value for a deposition time of 48 h produces a greater value compared to a deposition time of 24 h. The longer the settling time, the more starch will be produced (Rukmini & Santosa, 2019). At a temperature of 80°C, starch degradation occurs because temperature is too high, resulting in a low yield value compared to that of temperature 70°C.

Table 1. Water content and yield with variations in temperature and deposition time of durian seed starch

Drying Temperature (°C)	Settling Time (h)	MC Initial (%wb)	MC Final (%wb)	Yield (%)
60	24	71.55	5.79	10.76
	48	67.48	5.68	12.34
70	24	68.76	6.25	14.92
	48	63.94	6.26	16.03
80	24	61.27	5.37	9.18
	48	61.27	5.50	9.77

3.2. Effect of Treatment on Starch Characteristic

Durian seed starch resulting from variations in settling time and drying temperature produces characteristic values, namely water content, brightness level (L), redness level (a), yellowness level (b), yield, and water absorption capacity. The results of the characteristic values obtained were then analyzed using a two-way ANOVA test. The results of the ANOVA analysis can be seen in Table 2. It can be observed that the results of the drying temperature and the time of starch deposition are significantly different in the drying temperature treatment, indicating that there is a significant difference in the final water content value, level of yellowness (*b*), yield and water absorption capacity, whereas in the treatment of the time of starch deposition there is a significant difference in the yield observation variable. In the treatment interaction of length of settling time and drying temperature there was no significant difference. Observed variables that have significantly different means are followed by the Duncan Multiple Range Test (DMRT) at the $p \leq 0.05$ level. Duncan test results can be seen in Table 3.

Table 2. ANOVA test results on durian seed starch characteristics

Observation Variable	Source of variance	Sum of Squares (JK)	Degrees of freedom (DB)	Mean sum of squares	*F*-count	*F*-table	*p*-value
Moisture Content	Settling time	0.0002	1	0.0002	0.0021	4.7472	0.964 ns
	Temperature	2.0550	2	1.0275	11.0107	3.8853	0.002**
	Interaction	0.0441	2	0.0220	0.2361	3.8853	0.788 ns
	Error	1.1198	12	0.0933			
	Total	3.2191	17				
Lightness (L)	Settling time	0.4161	1	0.4161	0.6048	4.7472	0.745 ns
	Temperature	0.4192	2	0.2096	0.3047	3.8853	0.451 ns
	Interaction	0.0573	2	0.0287	0.0417	3.8853	0.960 ns
	Error	8.2550	12	0.6879			
Redness (a)	Settling time	0.0119	1	0.0119	0.2237	4.7472	0.635 ns
	Temperature	0.3479	2	0.1740	3.2626	3.8853	0.077 ns
	Interaction	0.0892	2	0.0446	0.8364	3.8853	0.457 ns
	Error	0.6399	12	0.0533			
	Total	1.0889	17				
Yellowness (b)	Settling time	0.0193	1	0.0193	0.0970	4.7472	0.757 ns
	Temperature	1.6355	2	0.8177	4.1009	3.8853	0.044*
	Interaction	0.3929	2	0.1965	0.9853	3.8853	0.398 ns
	Error	2.3928	12	0.1994			
	Total	4.4405	17				
Water Absorption Capacity	Settling time	0.0033	1	0.00327	1.7495	4.7472	0.004**
	Temperature	1.4360	2	0.71799	383.9785	3.8853	0.000**
	Interaction	0.0080	2	0.00398	2.1298	3.8853	0.455 ns
	Error	0.0224	12	0.00187			
	Total	1.4697	17				
Yield	Settling time	5.3880	1	5.38795	12.3018	4.7472	0.201 ns
	Temperature	111.6023	2	55.80113	127.4057	3.8853	0.000**
	Interaction	0.7325	2	0.36627	0.8363	3.8853	0.171 ns
	Error	5.2558	12	0.43798			

Note: *) significant, **) highly significant, ns = not significant

Table 3. Duncan test results on the effect of drying temperature

Temperature (°C)	MC (%wb)	Color *L*	Color *a*	Color *b*	WAC (%)	Yield (%)
60	5.74±0.075b	92.40±0.12 a	2.01±0.22 a	1.27±0.190a	0.93±0.026b	11.55±1.062c
70	6.26±0.457a	92.72±0.82 a	1.72±0.30 a	1.59±0.413ab	0.60±0.068a	15.48±0.961b
80	5.44±0.136a	92.73±1.03 a	1.71±0.10 a	2.01±0.595b	1.29±0.039c	9.47±0.473a

Note: Means followed by different letters in the same column are significantly different under DMRT at α = 0.05. MC = water content; WAC = water absorption capacity.

