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Effect of Additional Sodium Metabisulphite ($Na_2S_2O_5$) on Physical-Chemical Characteristics of Cashew Dregs Flour

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Abstract

Wheat flour is a food ingredient that comes from the availability of wheat in Indonesia for import, even though its use is very high. Therefore currently, there are many efforts to substitute flour from local sources such as flour from tubers and nuts, one of which can be used from cashew nuts from cashew plants. 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 ($Na_2S_2O_5$). Analysis of cashew nut pulp obtained 8.79% fat content, 4.94% protein, 8.25% water content, 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%.

Keywords: Cashew Dregs, Flour, Sodium Metabisulfite

1. Introduction

Wheat flour is a food material derived from wheat whose availability in Indonesia must be imported, while its use is very high. (Ministry of Industry of Indonesia, 2013). Based on data from the Indonesian Wheat Flour Association (2017), the volume of Indonesian wheat imports in 2017 increased by around 9% to 11.48 million tonnes from the previous year. Likewise, the value increased 9.9% to US $ 2.65 billion from the previous one.

Cashew nuts are one of the most important agro-industrial crops in India, Brazil, Vietnam and African countries. Cashew tree (Anacardium occidentale) is a native plant Brazil and in the sixteenth century introduced into other regions of the world ter primary for soil conservation (Sharma *et al.*, 2020). Cashews, Anacardium occidentale L., belong to the Anacardiaceae family . cashew nuts contains several amino acids and fat content is quite high at 78-80% unsaturated fatty acids from cashew nut oil and bioactive compounds such as MUFA (Monounsaturated Fatty Acid), PUFA (Poly

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Unsaturated Fatty Acid), 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%) provides 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 have been shown to be antioxidants, participate in thyroid metabolism, and bioactivity in cancer prevention (Amorim *et al*., 2018).

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

2. Materials and methods

2.1 Preparation making Cashew dregs Flours

Furthermore, the cashew nut dregs are obtained from cashew milk processing. The sample then analyzed the raw materials in the form of air content, ash content, fat and protein. Then the sample was immersed with sodium metabisulfite for 30 minutes, after which it was filtered and dried at 75° C for 2 hours. The flour is then pulverized with a grinder and 80 mesh of sieves . Samples were immersed in sodium metabisulfite with five treatments, without immersion (A), immersion with 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, ai content, ash content, proximate analysis and flour power of flour .

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3. Results

Analysis of raw materials in the form of wet cashew pulp per 100 grams contains 8.79% fat, 4.94% protein, 8.25% moisture content and 2% ash content. The results of the analysis of variety 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 or significant effect on the color 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, it will followed by the DMRT (Duncan Multiple Range Test).

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 colors in the treatment, control (A) is darker and has a brownish color 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 sig value is 0.001 (Sig <0.05).

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 will be. In table 4, the results of one way ANOVA data analysis are obtained, the resulting sig value is 0.05 (Sig <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 was obtained an average of four repetitions, namely 2.375 %. Determination of selected flour based on physical and chemical parameter. The parameter of the best treatment results of cashew starch are shown in table 5.

4. Discussion

From the analysis of wet cashew dregs per 100 grams, 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 browner the flour is. Measured browning is enzymatic and non-enzymatic. The results of the analysis of variance showed that the addition of sodium metabisulfite with a concentration of 0.6% gave the influence is significantly different. The results of research Hardoko, et al. (2010) showed 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 SO2 . Sinha et al. (2017) also stated that the browning reaction can be inhibited by sulfite due to the reaction of sulfit ions with quinine, inhibition of 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 color 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, it will followed by the DMRT (Duncan Multiple Range Test). 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 colors in the treatment, control (A) is darker and has a brownish color compared to the other

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samples, this is evidenced by the large absorbance value obtained where according to (Sirait et al., 2020) 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, namely 2.375%. This result is not much different from the results of research by Kosoko et al., (2014), in their research 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 gives the results shown in Figure 8. It can be seen that the higher the concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium metabisulfite contains the minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt, namely organic salt and inorganic salt. Organic salts such as salts of malic, oxidic, concentrated acetic acid. Meanwhile, inorganic salts are in the form of phosphorus, carbonate, chloride, sulfur, and nitrate salts (Mendes, *et al*. 2019). So, 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 complied with the SNI only for the unsuitable ash content, the high ash content is due to the higher concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium metabisulfite contains minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt, namely organic salt and inorganic salt. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

Table 6 shows the analysis of the best treatments where the fat content of cashew nuts was 47.64%, while 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 75ºC for 2 hours in the process of making cashew nut flour. Heat can cause disruption of the cell structure and the partition membrane of a material causing the release of more free fat molecules so that fat will be easily extracted from the material (Kosoko *et al.,* 2014). The results of measuring the fat content of cashew nuts flour were higher than those of Kosoko et al., Namely the fat content of roasted cashews was 43.25%. The milling process results in 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 dregs flour decreased with the results of research by Kosoko *et al* (2014)., in his research showed that the protein content of roasted cashews was 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 processing carried out. The factors that influence the process of reducing the amount of protein are temperature and water.

Temperature causes protein denaturation and water causes dissolved protein to be lost with water. This happens in the manufacture of flour. The results of the calculation of the carbohydrate content of wet cashew nuts were 33.27%. While the carbohydrate content in cashew flour is 28.59%. This result is lower when compared to the results of the study by Kosoko *et al* (2014). namely 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 so that the carbohydrate content of cashew nut flour is lower than the carbohydrate content. The decrease in carbohydrate levels can be caused by the drying and soaking process with sodium metabisulfite where the cell walls of cashew pulp are dissolved in water so that they expand and are semipermaebel, so that the molecules of organic compounds such as sugar can freely penetrate the cell walls into the water. During the soaking process, soluble substances such as carbohydrates and vitamins will be dissolved (Sunarti, 2013).

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Water absorption capacity is the ability to absorb water and hold 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 is one of the characteristics of protein. According to Wianarno 1992, carbohydrates have the ability to absorb water higher 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 absorption of oil because the breakdown of complex molecules becomes simpler. The absorption power of the selected cashew flour flour was 30.2%. Oil absorption is an important property in food formulation because it can improve the flavor and mouthfeel of food. After that, flour analyzed the water content and selected the lowest water content to be analyzed the score of the baking expansion (Yudanto et al., 2020). Baking expansion of cookies is related to the crispiness of cookies. The higher 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 oven due to the influence of temperature,

causing the water bound in the gel to become steam. The resulting vapor pressure forces the starch gel to form an expanding product (Lavlensia, 2013).

5. Conclusion

The results showed that the concentration of sodium metabisulfite had a significant effect on improving the color 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 - Disclose any potential conflict of interest appropriately.

The authors declare no conflict of interest.

Acknowledgments

Thanks to all declare no conflict of interest.

References

Abitogu, A. 2009. Physicochemical parameters and fatty acid composition of cashew nut (Annacardium occidentale) oil. Nigerian journal of Chemical Research.

