Food Research 7 (4) : 235 - 239 (August 2023)
Journal homepage: https://www.myfoodresearch.com

FOOD RESEARCH

FULL PAPER

Effect of additional sodium metabisulphite ($Na_2S_2O_5$) on physico-chemical characteristics of cashew nut (*Anacardium occidentale L*) dregs flours

[1,*]Arifan, F., [1]Jannah, R., [1]Broto, W., [1]Sapatra E.F., [1]Prasetyo, A.N.F. and [2]Susanti

[1]*Industrial Chemical Engineering, Vocational School, Diponegoro University, Semarang, 50275, Indonesia*
[2]*Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, 50275, Indonesia*

Article history:
Received: 11 June 2021
Received in revised form: 4 July 2023
Accepted: 5 August 2023
Available Online: 22 August 2023

Keywords:
Cashew dregs,
Flour,
Sodium metabisulfite

DOI:
https://doi.org/10.26656/fr.2017.7(4).417

Abstract

Wheat flour is a food ingredient derived from wheat whose availability in Indonesia must be imported, while its use is very high. Currently, there are several efforts to substitute flour from local sources such as flour from tubers and nuts, one of which can be used from cashew nuts. Developments to produce quality wheat flour continue to be developed in order to obtain the ideal food product. One way is by adding sodium metabisulfite ($Na_2S_2O_5$). The analysis of cashew nut pulp obtained 8.79% fat, 4.94% protein, 8.25% water, and 2% ash content. The results of the browning index of cashew powder obtained the best value at 0.6% sodium metabisulfite concentration of 0.364. The water content is 5.375% and the ash content is 2.375%.

1. Introduction

Wheat flour is a food ingredient that comes from wheat and in Indonesia, it must be imported because of its high demand (Ministry of Industry of Indonesia, 2013). Based on data from the Asosiasi Produsen Terigu Indonesia (2017), the volume of Indonesian wheat imports in 2017 increased by around 9% of 11.48 million tonnes from the previous year. Likewise, the value increased by 9.9% of the $2.65 billion the previous.

Cashew nuts are one of the most important agro-industrial crops in India, Brazil, Vietnam and African countries. The cashew tree (*Anacardium occidentale* L.) is a native plant of Brazil and in the sixteenth century was introduced into other regions of the world primarily for soil conservation (Sharma *et al*., 2020). Cashews (*Anacardium occidentale* L.) belong to the *Anacardiaceae* family. Cashew nuts contain several amino acids and fat content at 78-80% unsaturated fatty acids from cashew nut oil and bioactive compounds such as monounsaturated fatty acid (MUFA), polyunsaturated fatty acid (PUFA), phenols, and tocopherols which in addition to increasing the taste of food is also good for health. Cashews are reported to be rich in fat (46%), protein (21.2%) and carbohydrates (22.3%) and provide 596 kcal of energy per 100 g of intake. In addition, cashews contain large amounts of essential amino acids, vitamins and minerals (Amorim *et al*., 2018). Its fatty acid content can control cholesterol and selenium levels, exhibit antioxidant properties, participate in thyroid metabolism, and bioactivity in cancer prevention (Amorim *et al*., 2018).

By observing the potential nutritional content and benefits of various cashews that can be processed into flour to create a variety of food. The processing of cashew nut flour is expected to reduce the use of wheat flour and dependence on imported materials to support self-reliance programs in the food sector (Nafa'ani, 2019). The development to produce good quality flour continues in order to obtain ideal food products. The opportune method discussed in this article is the addition of sodium metabisulfite ($Na_2S_2O_5$).

2. Materials and methods

2.1 Preparation of making cashew dregs flour

The cashew nut dregs are processed from cashew milk. The samples were then analyzed for their raw materials in the form of air content, ash content, fat, and protein. Then, the sample was immersed in sodium metabisulfite for 30 mins and later filtered and dried at 75°C for 2 hrs. The flour was then pulverized with a grinder and sieved with 80 meshed-sized sieves. The samples were immersed in sodium metabisulfite with five treatments, without immersion (A), immersion with

*Corresponding author.
Email: *fahmiarifan@live.undip.ac.id*

eISSN: 2550-2166 / © 2023 The Authors.
Published by Rynnye Lyan Resources

FULL PAPER

a concentration of 0.1% (B), 0.3% (C), 0.5% (D) and 0.6% (E).

2.2 Determination of physical and chemical characteristics

The data analyzed included the physical and chemical properties of cashew flour in the form of browning index, proximate analysis, and baking expansion.