Based on Table 3, it can be seen that the Duncan test of durian seed starch characteristics, drying temperature influences the final water content value, yellowness level (b), water absorption capacity, and yield which are indicated by different alphabets. Treatment temperatures of 60°C, 70°C, and 80°C showed significant differences in the observed variables of final water content. Treatment temperatures of 60°C and 80°C showed significant differences in final moisture content, yellowness level (b), and yield.

3.2.1. Starch Moisture Content

The moisture content of durian seed starch ranges between 5.37 - 6.26%. The highest value was obtained at a temperature treatment of 70°C with a settling time of 48 hours, while the lowest value was obtained from a combination of a temperature treatment of 80°C with a sedimentation time of 24 hours. At a temperature of 70°C, the highest water content value was obtained because at this temperature the evaporation of water may be faster on the surface of the material but the inside has not yet evaporated. According to Simanjuntak *et al*. (2014), the higher the drying temperature, the lower the water content value produced because the water that comes out of the material is greater. According to the SNI 3451:2011 standard, the maximum water content of starch is 14%, so the water content value of durian seed starch has met the requirements (BSN, 2011).

Table 4. Effect of treatments on the moisture content of durian seed starch

Settling Time (h)	Drying Temperature (°C)			Average
	60	70	80	
24	5.80	6.25	5.37	5.81 A
48	5.68	6.26	5.50	5.81 A
Average	5.74 b	6.26 a	5.44 a	

Note: Means followed by different letters are significantly different under DMRT at α = 0.05. Uppercases for settling time, lowercases for drying temperatures.

3.2.2. Starch Color

Based on the Table, the brightness level (L) of durian seed starch ranges from 92.33 to 92.92. The L value indicates the level of darkness or lightness with a range of 0-100, where a value of 0 tends towards black, while a value of 100 indicates a tendency towards white or bright colors (Pomeranz & Meloan, 1994). The results of the analysis of variance showed that the settling time and drying temperature had no significant effect on the brightness level (L) of durian seed starch. The highest value was obtained from a combination of 80°C temperature treatment with a 24-h sedimentation period, while the lowest value was obtained from a combination of 60°C temperature treatment with a 48-h settling time. In the sedimentation process, lower starch produces solids that are formed that do not break, thus reducing turbidity in the sedimentation process which will affect the brightness level of the product (Rukmini & Santosa, 2019).

Table 5. Effect of treatments on the color of durian seed starch: lightness (*L*), redness (*a*), yellowness (*b*)

Settling Time (h)	Drying Temperature (°C)			Average
	60	70	80	
		Lightness (*L*)		
24	92.48	92.91	92.92	92.77 A
48	92.33	92.53	92.54	92.47 A
Average	92.40 a	92.72 a	92.73 a	
		Redness (*a*)		
24	1.95	1.84	1.72	1.84 A
48	2.06	1.60	1.70	1.78 A
Average	2.01 a	1.72 a	1.71 a	
		Yellowness (*b*)		
24	1.16	1.56	2.25	1.657 A
48	1.38	1.61	1.77	1.587 A
Average	1.270 a	1.585 b	2.010 c	

Note: Means followed by different letters are significantly different under DMRT at α = 0.05. Uppercases for settling time, lowercases for drying temperatures.

The redness level of durian seed starch ranges from 1.60 to 2.06. The highest value is obtained from a combination of 60°C temperature treatment with a sedimentation time of 48 hours, while the lowest value is obtained from a combination of 70°C temperature treatment with a sedimentation time of 48 hours. The redness (*a*) values for the combination of drying temperature and settling time treatments did not differ significantly. This is thought to occur due to the browning reaction (bowing) in wet durian seed starch before drying. Sudirman *et al*. (2018) stated that the browning reaction occurs because wet starch is in direct contact with outside air for a long time.

Based on Table 5, it was found that the yellowness level (*b*) value of durian seed starch during the drying and settling process increased. The value *b* indicates the yellowness level of a substance. The magnitude of b or yellowness level ranges from -50 to 70. Negative values indicate bluer coloration, while positive values indicate yellower coloration (Sutarsi *et al*., 2023). At the level of yellowness, the highest value was obtained from a combination of treatment at a temperature of 80℃ with a deposition period of 24 hours. In this research, the temperature of 80℃ showed the highest yellowness level value, namely 2.25, this shows that the higher the drying temperature, the higher the yellowness level value. That the higher the drying temperature, the higher the *b* value (Purbasari & Putri, 2021). This can be explained by the fact that at higher temperatures browning will occur, which is initiated by the Maillard reaction between sugar and amino acids (Kusumawati *et al*., 2012).