Adeleke, R.O., and O.A Abiodun. 2010. "Nutritional composition of breadnut seeds (Artocarpus camansi)". African Journal of Agricultural Reseach Vol. 5 (11), pp. 1273-1276

Amorim, M., Pereira, J. O., Silva, L. B., Ormenese, R. C. S. C., Pacheco, M. T. B., & Pintado, M. (2018). Use of whey peptide fraction in coated cashew nut as functional ingredient and salt replacer. LWT - Food Science and Technology, 92(May 2017), 204–211. https://doi.org/10.1016/j.lwt.2017.12.075

AOAC. 1995. Official Methods of Analysis, 16 th ed. AOAC International, Maryland.

Ariyantoro, A. R., Rachmawanti, D., & Ikarini, I. (2016). Karakteristik Fisikokimia Tepung Koro Pedang (Canavalia Ensiformis) Termodifikasi Dengan Variasi Konsentrasi Asam Laktat Dan Lama Perendaman. 36(1), 1–6.

Astawan, Made. 2009. Sehat dengan Hidangan Kacang dan Biji-bijian. Jakarta: Penebar Swadaya.

Asosiasi Produsen Terigu Indonesia. 2017. Data Impor Gandum. https://industria.kontan.co.id/news/.

Badan Pusat Statistik. 2017. Data Impor Gandum Indonesia 2017. [Online] Available at: http://www.bps.go.id

BPOM RI No. 36 tahun 2013 tentang Batas Maksimum Penggunaan Bahan Tambahan Pengawet

BSN. 2006. SNI 01-3751-2006. Tepung Terigu Sebagai Bahan Makanan. Badan Standardisasi Nasional. Jakarta.

Fajrin, J., Pathurahman, Lalu Gita Pratama, Basuki, T., Lia, V., Balai, U. P. T., Biomaterial, P., Marpaung, J. L., Sutrisno, A., Lumintang, R., Surata, I. W., Lokantara, I. P., Arimbawa, P., & Purwanto, D. (2016). Aplikasi Metode Analysis of Variance (Anova) Untuk Mengkaji Pengaruh. Jurnal Energi Dan Manufaktur, 6(2), 11–23.

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Harmon, M., Skow, B., Simonson, P., Peck, J., Craig, R. T., Jackson, J. P., Simonson, P., Peck, J., Craig, R. T., Jackson, J. P., Pointon, D., Sugiyono, A., Thiel, C., Priyono, Sugiyono, S., Bentley, J. L., Van Fraassen, B. C., Creswell, John W. Edition, T., Hirschberg, W., … McCrae, R. R. (2016). Metode Penelitian Kuantitatif. In Philosophy of Science. https://doi.org/http://dx.doi.org/10.1007/978-1-4419-8580-4_5

Hardoko, L. Hendarto dan T. M. Siregar. 2010. Pemanfaatan ubi jalar ungu (Ipomoea batatas L. Poir) sebagai pengganti sebagian tepung terigu dan sumber antioksidan pada roti tawar. J. Teknol. dan Industri Pangan. 21(1): 25.

Hidayat, N., Sunartati, R., Nurman, S., Irmayati, & Sholihati. (2019). Innovation Utilization of Tofu Waste Into Flour With The Addition of Sodium Metabisulfit As Antibrowning. Innovation,1(1),1–7. https://pdfs.semanticscholar.org/3cc1/74525db9336469af32aa2165494b0fba76b6.pdf

Herudiyanto, Marleen, Debby M. Sumanti dan Ria Nurul Ahadlyah. 2007. Pengaruh Konsentrasi dan Lama Perendaman Dalam Larutan Natrium Metabisulfit (Na2S2O5) Terhadap KarakteristikTepung Bawang Merah (Allium ascalonicum L) Varietas Sumenep. Jurnal Teknotan Vol. 1 No. 1 Januari 2007

He, Q., Luo, Y., and ChEN, p., 2008, Elucidation of The Mechanism Of Enzymatic Browning By Sodium Chlorite, Food Chemistry (110);47-851 Ismail, F. (2018). Statistika untuk penelitian pendidikan dan ilmu-ilmu sosial. Prenadamedia Group.

Kementrian Perdagangan Republik Indonesia.2014.Pengertian Tentang Kacang Mete.Jakarta:Ensiklopedia.

Kumar, S., Rekha, dan L. K. Sinha. 2010. Evaluation of quality characteristics of soy based millet biscuits. Pelagia Research Library. 1(3): 187-196.

Kosoko, S.B., Oluwole, O.B., A.O. Darmola, Adepoju, M.A., Oyelakin, A.J., Tugbobo-amisu, A.O., Alagbe, G.O. dan 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.

Kristianto, A. Made.2012. Physicochemical Properties And Functional Qualities Of High Protein Mucuna Bean (Mucuna Pruriens L.) Flour. Faculty of Agricultural Engineering and Technology, Bogor Agricultural University, IPB Darmaga Campus

Lavlinesia. 2013. Kajian Beberapa Faktor Pengembangan Volumetrik dan Kerenyahan Kerupuk Ikan. Tesis. Institut Pertanian Bogor. Bogor

Mendes, M. K. de A., Oliveira, C. B. dos S., Veras, M. D. A., Araújo, B. Q., Dantas, C., Chaves, M. H., Lopes Júnior, C. A., & Vieira, E. C. (2019). Application of multivariate optimization for the selective extraction of phenolic compounds in cashew nuts (Anacardium occidentale L.). Talanta, 205(May), 120100. https://doi.org/10.1016/j.talanta.2019.06.100

Nafa'ani Rachma, 2019. Pemanfaatan Tepung Kacang Hijau Sebagai Substitusi Pada Produk Kacang Hijau Nastar Cookies (Kajonas Cookies). Skripsi. Fakultas Teknik. Universitas Negri Yogyakarta.

N. Chandrasekara, F. Shahidi, Effect of roasting on phenolic content and antioxidant activities of whole cashew nuts, kernels, and testa, J. Agric. Food Chem. 59 (2011) 5006–5014.

Negri, Lely Kusmawati, 2016. Pengaruh Penambahan Natrium Metabisulfit terhadap Mutuh Tepung Bentul (Colocasia asculenta (L). Schott). Karya Tulis Ilmiah. Akademi Analisis Farmasi dan Makanan. Malang.

Nurani, dkk. 2014. Pemanfaatan Tepung Kimpul (Xanthosoma sagittifolium) sebagai Bahan Baku Cookies (Kajian Proporsi Tepung dan Penambahan Margarin). Jurnal Pangan dan Agroindustri Vol.2 No.2 p.50-58. Universitas Brawijaya. Malang.

Ogunsina, B. S., & Bamgboye, A. I. (2014). Pre-shelling parameters and conditions that influence the whole kernel out-turn of steam-boiled cashew nuts. Journal of the Saudi Society of Agricultural Sciences, 13(1), 29–34. https://doi.org/10.1016/j.jssas.2012.12.005

Owiredu, I., Laryea, D., & Barimah, J. (2014). Evaluation of cashew nut flour in the production of biscuit. Nutrition and Food Science, 44(3), 204–211. https://doi.org/10.1108/NFS-06-2013-0067

Purwanto. C. C., dkk. 2013. Kajian Sifat Fisik dan Kimia Tepung Labu Kuning (Cucurbita maxima) dengan Perlakuan Blanshing dan Perendaman dengan Natrium Metabisulfit. Universitas Sebelas Maret. Surakarta

Prabasini, Ishartani, dan Rahardian. 2013. Kajian Sifat Fisika dan Kimia Tepung Labu Kuning (Cucurbita moschata) dengan Perlakuan Blanching dan Perendaman Natrium Metabisulfit (Na2S2O5). Jurnal Teknosains Pangan Vol. 2 No.2

Quality Evaluation of Roasted Cashew Nut Kernel : Effect of Roasting Methods. Advance Journal of Food Science and Technology. 6(12): 13621371.