2.2.1 Browning index

A 1 g of cashew nut flour sample was extracted with 40 mL of distilled water and 10 mL of 10% trichloroacetic acid solution in a glass beaker. The extract was filtered through a Buchner funnel using Whatman paper No. 2, the filtrate was left for 2 hrs at room temperature. Its concentration was measured with a spectrophotometer at a wavelength of 420 nm. Browning in the sample is generally caused by organic compounds that have the ability to absorb light at certain wavelengths. The amount of browning in the sample will affect how much light is absorbed by the substance. Thus, the higher the browning index, the higher the absorbance at the wavelength associated with the browning.

2.2.2 Proximate analysis

The proximate analysis used is fat content, protein content, carbohydrate content, and water absorption (SNI, 1992).

2.2.3 Baking expansion

Flour swellability analysis of cashew nuts is done by measuring the diameter of raw cookies and after baking. To calculate the expansion ratio, use the following formula:

$$\text{Expansion Ratio} = \frac{\text{Diameter after baking} - \text{Diameter raw}}{\text{Diameter raw}} \times 100\%$$

2.3 Statistical analysis

Microsoft Excel was used for statistical analysis to perform one-way ANOVA. Duncan multiple range test (DMRT) was employed to evaluate the significant difference where the p-value is < 0.05.

3. Results

Analysis of raw materials in the form of wet cashew pulp per 100 g contains 8.79% fat, 4.94% protein, 8.25% moisture content and 2% ash content. The results of the analysis of variance showed that the addition of sodium metabisulfite with a concentration of 0.6% had a significantly different effect ($p<0.05$) on the browning index of cashew flour. Cashew flour A (without treatment/control) has the highest browning index value of 0.749 while E (immersion in 0.6% sodium metabisulfite) has the lowest value of 0.364. Table 1 shows the one-way ANOVA calculation results, where the concentration of sodium metabisulfite has a significant effect on the colour quality of cashew flour. This is evidenced by the resulting F count of 108.5465 while the F critical is 4.89321 where F is greater than the critical F which means that if the sodium metabisulfite concentration is changed the variable will significantly affect the physical-chemical average of cashew flour, this was then followed by the Duncan multiple range test (DMRT).

In Table 2, based on the continued test of the Duncan Multiple Range Test (DMRT) 5%, it can be seen that the soaking treatment of cashew flour with various concentrations gives significantly different results in each treatment. Of the five colours in the treatment, control (A) is darker and has brownish colours compared to the other samples, this is evidenced by the large absorbance value obtained. Based on the results of one-way ANOVA data analysis, the resulting significant value is 0.001 ($p <0.05$).

Table 2. Duncan's Multiple Distance Test (DMRT) results.

Treatment	Average	DMRT 5%
A (control)	0.364	0.417
B	0.447	0.501
C	0.556	0.611
D	0.633	0.688
E	0.749	

The results of the data analysis can be seen in Table 3. The results of the water content indicate that the higher the concentration of sodium metabisulfite ($Na_2S_2O_5$), the lower the water content. In Table 4, the results of one-way ANOVA data analysis are obtained, and the resulting p-value is 0.05 ($p<0.05$). The average value of ash content in cashew flour with a concentration of 0% sodium metabisulfite or without the addition of sodium metabisulfite is 1.5%. The highest value of ash content has obtained an average of four repetitions, 2.375%. The determination of selected flour was based on physical

Table 1. Browning index analysis results

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.365744	4	0.091436	108.5465	6.98E-11	4.89321
Within Groups	0.012636	15	0.000842			
Total	0.378379	19				

https://doi.org/10.26656/fr.2017.7(4).417
© 2023 The Authors. Published by Rynnye Lyan Resources

Table 3. Results of ANOVA analysis of moisture content.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	19.95	4	4.9875	34.2	2.24E-07	3.055568
Within Groups	2.1875	15	0.145833			

Table 4. Results of ANOVA analysis of ash content

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2.375	4	0.59375	5.7	0.005392	3.055568
Within Groups	1.5625	15	0.104167			
Total	3.9375	19				

and chemical parameters. The parameter of the best treatment results of cashew starch is shown in Table 5.

Table 5. Characteristics of cashew dregs.