3.2.3. Water Absorption Capacity

Water absorption capacity affects the quality of a food ingredient. Water absorption is one of the factors that affect the quality of starch. Water absorption in starch is the ability of starch to absorb water. Particle size, water content and differences in chemical content of materials affect water absorption (Liputo *et al*., 2022). The results of water absorption measurements can be seen in Table 6. The lowest water absorption value was obtained from a combination of 70℃ temperature of 0.55. Treatment at a temperature of 80℃ produces a low water content and produces dry durian seed starch. Starch dried at 80℃ has a more porous structure which increases the ability to absorb water compared to starch dried at lower temperatures. This shows that the water content value influences the level of water absorption capacity. The drier the material produced, the higher the resulting water absorption capacity (Kurniasari *et al*., 2015).

Table 6. Effect of treatments on the water absorption capacity of durian seed starch

Settling Time (h)	Drying Temperature (°C)			Average
	60	70	80	
24	0.92	0.64	1.30	0.953 A
48	0.93	0.55	1.28	0.920 A
Average	0.925 b	0.595 a	1.290 c	

Note: Means followed by different letters are significantly different under DMRT at α = 0.05. Uppercases for settling time, lowercases for drying temperatures.

Table 7. Effect of treatments on the water absorption capacity of durian seed starch

Settling Time (h)	Drying Temperature (°C)			Average
	60	70	80	
24	10.76	14.93	9.18	11.623 A
48	12.34	16.03	9.77	12.713 B
Average	11.550 b	15.48 c	9.475 a	

Note: Means followed by different letters are significantly different under DMRT at α = 0.05. Uppercases for settling time, lowercases for drying temperatures.

3.2.4. Yield

Yield measurements were carried out to determine the effect of the weight of durian seed starch with a combination of drying temperature and settling time. The yield measurement results can be seen in Table 4. The highest value was obtained from a drying temperature of 70℃ with a settling time of 48 hours. Meanwhile, the lowest value was obtained from a temperature treatment of 80℃ with a deposition time of 24 hours. The longer the settling time, the more starch will be produced (Rukmini & Santosa, 2019). In the drying process, an evaporation process occurs so that the higher the drying temperature, the lower the yield value will be (Jamaludin & Andari, 2023). This is also in accordance with Zulhida & Tambunan (2013), that the higher the drying temperature used, the higher the weight loss will be, resulting in lower yields.

4. CONCLUSION

1. The results of two-way ANOVA and Duncan analysis show that there is an influence of temperature on the variables of final water content, yellowness level, water absorption capacity and yield. Meanwhile, the length of deposition has an influence on the yield of starch.
2. The characteristics of durian seed starch include water content of 5.37% -6.26%; brightness or lightness values range from 92.33 – 92.92; redness level value 1.60 – 2.06; the yellowness level value ranges from 1.16 – 2.24; water absorption capacity ranges from 0.56 – 1.28 ml/g; and the yield value ranges from 9.18% – 16.03%.

REFERENCES

AOAC (Association of Officiating Analytical Chemists). (2005). *Official Methods of Analysis.* (18th ed.). AOAC Internasional, Maryland.

BSN (Badan Standardisasi Nasional). (2011). *SNI 3451:2011 – Tapioka*. Badan Standardisasi Nasional, Jakarta.

Cornelia, M., Syarief, R., Effendi, H., & Nurtama, B. (2013). Pemanfaatan pati biji durian (*Durio zibethinus* murr.) dan pati sagu (*Metroxylon* sp.) dalam pembuatan bioplastik. *Jurnal Kimia dan Kemasan*, ***35***(1), 20-29. https://doi.org/10.24817/jkk.v35i1.1869

Fauziah, Y.N., & Hariono, B. (2022). Uji sifat fisika tepung batang buah naga menggunakan pengering tipe rak. *JOFE: Journal of Food Engineering*, ***1***(4), 151–159. https://doi.org/10.25047/jofe.v1i4.3424

Haryati, S., Rini. A.S., & Safitri, Y. (2017). Pemanfaatan biji durian sebagai bahan baku plastik biodegradable dengan plasticizer giserol dan bahan pengisi caco3. *Jurnal Teknik Kimia*, ***23***(1), 1–8.

Hunter, R.S. (1958). Photoelectric color difference meter. *Journal of the Optical Society of America*, ***48***(597), 985-995.

Jamaludin, J., & Andari, F. (2023). Analisis waktu dan suhu pengeringan chips terhadap mutu tepung gembili (*Dioscorea esculenta* L.). *Jurnal Agroekoteknologi dan Agribisnis*, ***7***(1), 70–83.

Kharisma, N. (2015). The effect of different rotational speed (rpm) disc mill toward the uniformity index of brown sugar. *Jurnal Teknik Pertanian Lampung*, ***3***(3), 223–232.