Sharma, P., Gaur, V. K., Sirohi, R., Larroche, C., Kim, S. H., & Pandey, A. (2020). Valorization of cashew nut processing residues for industrial applications. Industrial Crops and Products, 152(May), 112550. https://doi.org/10.1016/j.indcrop.2020.112550

Sunarti. Richana, N. dan T. C. 2013. Karakterisasi sifat fisikokimia tepung umbi dan tepung pati dari umbi ganyong, suweg, ubi kelapa dan gembili. Jurnal Pascapanen. 1(1): 29-37

Tajudeen, Y., Okpuzor, J., & Fausat, A. T. (2011). Investigation of general effects of cement dust to clear the controversy surrounding its toxicity. Asian Journal of Scientific Research, 4(4), 315–325. https://doi.org/10.3923/ajsr.2011.315.325

Tufail, T., Saeed, F., Bader, H., Ain, U., Niaz, B., Afzaal, M., Din, A., & Suleria, R. (2020). Trends in Food Science & Technology Cashew nut allergy ; immune health challenge. 86(November 2018), 209–216. https://doi.org/10.1016/j.tifs.2019.02.014

Wang, D. F., H. Lin, J. Kan, X. Zeng, S. Shen. 2016. Food Chemistry. Nova Publishers, New York.

Yudanto, Y. A., Alvina, R. W., & 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.

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				

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

treatment	average	DMRT 5%	Symbol
A (control)	0,36475	0,417500309	a
B	0,4475	0,501904651	b
C	0,55625	0,611394752	c
D	0,6335	0,688847917	d
E	0,749		e

Note: Numbers that are not followed by the same letter show the difference real based on DMRT 5% test

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				

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%

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

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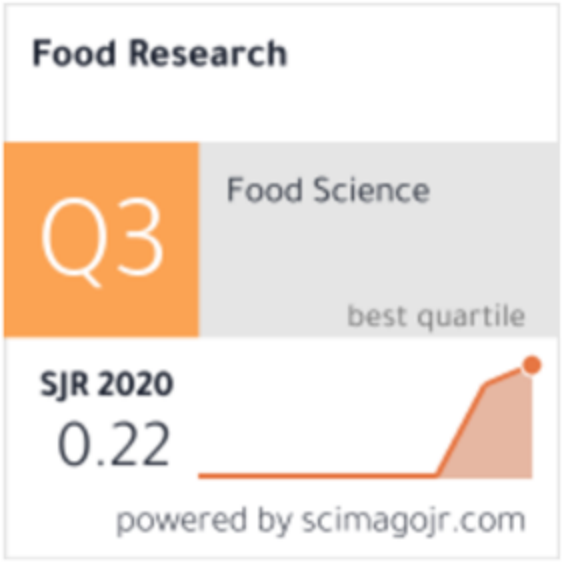

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11th June 2021

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Manuscript title: Effect of Additional Sodium Metabisulphite ($Na_2S_2O_5$) on Physical-Chemical Characteristics of Cashew Dregs Flour

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Effect of Additional Sodium Metabisulphite ($Na_2S_2O_5$) on Physical-Chemical Characteristics of Cashew Dregs Flour

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Abstract

Wheat flour is a food ingredient that comes from the availability of wheat in Indonesia for import, even though its use is very high. Therefore currently, there are many efforts to substitute flour from local sources such as flour from tubers and nuts, one of which can be used from cashew nuts from cashew plants. 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 ($Na_2S_2O_5$). Analysis of cashew nut pulp obtained 8.79% fat content, 4.94% protein, 8.25% water content, 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%.

Keywords: Cashew Dregs, Flour, Sodium Metabisulfite

1. Introduction

Wheat flour is a food material derived from wheat whose availability in Indonesia must be imported, while its use is very high. (Ministry of Industry of Indonesia, 2013). Based on data from the Indonesian Wheat Flour Association (2017), the volume of Indonesian wheat imports in 2017 increased by around 9% to 11.48 million tonnes from the previous year. Likewise, the value increased 9.9% to US $ 2.65 billion from the previous one.

Cashew nuts are one of the most important agro-industrial crops in India, Brazil, Vietnam and African countries. Cashew tree (*Anacardium occidentale*) is a native plant Brazil and in the sixteenth century introduced into other regions of the world ter primary for soil conservation (Sharma *et al*., 2020). Cashews, *Anacardium occidentale L*., belong to the *Anacardiaceae* family. Cashew nuts contains several amino acids and fat content is quite high at 78-80% unsaturated fatty acids from cashew nut oil and bioactive compounds such as MUFA (*Monounsaturated Fatty Acid*), PUFA (*Poly*

Unsaturated Fatty Acid), 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%) provides 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 have been shown to be antioxidants, participate in thyroid metabolism, and bioactivity in cancer prevention (Amorim *et al*., 2018).

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

2. Materials and methods

2.1 Preparation making Cashew dregs Flours

~~Furthermore,~~ the cashew nut dregs are obtained from cashew milk processing. The sample then analyzed the raw materials in the form of air content, ash content, fat and protein. Then the sample was immersed with sodium metabisulfite for 30 minutes, after which it was filtered and dried at 75° C for 2 hours. The flour is then pulverized with a grinder and 80 mesh of sieves . Samples were immersed in sodium metabisulfite with five treatments, without immersion (A), immersion with 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, ai content, ash content, proximate analysis and flour power of flour .

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3. Results

Analysis of raw materials in the form of wet cashew pulp per 100 grams contains 8.79% fat, 4.94% protein, 8.25% moisture content and 2% ash content. The results of the analysis of variety 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 or significant effect on the color 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, it will followed by the DMRT (*Duncan Multiple Range Test*).

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 colors in the treatment, control (A) is darker and has a brownish color 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 sig value is 0.001 (Sig <0.05).

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 will be. In Table 4, the results of one way ANOVA data analysis are obtained, the resulting sig value is 0.05 (Sig <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 was obtained an average of four repetitions, ~~namely~~ 2.375 %. Determination of selected flour based on physical and chemical parameter. The parameter of the best treatment results of cashew starch are shown in Table 5.

