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Physicochemical Characterization, Gelatinization Profile, and Proximate Analysis of Sweet Potato Starch (*Ipomoea batatas* L.) White, Yellow, and Purple

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ABSTRACT. Sweet potato (*Ipomoea batatas* L.) has a considerable potency to be developed in Indonesia because of its high nutritional content and spacious application of sweet potato starch in food and non-food fields. Physicochemical characterization, gelatinization profile, and proximate analysis of sweet potato starch white, yellow, and purple has been carried out. Initially, extraction of starch from white, yellow, and purple sweet potato flour was done using a maceration technique. The starch extract was then analysed to determine its physicochemical properties such as pH, density, boiling point, melting point, swelling capacity, and solubility in water, as well as morphological surface using Scanning Electron Microscopy (SEM). The gelatinization profile of sweet potato starch was measured using the Rapid Visco Analyzer (RVA). The proximate composition of sweet potato starch was also determined. The results showed that yellow sweet potato starch has a high amylose content of 28.17% which thus leads to difficulty in absorbing water, increasing the gelatinization temperature and affecting the structural stability of the starch. The molecular structure of amylose and amylopectin is the main factor influencing the determination of the physicochemical characterization of sweet potato starch. Proximate analysis of sweet potato starch showed high content of amylose (28.17%), water (17.03%), and protein (5.21%) with low amylopectin (71.83%), minerals (1.09%), fat (0.09%), and carbohydrates (76.9%) content. The three varieties of sweet potato show extraordinary potential in food industrial applications because they play a huge part in deciding the suitability of sweet potato starch for specific requirements and interest in developing new and remarkable starch sources.

Keywords: Gelatinization, *Ipomoea batatas* L., starch, proximate, sweet potato

INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is a kind of tuber plant from the Convolvulaceae family which has the sixth most significant role in the food world after rice, wheat, potatoes, corn, and cassava (Wadl et al., 2018). Sweet potatoes grow almost all over the world and can adapt to numerous environmental conditions, both in lowlands and highlands (Mustamu et al., 2018). As indicated by FAO (Food and Agriculture Organization) data, Indonesia positions as the tenth most elevated sweet potato producer in the world with a sweet potato production of 6.01% each year (Anggraeni et al., 2021). Data for 2016-2020 states that the demand for sweet potato consumption increases by 4.55% each year for the level of household consumption (Rozi et al., 2021).

Sweet potato has substantial potential to be developed in Indonesia. This tuber plant originating from Latin America has agroclimatic suitability to the climate in Indonesia. This is the reason sweet potatoes can grow well in Indonesia. The cultivation of sweet potatoes is easy, drought-resistant, and without so many pests and diseases, which can grow in several sorts of soil (Widodo et al., 2015).

Sweet potato is low price, promptly accessible in the neighbourhood market, and offers ease in item preparation. The main constituents of fresh potato consist of starch (178 g/kg), sugars (26 g/kg), and protein (3.2 g/kg) (Chookli et al., , 2020). Sweet potatoes also contain amylose of 8.5 to 38 %, contingent upon the varieties. Thusly, it is considered a decent material for producing starch lot-based items (Thao & Noomhorm, 2011). The characteristics of starch in sweet potatoes assume a part in the well-designed properties of food ingredients like swelling, gelatinization, pasting properties, retrogradation, digestibility, and suitability process. The functional properties of starch are predisposed by the size, granule shape, structure, ratio of amylose amylopectin, and level of crystallinity (Mahmudatussa'adah, 2014). Starch is a polysaccharide that is abundant in nature and has numerous applications (Istiqomah et al., 2022; Istiqomah, et al., 2022a; Mahmood et al., 2017). The molecular structure of amylose and amylopectin is shown in **Figure 1.**