Composition	Analysis results	Maximum Limit. SNI 01-3751-2006.
Browning Index	0.337	-
Water content	5.375%	14.5%
Ash Level	2.375%	0.70%

4. Discussion

From the analysis of wet cashew dregs per 100 g, it is concluded that cashew dregs can be reused as a substitute mixture for basic foodstuffs in food processing. The browning index value shows the degree of browning of the cashew flour. The higher the browning index value, the more intense the colour of the flour is. The browning was measured as enzymatic and non-enzymatic. The results of the analysis of variance showed that the addition of sodium metabisulfite with a concentration of 0.6% was significantly different. A study by Hardoko *et al*. (2010) reported that immersion in sodium metabisulfite solution could inhibit the browning process. According to Wang *et al*. (2016) sodium metabisulfite when dissolved in water will produce active SO_2 and was in line with a study by Sapers *et al*. (1997) whereby the browning reaction was inhibited by sulfite due to the reaction of sulfite ions with quinine, inhibition of the polyphenoloxidase activity and oxygen reduction. Table 1 shows the one-way ANOVA calculation results, where the concentration of sodium metabisulfite has a significant or significant effect on the colour quality of cashew flour.

This is observed in the resulting F count of 108.5465 while the F critical is 4.89321, where F is greater than the critical F which means that if the sodium metabisulfite concentration is changed the variable will significantly affect the physical-chemical average of cashew flour, it will be followed by the DMRT. In Table 2, based on the continued test of the 5% Duncan Multiple Range Test (DMRT), it can be seen that the soaking treatment of cashew flour with various concentrations gave significantly different results in each treatment. Of the five colours in the treatment, control (A) is darker and has a brownish colour compared to the other samples, this indicates that the large absorbance value obtained was aligned to the research by Sirait *et al*. (2020), that the greater the absorbance value, the higher the browning index.

The results of the water content indicate that the higher the concentration of sodium metabisulfite ($Na_2S_2O_5$), the lower the water content will be. Immersion in sodium metabisulfite causes the tissue cells in the material to become hollow, thus accelerating the drying process. The fast-drying process causes the water in the material to evaporate quickly (Purwanto, 2013). This is in line with the research conducted by Herudiyanto *et al*. (2007) that the low moisture content of cashew flour is related to the destruction of the material by sodium metabisulfite.

The highest ash content value was obtained by an average of four repetitions of 2.375%. This result is not much different from the research Kosoko *et al*. (2014), where they found that the ash content of roasted cashews was 2.47%. Allowed according to SNI 01-3751-2006 which is equal to 0.70%, the ash content of the cashew pulp flour is displayed in Table 5. It can be seen that the higher the concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This occurs due to sodium metabisulfite containing minerals such as Na and S. Its ash plays a role in the presence of these minerals and comes in the form of two kinds of salt, organic and inorganic salt. Organic salts are known as, oxide, and concentrated acetic acid. Meanwhile, inorganic salts are in the form of phosphorus, carbonate, chloride, sulfur, and nitrate salts (Mendes *et al*. 2019). Thus, based on the results of the study, it can be concluded that soaking using sodium metabisulfite can increase the ash content of the cashew flour.

Table 5 shows that the cashew dregs flour produced has combined with the SNI only for the unsuitable ash content, while the high ash content is due to the higher concentration of sodium metabisulfite. This occurs because sodium metabisulfite contains the minerals Na and S. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

https://doi.org/10.26656/fr.2017.7(4).417
© 2023 The Authors. Published by Rynnye Lyan Resources

Table 6 shows the analysis of the best treatments, where the fat content of cashew nuts was 47.64%. According to Astawan (2009), the total fat content of raw cashews was 47%. The higher fat content in cashew nut flour can be caused by the drying process with a temperature of 75°C for 2 hrs in the process of making cashew nut flour. Heat can cause disruption of the cell structure and the partition of the membrane of a material causing the release of more free fat molecules, that fat will be easily extracted from the material (Kosoko *et al*., 2014). The results from measuring the fat content of cashew nut flour were higher than those of Kosoko *et al*. (2014). The fat content of roasted cashews was 43.25%. The milling process resulted in a more extractable and measurable fat content in cashew nut flour compared to roasted cashews. High protein content helps to bind the components of food to help form the texture of the food (Andarwulan *et al*., 2011). The protein content of selected cashew nut flour was 15.27%. The results of measuring the protein content of cashew nut flour decreased when compared to the results of Kosoko *et al*. (2014), which reported that the protein content of roasted cashews is 18.39%. This is because the protein will suffer damage and decrease in quantity during food processing. The decrease in the amount of protein depends on the process carried out and the factors that influence the reduction in protein are temperature and water. Temperature causes protein denaturation which according to research by Ratnasari *et al.* (2017) states that less protein was lost with a shortened drying time.