4. Discussion

From the analysis of wet cashew dregs per 100 grams, 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 browner the flour is. Measured browning is enzymatic and non-enzymatic. The results of the analysis of variance showed that the addition of sodium metabisulfite with a concentration of 0.6% gave the influence is significantly different. The results of research Hardoko, *et al*. (2010) showed 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 SO2 . Sinha *et al*. (2017) also stated that the browning reaction can be inhibited by sulfite due to the reaction of sulfit ions with quinine, inhibition of 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 color 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, it will followed by the DMRT (Duncan Multiple Range Test). 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 colors in the treatment, control (A) is darker and has a brownish color compared to the other

samples, this is evidenced by the large absorbance value obtained where according to (Sirait *et al*., 2020) 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, ~~namely~~ 2.375%. This result is not much different from the results of research by Kosoko *et al*., (2014), in their research 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 gives the results shown in Figure 8. It can be seen that the higher the concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium metabisulfite contains the minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt, namely organic salt and inorganic salt. Organic salts such as salts of malic, oxidic, concentrated acetic acid. Meanwhile, inorganic salts are in the form of phosphorus, carbonate, chloride, sulfur, and nitrate salts (Mendes, *et al*. 2019). So, 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 complied with the SNI only for the unsuitable ash content, the high ash content is due to the higher concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium metabisulfite contains minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt, namely organic salt and inorganic salt. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

Table 6 shows the analysis of the best treatments where the fat content of cashew nuts was 47.64%, while 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 75ºC for 2 hours in the process of making cashew nut flour. Heat can cause disruption of the cell structure and the partition membrane of a material causing the release of more free fat molecules so that fat will be easily extracted from the material (Kosoko *et al*., 2014). The results of measuring the fat content of cashew nuts flour were higher than those of Kosoko *et al*., ~~Namely~~ the fat content of roasted cashews was 43.25%. The milling process results in more extractable and

easurable 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 dregs flour decreased with the results of research by Kosoko *et al* (2014)., in his research showed that the protein content of roasted cashews was 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 processing carried out. The factors that influence the process of reducing the amount of protein are temperature and water.

Temperature causes protein denaturation and water causes dissolved protein to be lost with water. This happens in the manufacture of flour. The results of the calculation of the carbohydrate content of wet cashew nuts were 33.27%. While the carbohydrate content in cashew flour is 28.59%. This result is lower when compared to the results of the study by Kosoko *et al*. (2014), ~~namely~~ 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 so that the carbohydrate content of cashew nut flour is lower than the carbohydrate content. The decrease in carbohydrate levels can be caused by the drying and soaking process with sodium metabisulfite where the cell walls of cashew pulp are dissolved in water so that they expand and are semipermaebel, so that the molecules of organic compounds such as sugar can freely penetrate the cell walls into the water. During the soaking process, soluble substances such as carbohydrates and vitamins will be dissolved (Sunarti, 2013).

Water absorption capacity is the ability to absorb water and hold 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 is one of the characteristics of protein. According to Wianarno (1992), carbohydrates have the ability to absorb water higher 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 absorption of oil because the breakdown of complex molecules becomes simpler. The absorption power of the selected cashew flour flour was 30.2%. Oil absorption is an important property in food formulation because it can improve the flavour and mouthfeel of food. After that, flour analyzed the water content and selected the lowest water content to be analyzed the score of the baking expansion (Yudanto *et al*., 2020). Baking expansion of cookies is related to the crispiness of cookies. The higher 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 oven due to the influence of temperature,

causing the water bound in the gel to become steam. The resulting vapor pressure forces the starch gel to form an expanding product (Lavlensia, 2013).

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 - Disclose any potential conflict of interest appropriately.

The authors declare no conflict of interest.

Acknowledgments

Thanks to all declare no conflict of interest.

References

Adeleke, R.O. and O.A Abiodun. (2010). Nutritional composition of breadnut seeds (*Artocarpus camansi*). *African Journal of Agricultural Reseach,*5 (11), 1273-1276.

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

Ariyantoro, A. R., Rachmawanti, D., and Ikarini, I. (2016). Karakteristik Fisikokimia Tepung Koro Pedang (Canavalia Ensiformis) Termodifikasi Dengan Variasi Konsentrasi Asam Laktat Dan Lama Perendaman. 36(1), 1–6. [In Bahasa Indonesia]

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

Asosiasi Produsen Terigu Indonesia. (2017). Data Impor Gandum. Retrieved on January 26, 2021 from https://industria.kontan.co.id/news/.

Badan Pusat Statistik. (2017). Data Impor Gandum Indonesia 2017. Retrived on January 07, 2021 from http://www.bps.go.id

BPOM RI No. 36. (2013). Tentang Batas Maksimum Penggunaan Bahan Tambahan Pengawet. Retrived on February 02 , 2021 from https://www.pom.go.ig

BSN. (2006). SNI 01-3751-2006. Tepung Terigu Sebagai Bahan Makanan. Badan Standardisasi Nasional. Jakarta. Retrived on 07, 2021 from

" https://js.bsn.go.id

Fajrin, J., Pathurahman, Lalu Gita Pratama, Basuki, T., Lia, V., Balai, U. P. T., Biomaterial, P., Marpaung, J. L., Sutrisno, A., Lumintang, R., Surata, I. W., Lokantara, I. P., Arimbawa, P., and Purwanto, D. (2016). Aplikasi Metode Analysis of Variance (Anova) Untuk Mengkaji Pengaruh. *Jurnal Energi Dan Manufaktur*, 6(2), 11–23. [In Bahasa Indonesia]

Harmon, M., Skow, B., Simonson, P., Peck, J., Craig, R. T., Jackson, J. P., Simonson, P., Peck, J., Craig, R. T., Jackson, J. P., Pointon, D., Sugiyono, A., Thiel, C., Priyono, Sugiyono, S., Bentley, J. L., Van Fraassen, B. C., Creswell, John W. Edition, T., Hirschberg, W., … McCrae, R. R. (2016). Metode Penelitian Kuantitatif. In Philosophy of Science. 4(1), 54-62. https://doi.org/http://dx.doi.org/10.1007/978-1-4419-8580-4_5

Hardoko, L. Hendarto dan T. M. Siregar. (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]

Hidayat, N., Sunartati, R., Nurman, S., Irmayati, and Sholihati. (2019). Innovation Utilization of Tofu Waste Into Flour With The Addition of Sodium Metabisulfit As Antibrowning. *Innovation*,1(1),1–7. https://pdfs.semanticscholar.org/3cc1/74525db9336469af32aa2165494b0fba76b6.pdf

Herudiyanto, Marleen, Debby M. Sumanti dan Ria Nurul Ahadlyah. (2007). Pengaruh Konsentrasi dan Lama Perendaman Dalam Larutan Natrium Metabisulfit ($Na_2S_2O_5$) Terhadap KarakteristikTepung Bawang Merah (*Allium ascalonicum L*) Varietas Sumenep. *Jurnal Teknotan*, 1 (1). Januari 2007

He, Q., Luo, Y., and Chen, P., (2018). Elucidation of The Mechanism Of Enzymatic Browning By Sodium Chlorite. *Food Chemistry* (110);47-851

Kumar, S., Rekha, dan L. K. Sinha. (2010). Evaluation of quality characteristics of soy based millet biscuits. *Pelagia Research Library*. 1(3): 187-196.

Kosoko, S.B., Oluwole, O.B., A.O. Darmola, Adepoju, M.A., Oyelakin, A.J., Tugbobo-amisu, A.O., Alagbe, G.O. dan 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.

Kristianto, A. Made. (2012). Physicochemical Properties And Functional Qualities Of High Protein Mucuna Bean (*Mucuna Pruriens L*.) Flour. Faculty of Agricultural Engineering and Technology, Bogor Agricultural University, IPB Darmaga Campus

Mendes, M. K. de A., 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(May), 120100. https://doi.org/10.1016/j.talanta.2019.06.100

N. Chandrasekara, F. Shahidi, and J. Agric (2011). Effect Of Roasting On Phenolic Content And Antioxidant Activities Of Whole Cashew Nuts, Kernels, And Testa. *Food Chem*. 59 (2011) 5006–5014.