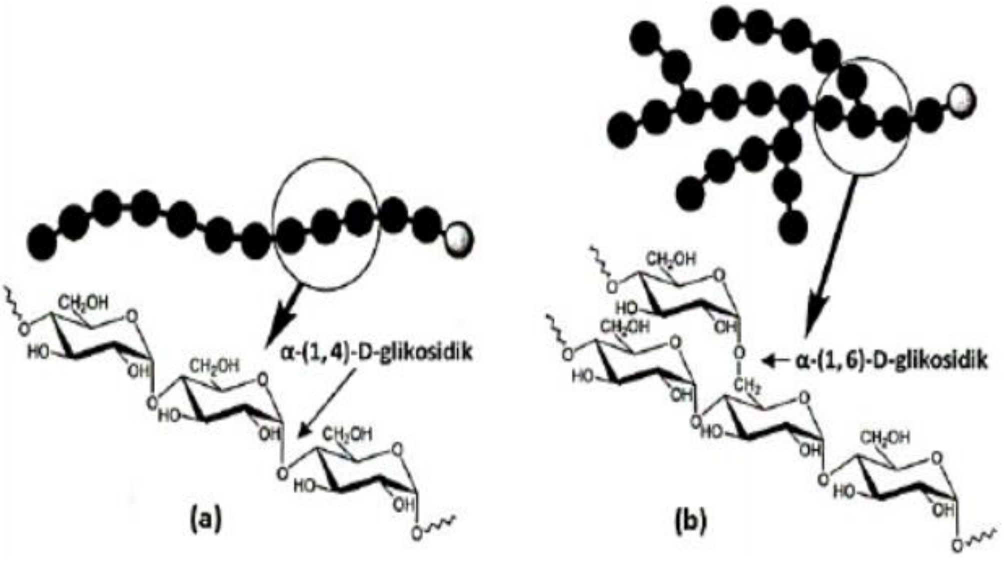

Figure 1. Structure of amylose (**a**) and amylopectin (**b**) (Sanyang et al., 2017)

Sweet potatoes in a fresh state are easily damaged during storage. Therefore, it is important to process fresh sweet potatoes into a structure that is more durable in storage, specifically as starch. Starch is utilized in 57% of food items and 43% of non-food products to impart different properties. Native starch assumes a significant role in optimizing food texture because of its properties such as gelling, thickening, texturing, and providing opacity (Hong et al., 2018).

Studies on the effect of varieties on physicochemical properties, gelatinization profiles, and proximate analysis of sweet potato starch in Indonesia are as yet limited. Different colour groups of the similar sweet potato from various varieties of sweet potato resulted in different properties and proximate analysis (Kim et al., 2013). An insignificant difference in the structure of sweet potato starch will result in very similar physical characteristics (thermal properties and gelatinization), so sweet potato starch has the potential as coloured flour material without any structural and physical differences (Lee & Lee, 2017). Sweet potato starch with high amylose content will be harder to absorb water and expand, resulting in a high gelatinization temperature. Increasing the gelatinization temperature will increase the structural stability of starch and granules that are resistant to gelatinization (Soison, et al., 2015).

Research on sweet potato starch assumes a significant role in the food industry and is interested in developing new and remarkable starch sources. Physicochemical characterization, gelatinization profile, and proximate analysis decide the quality and use of starch from different varieties of the same or various plants. Hence, study the physicochemical characterization, gelatinization profile, and proximate analysis to decide the reason for its usage. Three different varieties of sweet potato in similar growing conditions and growing environments in this research were used to compare the physicochemical characterization, gelatinization profile, and proximate analysis. This research on sweet potato starch will be the foundation for its development and utilization in line with the increasing demand for food, feed, and industrial raw materials. Sweet potato flour in Indonesia has high flexibility in its processing as a substitute for wheat flour for raw materials for the food processing industry, retains enzyme activity, and does not require spacious space for storage.

EXPERIMENTAL SECTION

Materials and Experimental Design

The materials used in this study were sweet potato flour (white, yellow, and purple) IELS organic foods Sleman, Yogyakarta, distilled water, n-hexane (Merck), $CuSO_4$ (Merck), Na_2SO_4 (Merck), H_2SO_4 95-97% (Merck), NaOH (Merck), H_3BO_3 (Merck), methyl orange (Merck) indicator, HCl 37% (Merck), I_2 (Merck), and KI (Merck).