Table 6. Characteristic results of the best treatment of cashew dregs flour.

Composition	Analysis result (%)
Fat level	47.64
Protein Level	15.27
Carbohydrate Level	28.59
Water Absorption	3.78
Oil Absorption	30.2
Flower Power	50

Temperature causes protein denaturation and water causes dissolved protein to be lost with water. This occurs in the manufacturing process of flour. The carbohydrate content of wet cashew nuts is 33.27%, while the carbohydrate content in cashew flour is 28.59%. This result is lower when compared to the results of Kosoko *et al*. (2014) where the carbohydrate content of roasted cashews was 29.10%. This can be caused by differences in fat content where cashew nut flour has more fat than roasted cashews, and the carbohydrate content of cashew nut flour is lower than the carbohydrate content. The decrease in carbohydrate levels was caused by the drying and soaking process with sodium metabisulfite where the cell walls of cashew pulp are dissolved in water and expanded and are semipermeable, resulting in the molecules of organic compounds such as sugar freely penetrating the cell walls into the water. During the soaking process, soluble substances such as carbohydrates and vitamins will be dissolved (Sunarti, 2013).

Moreover, water absorption capacity is the ability to absorb water and retain it in a food system. The water absorption capacity shows how much water (g) is absorbed by one gram of flour. The water absorption capacity of cashew flour is 3.78 g water/g flour. This value is higher than the water absorption capacity of commercial flour, which is 2.25 g water/g flour. This is related to the amount of protein and carbohydrates in cashew flour. The absorption and binding of water are a distinct characteristic of the protein. According to Wianarno (1992), carbohydrates have the ability to absorb a higher amount of water than protein. The absorption of oil is influenced by the structure of the starch, the absorption of water in the cashew flour at the time of immersion also facilitates the absorption of oil because the breakdown of complex molecules becomes simpler. The absorption power of the selected cashew flour was 30.2%. Oil absorption is an important property in food formulation because it can improve the flavour and mouthfeel of food. In addition to that, the flour was selected as the lowest water content to be analyzed for its score baking expansion (Yudanto *et al*., 2020). The baking expansion of cookies is related to the crispiness of cookies. The higher the baking expansion, the crispier the cookies will be. Baking expansion generated from cashew flour is 50%. The occurrence of swelling can be caused by the formation of air cavities in the cookies that have been baked in the oven due to the influence of temperature, causing the water bound in the gel to transform into steam. The resulting vapour pressure forces the starch gel to form an expanding product (Lavlinesia, 1995).

5. Conclusion

The results showed that the concentration of sodium metabisulfite had a significant effect on improving the colour quality. The most optimal results were obtained in the treatment of 0.6% sodium metabisulfite concentration, in this treatment, the browning Index value was 0.337, moisture content was 5.375% and ash content was 2.375%.

Conflict of interest

The authors declare no conflict of interest.

 © 2023 The Authors. Published by Rynnye Lyan Resources

References

Amorim, M., Pereira, J.O., Silva, L.B., Ormenese, R.C.S.C., Pacheco, M.T.B. and Pintado, M. (2018). Use Of Whey Peptide Fraction in Coated Cashew Nut as Functional Ingredient and Salt Replacer. *Food Science and Technology*, 92, 204–211. https://doi.org/10.1016/j.lwt.2017.12.075

Andarwulan, N., Kusnandar, F. and Herawati, D. (2011). Analisis Pangan. Jakarta, Indonesia: Dian Rakyat [In Bahasa Indonesia].

Astawan, M. (2009). Sehat dengan Hidangan Kacang dan Biji-bijian. Jakarta, Indonesia: Penebar Swadaya. [In Bahasa Indonesia]

Asosiasi Produsen Terigu Indonesia. (2017). Data Impor Gandum. Retrievied on December 29, 2020 from Website: https://industria.kontan.co.id/news/ [In Bahasa Indonesia]

Hardoko, L., Hendarto and Siregar, T.M. (2010). Pemanfaatan Ubi Jalar Ungu *(Ipomoea Batatas L. Poir*) Sebagai Pengganti Sebagian Tepung Terigu Dan Sumber Antioksidan Pada Roti Tawar. *Jurnal Teknologi dan Industri Pangan,* 21(1), 25. [In Bahasa Indonesia]

Herudiyanto, Marleen, Debby, M., Sumanti and Ria, N. (2007). Pengaruh Konsentrasi dan Lama Perendaman Dalam Larutan Natrium Metabisulfit ($Na_2S_2O_5$) Terhadap Karakteristik Tepung Bawang Merah (*Allium ascalonicum L*) Varietas Sumenep. *Jurnal Teknotan*, 1(1), 4788. [In Bahasa Indonesia]

Kosoko, S.B., Oluwole, O.B., A.O. Darmola, Adepoju, M.A., Oyelakin, A.J., Tugbobo-amisu, A.O., Alagbe, G.O. and Elemo, G.N. (2014). Comparative Quality Evaluation of Roasted Cashew Nut Kernel: Effect of Roasting Methods. *Advance Journal of Food Science and Technology*, 6(12), 1362- 1371.