Nurani, dkk. (2014). Pemanfaatan Tepung Kimpul (Xanthosoma sagittifolium) sebagai Bahan Baku Cookies (Kajian Proporsi Tepung dan Penambahan Margarin). Jurnal Pangan dan Agroindustri Vol.2 No.2 p.50-58. Universitas Brawijaya. Malang.

Ogunsina, B. S., and Bamgboye, A. I. (2014). Pre-Shelling Parameters And Conditions That Influence The Whole Kernel Out-Turn Of Steam-Boiled Cashew Nuts. *Journal of the Saudi Society of Agricultural Sciences*, 13(1), 29–34. https://doi.org/10.1016/j.jssas.2012.12.005

Owiredu, I., Laryea, D., and Barimah, J. (2014). Evaluation Of Cashew Nut Flour In The Production Of Biscuit. *Nutrition and Food Science*, 44(3), 204–211. https://doi.org/10.1108/NFS-06-2013-0067

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(May), 112550. https://doi.org/10.1016/j.indcrop.2020.112550

Sunarti. Richana, N. dan T.C. (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]

Tajudeen, Y., Okpuzor, J., and Fausat, A. T. (2011). Investigation Of General Effects Of Cement Dust To Clear The Controversy Surrounding Its Toxicity. *Asian Journal of Scientific Research*, 4(4), 315–325. https://doi.org/10.3923/ajsr.2011.315.325

Touzou, B. J. J., Soro, D., Soro, S., & Koffi, K. E. (2019). Quality Evaluation of Composite Bread Produced from Wheat and Fermented Cashew Kernel Flours. *Asian Food Science Journal*, 12(4), 1–8. https://doi.org/10.9734/afsj/2019/v12i430091

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.

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				

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

treatment	average	DMRT 5%	Symbol
A (control)	0,36475	0,417500309	a
B	0,4475	0,501904651	b
C	0,55625	0,611394752	c
D	0,6335	0,688847917	d
E	0,749		e

Note: Numbers that are not followed by the same letter show the difference real based on DMRT 5% test

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				

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%

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

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Manuscript ID : FR-2021-417

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Effect of Additional Sodium Metabisulphite (Na2S2O5) on Physical-Chemical Characteristics of Cashew Nut (*Anacardium occidentale L*) Dregs Flours

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Abstract

Wheat flour is a food ingredient that comes from the availability of wheat in Indonesia for import, even though its use is very high. Therefore currently, there are many efforts to substitute flour from local sources such as flour from tubers and nuts, one of which can be used from cashew nuts from cashew plants. 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 ($Na_2S_2O_5$). Analysis of cashew nut pulp obtained 8.79% fat content, 4.94% protein, 8.25% water content, 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%.

***Keywords*:** Cashew Dregs, Flour, Sodium Metabisulfite

1. Introduction

Wheat flour is a food material derived from wheat whose availability in Indonesia must be imported, while its use is very high. (Ministry of Industry of Indonesia, 2013). Based on data from the Indonesian Wheat Flour Association (2017), the volume of Indonesian wheat imports in 2017 increased by around 9% to 11.48 million tonnes from the previous year. Likewise, the value increased 9.9% to US $ 2.65 billion from the previous one.

Cashew nuts are one of the most important agro-industrial crops in India, Brazil, Vietnam and African countries. Cashew tree (*Anacardium occidentale*) is a native plant Brazil and in the sixteenth century introduced into other regions of the world ter primary for soil conservation (Sharma *et al*., 2020). Cashews, *Anacardium occidentale L*., belong to the *Anacardiaceae* family. Cashew nuts contains several amino acids and fat content is quite high at 78-80% unsaturated fatty acids from cashew nut oil and bioactive compounds such as MUFA (*Monounsaturated Fatty Acid*), PUFA (*Poly*

Unsaturated Fatty Acid), 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%) provides 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 have been shown to be antioxidants, participate in thyroid metabolism, and bioactivity in cancer prevention (Amorim *et al*., 2018).

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

2. Materials and methods

2.1 Preparation making Cashew dregs Flours

The cashew nut dregs are obtained from cashew milk processing. The sample then analyzed the raw materials in the form of air content, ash content, fat, and protein. Then the sample was immersed with sodium metabisulfite for 30 minutes, after which it was filtered and dried at 75 °C for 2 hours. The flour is then pulverized with a grinder and 80 meshes of sieves. Samples were immersed in sodium metabisulfite with five treatments, without immersion (A), immersion with 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 sample of 1 g of cashew nut flour 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 Buckner funnel using Whatman paper No. 2, then the filtrate was left for 2 hours at room temperature. Its concentration was measured with a spectrophotometer at a wavelength of 420 Nm.

2.2.2 Proximate Analysis

Proximate analysis is a chemical analysis to identify the nutritional content such as protein, carbohydrates, fat, and fiber in a food substance from food.

2.2.3 Baking Expansion

0.1 g of flour dissolved in 10 ml of distilled water. Then the solution was dissolved in a water bath at a temperature of 60 ^{0}C for 30 minutes. The supernatant was separated by centrifugation at a speed of 250 rpm for 15 minutes and then weighed.

3. Results

Analysis of raw materials in the form of wet cashew pulp per 100 grams contains 8.79% fat, 4.94% protein, 8.25% moisture content and 2% ash content. The results of the analysis of variety 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 or significant effect on the color 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, it will be followed by the DMRT (*Duncan Multiple Range Test*).

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 colors in the treatment, control (A) is darker and has a brownish color 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 sig value is 0.001 ($Sig < 0.05$).

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 will be. In Table 4, the results of one way ANOVA data analysis are obtained, the resulting sig value is 0.05 ($Sig < 0.05$). 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 was obtained an average of four repetitions, 2.375 %. Determination of selected flour based on physical and chemical parameter. The parameter of the best treatment results of cashew starch are shown in Table 5.

4. Discussion

From the analysis of wet cashew dregs per 100 grams, 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 browner the flour is. Measured browning is enzymatic and non-enzymatic. The results of the analysis of variance showed that the addition of sodium metabisulfite with a concentration of 0.6% gave the influence is 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 in line a study by Sinha *et al*. (2017) the browning reaction can be inhibited by sulfite due to the reaction of sulfit ions with quinine, inhibition of 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 color 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, it will followed by the DMRT (Duncan Multiple Range Test). 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 colors in the treatment, control (A) is darker and has a brownish color compared to the other samples, this is evidenced by the large absorbance value obtained where according research by (Sirait *et al*., 2020) 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) 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 the results shown in Figure 8. It can be seen that the higher the concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium metabisulfite contains the minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt organic salt, and inorganic salt. Organic salts such as salts of malic, oxidic, concentrated acetic acid. Meanwhile, inorganic salts are in the form of phosphorus, carbonate, chloride, sulfur, and nitrate salts (Mendes, *et al*. 2019). So, 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 complied with the SNI only for the unsuitable ash content, the high ash content is due to the higher concentration of sodium metabisulfite, the higher the ash content of the cashew flour. This happens because sodium

metabisulfite contains minerals Na and S. Ash content has something to do with the minerals of a material. The minerals contained in a material can be of two kinds of salt, namely organic salt, and inorganic salt. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

Table 6 shows the analysis of the best treatments where the fat content of cashew nuts was 47.64%, while 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 75ºC for 2 hours in the process of making cashew nut flour. Heat can cause disruption of the cell structure and the partition membrane of a material causing the release of more free fat molecules so that fat will be easily extracted from the material (Kosoko *et al*., 2014The results of measuring the fat content of cashew nuts flour were higher than those of Kosoko et al. The fat content of roasted cashews was 43.25%. The milling process results in 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 with the results of the study of Kosoko et al, (2014). which shows 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 processing carried out. The factors that influence the process of reducing the amount of protein are temperature and water.