The tools used in this study were Scanning Electron Microscope (SEM-EDX JEOL JSM-6510LA), UV/Vis double beam spectrophotometer UH5300 (Hitachi), IR Prestige-21 spectrometer (Shimadzu), Rapid Viscosity Analyzer (RVA) Newport Scientific, centrifuge LC-04R Oregon, magnetic stirrer with hotplate SP131320-33Q Thermolyne Cimarec, ultrasonic cleaner Delta D68H, melting point Stuart SMP10, Multi-point magnetic stirrer MaxBlend MP-6RS, L-C oven 3513-1 DL 1482X2, analytical balance Ohaus Pioneer PA224C, pycnometer Pyrex, water bath Memmert WNB10 Ring, pH indicator strips MQuant Supelco.

Sweet Potato Starch Extraction

Sweet potato flour (white, yellow, and purple) each as much as 250 g was macerated for 24 hours with 750 mL of distilled water. The subsequent slurry is isolated between the precipitate and the solution. The precipitate obtained was dried at a temperature of 45-60 °C. The dried starch was then ground and sieved through a 180-mesh sieve. The starch was stored in a closed container for the next step before analysis.

Characterization of Physical and Chemical Properties

Physical appearance

The white, yellow, and purple sweet potato starch obtained was observed for its shape, smell, and colour.

Acidity level/pH

Sweet potato starch was dissolved in distilled water in a ratio of 1:1 and then the pH was measured with a pH indicator.

Density measurement using a pycnometer

An empty, clean, and dry pycnometer were weighed (a gram). Sweet potato starch was put into the pycnometer to half the volume of the pycnometer. The pycnometer containing sweet potato starch was weighed (b gram) and then added water to fill the pycnometer volume. Make sure there are no air bubbles in the pycnometer. The pycnometer containing starch and water was then weighed (c grams). The density of starch is obtained through the following calculations.

$$Density\ of\ starch\ (\frac{g}{mL}) = \frac{(b-a)}{(c-b)/\rho_{air}}$$

Boiling point

0.1 g of sweet potato starch was dissolved in distilled water and heated on a hotplate while observed for the appearance of bubbles and maximum temperature stabilization.

The melting point measurement

The sweet potato starch sample is inserted into the capillary tube until it reaches about half the height of the capillary tube. A capillary tube is inserted into the Stuart SMP10. The appliance is turned on according to the procedure listed. The melting of the capillary tube can be seen through the magnifying glass in the instrument.

Swelling capacity and solubility in water

Sweet potato starch (white, yellow, and purple) 0.1 g (A) each was dissolved in 10 mL of distilled water and heated in a water bath containing 85 °C distilled water for 30 min. The heated sample was quickly cooled to 25 °C and centrifuged at 2000 rpm for 30 min. The supernatant obtained was weighed (D) and then transferred to a pre-weighed dish (B) and evaporated to dryness in an oven at 105 °C then the cup was weighed again (C). The calculation of swelling capacity and solubility in the water index is as follows.

$$Swelling\ capacity = \frac{D}{A}\left(\frac{g}{g}\right)$$

$$Solubility\ in\ water = \frac{(C-B)}{A} \times 100\%$$

Surface Morphology Analysis by Scanning Electron Microscopy (SEM)

Sweet potato starch samples (white, yellow, and purple) were dried at 40°C until totally dry to avoid moisture disturbance. The samples were mounted on double-sided carbon tape on the SEM stub and examined under SEM. SEM images were analysed using Image J software to determine the shape of the granules.