Kurniasari, E., Waluyo. S., & Sugianti, C. (2015). Mempelajari laju pengeringan dan sifat fisik mie kering berbahan campuran tepung terigu dan tepung tapioka. *Jurnal Teknik Pertanian Lampung*, ***4***(1), 1–8.

Kusumawati, D.D.,,Amanto B.S., & Muhammad, D.R.A. (2012). The influence of preliminary treatment and drying temperature due to physical chemical, and sensory properties of jackfruit seeds flour (*Artocarpus heterophyllus*). *Jurnal Teknosains Pangan*, ***1***(1), 41-48.

Liputo, S.A., Lasale, N.R., & Limonu, M. (2022). Karakteristik fisik dan kimia pati resisten pisang goroho (*Musa acuminafe*, Sp) pada berbagai suhu pengeringan. *Jambura Journal of Food Technology (JJFT)*, ***4***(1), 64-77. http://dx.doi.org/10.37905/jjft.v4i1.11049

Pomeranz, Y., & Meloan, C.E. (1994). *Food Analysis: Theory and Practice*. Chapman and Hall, New York.

Purbasari, D., & Putri, R.R.E. (2021). Physical quality of red chili powder (*Capsicum annum* l.) result. *Protech Biosystems Journal*, ***1***(1), 25-37. https://doi.org/10.31764/protech.v1i1.5978

Rahman, M.T. (2021). Analisa sistem pengering padi otomatis berbasis sensor suhu DS18B20. *Prosiding Seminar Nasional FORTEI7-4 2021 (SinarFe7-4),* ***4***(1), 171–174. https://journal.fortei7.org/index.php/sinarFe7/article/view/46

Rieuwpassa, F.J., Santoso, J., & Trilaksani, W. (2013). Characterization of functional properties fish protein concentrate of skipjack roe (*Katsuwonus pelamis*). *Jurnal Ilmu dan Teknologi Kelautan Tropis*, ***5***(2), 299-309. https://doi.org/10.28930/jitkt.v5i2.7559

Rukmini, P., & Santosa, I. (2019). Pemanfaatan pati gembili (*Dioscorea esculenta*) menjadi glukosa dengan metode hidrolisis asam menggunakan katalis hcl. *Konversi*, ***8***(1), 49–58. https://dx.doi.org/10.20527/k.v8i1.6514

Sabella, A. (2019). Karakteristik bioplastik dari rumput laut (*Eucheuma cottonii*) dan pati singkong dengan penambahan pati dari limbah biji durian. *Risenologi*, ***4***(2), 80–89.

Simanjuntak, S., Nugroho, W.A. & Yulianingsih, R. (2014). Pengaruh suhu pengeringan dan konsentrasi natrium metabisulfit ($Na_2S_2O_5$) terhadap sifat fisik-kimia tepung biji durian (*Durio zibethinus*). *Jurnal Bioproses Komoditas Tropis*, ***2***(2), 91–99.

Suarti, B., Fuadi, M., & Siregar, B.H. (2013). Pembuatan pati dari biji durian melalui penambahan natrium metabisulfit dan lama perendaman. *Agrium*: *Jurnal Ilmu Pertanian*, ***18***(1), 69-78.

Sudirman, N.A., Sukainah, A., & Yanto, S. (2018). Pengaruh pengeringan menggunakan room dryer terhadap kualitas tepung sagu. *Jurnal Pendidikan Teknologi Pertanian*, ***4***, S104-S112.

Sutarsi, S., Abadiyah, N., Lestari, N.P., Purbasari, D., & Taruna, I. (2024). Engineering characteristics of curcuma flour (*Curcuma xanthorrhiza* Roxb.) from convection drying. *Jurnal Teknik Pertanian Lampung*, ***13***(2), 525–535. http://dx.doi.org/10.23960/jtep-l.v13i2.525-535

Traina, M.S., & Breene, W.M. (1994). Composition, functionality and some chemical and physical properties of eight commercial full-fat soy flour. *Journal of Food Processing and Preservation*, ***18***(3), 229-252. https://doi.org/10.1111/j.1745-4549.1994.tb00846.x

Wahyuni, R., Guswandi, G., & Rivai, H. (2014). Pengaruh cara pengeringan dengan oven, kering angin dan cahaya matahari langsung terhadap mutu simplisia herba sambiloto. *Jurnal Farmasi Higea*, ***6***(2), 126–133.

Zulhida, R., & Tambunan, H.S. (2013). Pemanfaatan biji alpukat (*Persea americana* Mill) sebagai bahan pembuat pati. *Agrium*: *Jurnal Ilmu Pertanian*, ***18***(2), 144-148.