Temperature causes protein denaturation and water causes dissolved protein to be lost with water. This happens in the manufacture 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 the study by Kosoko *et al.* (2014), 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 so that the carbohydrate content of cashew nut flour is lower than the carbohydrate content. The decrease in carbohydrate levels can be caused by the drying and soaking process with sodium metabisulfite where the cell walls of cashew pulp are dissolved in water so that they expand and are semipermaebel, so that the molecules of organic compounds such as sugar can freely penetrate the cell walls into the water. During the soaking process, soluble substances such as carbohydrates and vitamins will be dissolved (Sunarti, 2013).

Water absorption capacity is the ability to absorb water and hold 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 is one

of the characteristics of protein. According to Wianarno (1992), carbohydrates have the ability to absorb water higher 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 absorption of oil because the breakdown of complex molecules becomes simpler. The absorption power of the selected cashew flour flour was 30.2%. Oil absorption is an important property in food formulation because it can improve the flavour and mouthfeel of food. After that, flour analyzed the water content and selected the lowest water content to be analyzed the score of the baking expansion (Yudanto *et al*., 2020). Baking expansion of cookies is related to the crispiness of cookies. The higher 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 oven due to the influence of temperature, causing the water bound in the gel to become steam. The resulting vapor pressure forces the starch gel to form an expanding product (Lavlensia, 2013).

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 - Disclose any potential conflict of interest appropriately.

The authors declare no conflict of interest.

Acknowledgments

Thanks to all declare no conflict of interest.

References

Adeleke, R.O. and O.A Abiodun. (2010). Nutritional composition of breadnut seeds (*Artocarpus camansi*). *African Journal of Agricultural Research,*5 (11), 1273-1276.

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

Ariyantoro, A. R., Rachmawanti, D., and Ikarini, I. (2016). Karakteristik Fisikokimia Tepung Koro Pedang (*Canavalia Ensiformis*) Termodifikasi Dengan Variasi Konsentrasi Asam Laktat Dan Lama Perendaman. 36(1), 1–6. [In Bahasa Indonesia]

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

Asosiasi Produsen Terigu Indonesia. (2017). Data Impor Gandum. Retrieved on January 26, 2021 from

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Badan Pusat Statistik. (2017). Data Impor Gandum Indonesia 2017. Retrived on January 07, 2021 from http://www.bps.go.id

BSN. (2006). SNI 01-3751-2006. Tepung Terigu Sebagai Bahan Makanan. *Badan Standardisasi Nasional. Jakarta*. Retrived on 07, 2021 from " https://js.bsn.go.id

Fajrin, J., Pathurahman, Lalu Gita Pratama, Basuki, T., Lia, V., Balai, U. P. T., Biomaterial, P., Marpaung, J. L., Sutrisno, A., Lumintang, R., Surata, I. W., Lokantara, I. P., Arimbawa, P., and Purwanto, D. (2016). Aplikasi Metode Analysis of Variance (Anova) Untuk Mengkaji Pengaruh. *Jurnal Energi Dan Manufaktur*, 6(2), 11–23. [In Bahasa Indonesia]

Hardoko, L. Hendarto dan T. M. Siregar. (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]

Hidayat, N., Sunartati, R., Nurman, S., Irmayati, and Sholihati. (2019). Innovation Utilization of Tofu Waste Into Flour With The Addition of Sodium Metabisulfit As Antibrowning. *Innovation*,1(1),1–7. https://pdfs.semanticscholar.org/3cc1/74525db9336469af32aa2165494b0fba76b6.pdf

Herudiyanto, Marleen, Debby M. Sumanti dan Ria Nurul Ahadlyah. (2007). Pengaruh Konsentrasi dan Lama Perendaman Dalam Larutan Natrium Metabisulfit ($Na_2S_2O_5$) Terhadap KarakteristikTepung Bawang Merah (*Allium ascalonicum L*) Varietas Sumenep. *Jurnal Teknotan*, 1 (1). Januari 2007

He, Q., Luo, Y., and Chen, P., (2018). Elucidation of The Mechanism Of Enzymatic Browning By Sodium Chlorite. *Food Chemistry* (110);47-851

Kumar, S., Rekha, dan L. K. Sinha. (2010). Evaluation of quality characteristics of soy based millet biscuits. *Pelagia Research Library*. 1(3): 187-196.

Kosoko, S.B., Oluwole, O.B., A.O. Darmola, Adepoju, M.A., Oyelakin, A.J., Tugbobo-amisu, A.O., Alagbe, G.O. dan 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.

Kristianto, A. Made. (2012). Physicochemical Properties And Functional Qualities Of High Protein Mucuna Bean (*Mucuna Pruriens L.*) Flour. Faculty of Agricultural Engineering and Technology, Bogor Agricultural University, IPB Darmaga Campus

Mendes, M. K. de A., 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(May), 120100. https://doi.org/10.1016/j.talanta.2019.06.100

N. Chandrasekara, F. Shahidi, and J. Agric (2011). Effect Of Roasting On Phenolic Content And Antioxidant Activities Of Whole Cashew Nuts, Kernels, And Testa. *Food Chem*. 59 (2011) 5006–5014.

Nurani, dkk. (2014). Pemanfaatan Tepung Kimpul (*Xanthosoma sagittifolium*) sebagai Bahan Baku Cookies (Kajian Proporsi Tepung dan Penambahan Margarin*). Jurnal Pangan dan Agroindustri*, 2 (2), 50-58. Universitas Brawijaya. Malang.

Ogunsina, B. S., and Bamgboye, A. I. (2014). Pre-Shelling Parameters And Conditions That Influence The Whole Kernel Out-Turn Of Steam-Boiled Cashew Nuts. *Journal of the Saudi Society of Agricultural*

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Sciences, 13(1), 29–34. https://doi.org/10.1016/j.jssas.2012.12.005

Owiredu, I., Laryea, D., and Barimah, J. (2014). Evaluation Of Cashew Nut Flour In The Production Of Biscuit. *Nutrition and Food Science*, 44(3), 204–211. https://doi.org/10.1108/NFS-06-2013-0067

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(May), 112550. https://doi.org/10.1016/j.indcrop.2020.112550

Sunarti. Richana, N. dan T.C. (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]

Tajudeen, Y., Okpuzor, J., and Fausat, A. T. (2011). Investigation Of General Effects Of Cement Dust To Clear The Controversy Surrounding Its Toxicity. *Asian Journal of Scientific Research*, 4(4), 315–325. https://doi.org/10.3923/ajsr.2011.315.325

Touzou, B. J. J., Soro, D., Soro, S., & Koffi, K. E. (2019). Quality Evaluation of Composite Bread Produced from Wheat and Fermented Cashew Kernel Flours. *Asian Food Science Journal*, 12(4), 1–8. https://doi.org/10.9734/afsj/2019/v12i430091

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.