Lavlinesia. (1995). Kajian Beberapa Faktor Pengembangan Volumetrik dan Kerenyahan Kerupuk Ikan. Bogor, Indonesia: Institut Pertanian Bogor. Thesis.

Mendes, M.K., Oliveira, C.B. dos S., Veras, M.D.A., Araújo, B.Q., Dantas, C., Chaves, M.H., Lopes Júnior, C.A. and Vieira, E.C. (2019). Application Of Multivariate Optimization for The Selective Extraction of Phenolic Compounds In Cashew Nuts (*Anacardium occidentale L*). *Talanta*, 205, 120100. https://doi.org/10.1016/j.talanta.2019.06.100

Nafa'ani, R. (2019). Pemanfaatan Tepung Kacang Hijau Sebagai Substitusi Pada Produk Kacang Hijau Nastar Cookies (*Kajonas Cookies*). Indonesia: Universitas Negri Yogyakarta. BSc Thesis. [In Bahasa Indonesia]

Purwanto. C.C., Ishartani, D. and Rahardian, D. (2013). Kajian Sifat Fisik dan Kimia Tepung Labu Kuning (Cucurbita maxima) dengan Perlakuan Blanshing dan Perendaman dengan Natrium Metabisulfit. *Jurnal Tekno Sains*, 2(2), 2302-0733. [In Bahasa Indonesia]

Ratnasari, D., Rustanti., N., Arifan., F. and Afifa, D.N. (2017). The Effects of Treatments on Batu Banana Flour and Percentage of Wheat Substitution on The Resistant Starch, *In Vitro* Starch Digestibility Content and Palatability of Cookies Made with Banana (*Musa balbisiana Colla*) Flour. *IOP Conference Series: Earth and Environmental Science*, 116, 012003. https://doi.org/10.1088/1755-1315/116/1/012003

Sapers, G.M., Cooke, P.H., Heidel, A.E. Martin, S.T. and Miller, R.L. (1997). Structural changes related to texture of pre-peeled potatoes. *Journal of Food Science*, 60(1), 797-803.

Sharma, P., Gaur, V.K., Sirohi, R., Larroche, C., Kim, S.H. and Pandey, A. (2020). Valorization Of Cashew Nut Processing Residues For Industrial Applications. *Industrial Crops and Products*, 152, 112550. https://doi.org/10.1016/j.indcrop.2020.112550

Sirait, V.A.A., Zulkifli, Z., Handayani, T.T. and Lande, M.L. (2020). Pengaruh Penambahan Asam Sitrat Terhadap Proses Non-Enzimatik Browning Jus Buah Pir Yali (Pyrus bretschneideri Rehd). Jurnal Penelitian Pertanian Terapan, 18(3), 186. https://doi.org/10.25181/jppt.v18i3.1505 [In Bahasa Indonesia]

Standardisasi Nasional Indonesia (SNI). (1992). Metode Pengujian Air dan Serbuk untuk Makanan (SNI 01-2891-1992). Jakarta, Indonesia: Badan Standardisasi Nasional. [In Bahasa Indonesia]

Sunarti, T.C. and Richana, N. (2013). Karakterisasi Sifat Fisikokimia Tepung Umbi Dan Tepung Pati Dari Umbi Ganyong, Suweg, Ubi Kelapa Dan Gembili. *Jurnal Pascapanen*, 1(1), 29-37. [In Bahasa Indonesia]

Winarno, F.G. (1992). Kimia Pangan dan Gizi. Jakarta, Indonesia: Gramedia Pustaka Utama. [In Bahasa Indonesia]

Yudanto, Y.A., Alvina, R.W. and Pudjihastuti, I. (2020). The Effect of Lactic Acid Hydrolysis in the Making of Modified Maizena Flour. *Journal of Vocational Studies on Applied Research*, 2(2), 16-19.

 © 2023 The Authors. Published by Rynnye Lyan Resources