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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				

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

treatment	average	DMRT 5%	Symbol
A (control)	0.36475	0.417500309	a
B	0.4475	0.501904651	b
C	0.55625	0.611394752	c
D	0.6335	0.688847917	d
E	0.749		e

Note: Numbers that are not followed by the same letter show the difference real based on DMRT 5% test

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			

283

284 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				

285

286 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%

287

288 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

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(21 Agustus 2021)

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Effect of additional sodium metabisulphite (Na2S2O5) on physical-chemical characteristics of cashew nut (*Anacardium occidentale L*) dregs flours

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Abstract

Wheat flour is a food ingredient that comes from the availability of wheat in Indonesia for import, even though it is in very frequent use. 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%.

***Keywords*:** Cashew Dregs, Flour, Sodium Metabisulfite

1. Introduction

Wheat flour is a food material derived in Indonesia to be imported, as it is in high demand (Ministry of Industry of Indonesia, 2013). Based on data from the Indonesian Wheat Flour Association (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 9.9% of the US $2.65 billion from the previous one.

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 MUFA (Monounsaturated Fatty Acid), PUFA

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(Poly Unsaturated Fatty Acid), 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 ($Na_2S_2O_5$).

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2. Materials and methods

2.1 Preparation making cashew dregs flours

The cashew nut dregs are processed from cashew milk. The samples are 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 is 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 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 analysed 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 sample of 1 g of cashew nut flour 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, then the filtrate was left for 2 hrs at room temperature. Its concentration was measured with a spectrophotometer at a wavelength of 420 nm.

2.2.2 Proximate analysis

Proximate analysis is a chemical analysis to identify the nutritional content such as protein, carbohydrates, fat, and fibre in a food substance from food.

2.2.3 Baking expansion

About 0.1 g of flour dissolved in 10 mL of distilled water. Then the solution was dissolved in a water bath at a temperature of 60^0C for 30 mins. The supernatant was separated by centrifugation at a speed of 250 rpm for 15 mins and then weighed.

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 DMRT (*Duncan Multiple Range Test*).

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 a brownish colour 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 ($Sig < 0.05$).

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, the resulting sig value is 0.05 ($Sig < 0.05$). 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 and chemical parameters. The parameter of the best treatment results of cashew starch is shown in Table 5.

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 Sinha *et al*. (2017) 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.

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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 Figure 8. 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 malic, oxidic, 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.

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Table 5 shows that the cashew dreg 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 mineral Na and S. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

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.

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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, that 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 penetrate 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 is a distinct characteristic of the protein. According to Wianarno (1992), carbohydrates have the ability to absorb

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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 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 analysed 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 (Lavlensia, 2013).

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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 - Disclose any potential conflict of interest appropriately.

The authors declare no conflict of interest.

Acknowledgements

Thanks to all declare no conflict of interest.

205 **References**

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

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

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

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

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

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

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

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

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

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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				

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

treatment	average	DMRT 5%	Symbol
A (control)	0.36475	0.417500309	a
B	0.4475	0.501904651	b
C	0.55625	0.611394752	c
D	0.6335	0.688847917	d
E	0.749		e

Note: Numbers that are not followed by the same letter show the difference real based on DMRT 5% test

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				

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%

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245 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

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6. Bukti Konfirmasi Review dan Hasil Review Mikro Ketiga

(29 Agustus 2021)

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Fahmi Arifan <fahmiarifan@live.undip.ac.id>

Manuscript ID: FR-2021-417

Food Research <foodresearch.my@outlook.com> Sun, Aug 29, 2021 at 11:30 PM
To: Fahmi Arifan <fahmiarifan@live.undip.ac.id>

Dear Fahmi Arifan,

Kindly revise the manuscript according to the comments attached and revert to us within a week.
Please leave the tracking on for ease of identifying what was changed.

Best regards,
Son Radu, PhD
Chief Editor

From: Fahmi Arifan <fahmiarifan@live.undip.ac.id>
Sent: Sunday, 29 August, 2021 2:56 PM
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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 (*Duncan Multiple Range Test*). 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 colors in the treatment, control (A) is darker and has a brownish color compared to the other samples, this indicates that the large absorbance value obtained were 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 Figure 8. 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 mineral Na and S. Furthermore, the best treatment will be further tested in the form of a proximate test and its swelling power test.

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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 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, that 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 penetrate 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 is a distinct characteristic of the protein. According to Winarno (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 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

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it can improve the flavor 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 vapor pressure forces the starch gel to form an expanding product (Lavlensia, 1995).

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not the same in refrences

5. Conclusion

The results showed that the concentration of sodium metabisulfite had a significant effect on improving the color 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 - Disclose any potential conflict of interest appropriately.

The authors declare no conflict of interest.

Acknowledgements

Thanks to all declare no conflict of interest.

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., Herawati, D. (2011). Analisis Pangan. *Dian Rakyat*. Jakarta.

Astawan, M. (2009). Sehat dengan Hidangan Kacang dan Biji-bijian. Jakarta, 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/

BPOM, R.I. No. 36. (2013). Tentang Batas Maksimum Penggunaan Bahan Tambahan Pengawet. Retrievied on December 20, 2020 from Website: http://www.pom/go/id

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). [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. *Tesis*. Institut Pertanian Bogor. Bogor

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(May), 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*). *Skripsi*. Fakultas Teknik. Universitas Negri Yogyakarta.

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

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(May), 112550. https://doi.org/10.1016/j.indcrop.2020.112550

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. *PT. Gramedia Pustaka Utama*. Jakarta.

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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.

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				

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

treatment	average	DMRT 5%	Symbol
A (control)	0.36475	0.417500309	a
B	0.4475	0.501904651	b
C	0.55625	0.611394752	c
D	0.6335	0.688847917	d
E	0.749		e

Note: Numbers that are not followed by the same letter show the difference real based on DMRT 5% test

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	

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%

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

7. Bukti Konfirmasi Artikel Accepted

(6 Desember 2021)

Undip Email
@live.undip.ac.id

Fahmi Arifan <fahmiarifan@live.undip.ac.id>

FR-2021-417 - Decision on your manuscript

Food Research <foodresearch.my@outlook.com> Mon, Dec 6, 2021 at 2:40 PM
To: Fahmi Arifan <fahmiarifan@live.undip.ac.id>

Dear Dr Fahmi,

It is a pleasure to accept your manuscript for publication in Food Research journal. Please refer to the attachment for your acceptance letter.

Please note that all accepted manuscripts are subjected to Article Processing Charges (APC) as the Journal will provide full publishing services. Please fill in the article processing fee form attached with this letter and revert to us within five (5) working days. Once we have received the form, your article will be transferred to production.

Thank you for your fine contribution. We look forward to your continued contributions to the Journal.

Sincerely,
Dr Vivian New
Editor
Food Research

From: Food Research <foodresearch.my@outlook.com>
Sent: Sunday, 5 September, 2021 8:58 PM
To: Fahmi Arifan <fahmiarifan@live.undip.ac.id>
Subject: Re: Manuscript ID: FR-2021-417

Dear Fahmi Arifan,

Thank you for taking the time to revise the manuscript accordingly. we will contact you again for further processing.

Best regards,
Son Radu, PhD
Chief Editor

From: Fahmi Arifan <fahmiarifan@live.undip.ac.id>
Sent: Sunday, 5 September, 2021 12:50 AM
To: Food Research <foodresearch.my@outlook.com>
Subject: Re: Manuscript ID: FR-2021-417

Dear Radu's son, Ph.D. as Chief Editor of Food Research

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Please find the attached manuscript. I can't wait to hear from you. Thank you.

Greetings,
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On Sun, Aug 29, 2021 at 11:30 PM Food Research <foodresearch.my@outlook.com> wrote:

> Dear Fahmi Arifan,
>
> Kindly revise the manuscript according to the comments attached and revert to us within a week.
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> Best regards,
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> There were numerous grammatical and incoherent sentences found within the manuscript. From the file enclosed, several changes were done to drastically improve the linguistic aspects, however, more improvements should be implemented as some sentences were not understandable by our editors. Kindly proofread the manuscript by an English linguist and it is imperative to use the file attached as it has been edited according to Food Research format.
> Furthermore, numerous references were not found CITED within the text and have been deleted, there were also MANY citations that were not found in the references section, kindly revise accordingly and adhere strictly to Food Research format.
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Please find the attached manuscript. I can't wait to hear from you. Thank you.

Greetings,
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On Thu, Jul 29, 2021 at 11:57 PM Food Research <foodresearch.my@outlook.com> wrote:

> Dear Fahmi,
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> **From:** Fahmi Arifan <fahmiarifan@live.undip.ac.id>
> **Sent:** Thursday, 29 July, 2021 11:44 PM
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> **Subject:** Re: Manuscript ID: FR-2021-417
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> Dear Son Radu, Ph.D. as Chief Editor of Food Research
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>
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> >
> > Manuscript FR-2021-417 entitled " Effect of Additional Sodium Metabisulphite (Na2S2O5) on Physical-Chemical Characteristics of Cashew Dregs Flour " which you submitted to Food Research, has been reviewed. The comments of the reviewer(s) are included in the attached file.
> >
> > The reviewer(s) have recommended publication, but also suggest some revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s)' comments and revise your manuscript. Once the revised manuscript is prepared, please send it back to me for further processing.

Because we are trying to facilitate timely publication of manuscripts submitted to Food Research, your revised manuscript should be submitted before or by 30th July 2021. If it is not possible for you to submit your revision by this date, please let us know.

Once again, thank you for submitting your manuscript to Food Research and I look forward to receiving your revised manuscript.

Sincerely,

Son Radu, PhD
Chief Editor, Food Research
foodresearch.my@outlook.com

From: Food Research <foodresearch.my@outlook.com>
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To: Fahmi Arifan <fahmiarifan@live.undip.ac.id>
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Your paper will be reviewed by three or more reviewers assigned by the Food Research editorial board and final decision made by the editor will be informed by email in due course. Reviewers' suggestions and editor's comments will be then made available via email attached file. You can monitor the review process for your paper by emailing us on the "Status of my manuscript".

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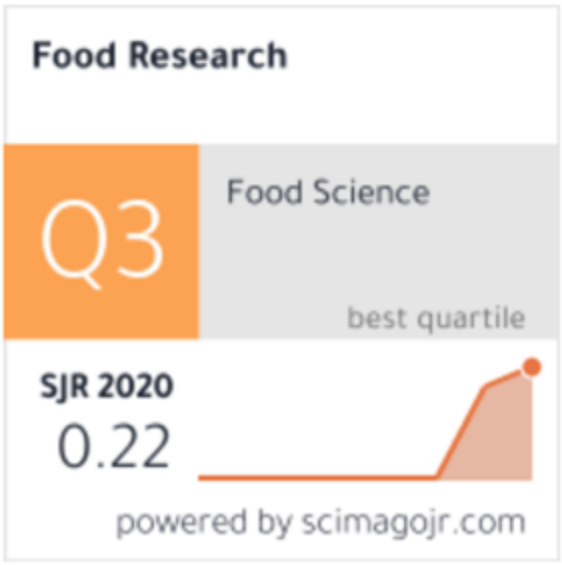

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Subject: Re: Manuscript Submission

Dear Son Radu, Ph.D. as Chied Editor of Food Research

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Fahmi Arifan and Team

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> Adhering to Food Research format is greatly appreciated.
>
> Best regards,
> Son Radu, PhD
> Chief Editor
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> ---
>
> **From:** Fahmi Arifan <fahmiarifan@live.undip.ac.id>
> **Sent:** Tuesday, 8 June, 2021 6:54 PM
> **To:** foodresearch.my@outlook.com <foodresearch.my@outlook.com>
> **Cc:** rifatuljannah.rj@gmail.com <rifatuljannah.rj@gmail.com>
> **Subject:** Manuscript Submission
>
> Dear Food Research Organizers,
>
> Hello! My name is Fahmi Arifan from Industrial Chemical Engineering of Diponegoro University, Semarang-Indonesia. I would like to register a manuscript for Food Research. Please find the manuscript attached.
>
> I'm looking forward to hearing from you. Thank you.

Sincerely,
Fahmi Arifan and Team

2 attachments

FR-2021-417 Acceptance Letter.pdf
107K

FR Article Processing Fee Form.docx
328K

FOOD
RESEARCH

6th December 2021

Dear Dr Arifan,

ACCEPTANCE LETTER

Food Research is pleased to inform you that the following manuscript has been accepted for publication in Food Research journal.

Manuscript Title	:	Effect of additional sodium metabisulphite ($Na_2S_2O_5$) on physical-chemical characteristics of cashew nut (Anacardium occidentale L) dregs flours
Authors	:	Jannah, R., Arifan, F. and Susanti

We thank you for your fine contribution to the Food Research journal and encourage you to submit other articles to the Journal.

Yours sincerely,

Professor Dr. Son Radu
Chief Editor
Food Research

8. Bukti konfirmasi artikel published online (22 Agustus 2023)

Undip Email
@live.undip.ac.id

Fahmi Arifan <fahmiarifan@live.undip.ac.id>

Re: FR-2021-417 - Article Production

Food Research Production <fr.production@outlook.com> Tue, Aug 22, 2023 at 7:54 PM
To: Fahmi Arifan <fahmiarifan@live.undip.ac.id>

Dear Dr Arifan,

Kindly be informed that your manuscript has been published and assigned to Food Research 2023, Vol. 7, Issue 4 (August). Your manuscript is currently available online and in press on our website https://www.myfoodresearch.com. Alternatively, you can download a copy of the manuscript by clicking on the following link:
https://doi.org/10.26656/fr.2017.7(4).417

We encourage you to share your published work with your colleagues. Thank you for your fine contribution. We hope that you continue to submit other articles to the Journal.

Thanks & Regards
Dr Vivian New, PhD
Editor
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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*

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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

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eISSN: 2550-2166
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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				

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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.

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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.

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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.

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