Gelatinization Profile with Rapid Viscosity Analyzer (RVA)

3 g of sweet potato starch (white, yellow, and purple) were weighed in a Rapid Viscosity Analyzer (RVA) holder and 25 mL of distilled water was added. Measurements include the heating and cooling process phases with constant stirring of 160 rpm. In the heating process, the starch suspension was heated at a temperature of 50-95 °C at a speed of 6 °C/min for 5 min. After heating, the pasta was cooled again to a temperature of 50 °C at a speed of 6 °C/min for 2 min. The plot of paste viscosity) in units of arbitrary RVA (RVU) versus time employed to measure the initial paste temperature (P_{temp}), peak viscosity (VP), heat viscosity (HV), breakdown viscosity (BV), setback viscosity (SV), final viscosity (FV) and peak time (P_{time}).

Proximate Analysis

Proximate analysis carried out included the determination of water content by thermogravimetry (Mahmudatussa`adah, 2014), mineral content by the dry method (Mahmudatussa`adah, 2014), fat content by Soxhlet method (Qalsum et al., 017), protein content by Kjeldahl method (Qalsum et al., 2017), carbohydrate content is determined by a different method (Mahmudatussa`adah, 2014), and determination of amylose and amylopectin distribution by UV-Vis Spectrophotometry method (Siroha et al.,2019).

RESULTS AND DISCUSSION

Starch Extraction

Extraction of sweet potato starch (white, yellow, and purple) was carried out by maceration starch samples using distilled water. Apart from being a cheap and easily available solvent, soaking with distilled water will not break the hydrogen bonds in the starch and will not change the starch structure because there are no starch molecules extracted or dissolved together with the distilled water. Natural hydrolysis cannot occur in this process because there are no acids or enzymes that can hydrolyse starch into simpler components (Wibowo et al., 2008).

Characterization of Physicochemical Properties

Characterization of the physicochemical properties of sweet potato starch is shown in **Table 1**. The three varieties of sweet potato starch have a similar shape and smell, but the colour produced is different depending on the original colour of the sweet potato used. The physical form of sweet potato starch from the study is shown in **Figure 2**.

pH is the degree of acidity to state the level of acidity or alkalinity of a sample. Measurement of the pH of sweet potato starch in both white, yellow, and purple showed a low pH of 4.50-5.50. The pH value of starch ranges from 5.0 to 7.0 (Whistler et al, 1984). The low pH value obtained may occur because during the processing of sweet potato starch there is a delayed process or the storage process is not maintained which allows for acid-forming microbial activity which makes sweet potato starch has a low pH. According to (Ega & Lopulalan, 2015), the higher the acidity of the starch produced, the more terrible the quality of the flour, and the other way around if the lower the acidity of the starch, the better the quality of the flour. Low pH might bring about a specific degree of starch hydrolysis, while alkaline pH may influence the steady of the ester bonds shaped (Sitohy et al., 2000).

The density of purple sweet potato starch showed the highest density, where the factors that affect the density of a material are the size of the uniformity and surface flatness of the material. This is apparently because purple sweet potato starch has a smaller granule size (**Figure 3**) than white and yellow sweet potato starch granules, so the distance between the granules is more and causes a smaller weight for every similar volume. The results of this research are similar to the previous research by Iheagwara (2013) which obtained a density of sweet potato starch of 0.59 g/mL (Iheagwara, 2012).

The boiling point obtained is the maximum temperature stability of sweet potato starch solution when heated, which is at a temperature of 74-80 °C. The boiling point of starch ranges from 55 °C to 85 °C (Whistler et al., 1984). Melting point cannot be determined because sweet potato starch cannot change phase to liquid without a dissolvable. This determination aims to determine the solubility of starch in water. In cold water, starch will not dissolve when the suspension in water is heated will form a viscous colloid, giving a deep purple colour to the iodine test and can be hydrolysed using acid to produce glucose. The molecules are straight or branched unpaired to form a network that unites the starch granules. Another characteristic of starch is that it takes a long time to cook. Retrogradation and syneresis processes are also general in natural starch. Retrogradation is a recrystallization process and formation of a starch matrix that has undergone gelatinization due to the influence of temperature. The main constituents of starch are amylose and amylopectin. Amylose gives hardness properties when amylopectin causes stickiness (Ega & Lopulalan, 2015).

Table 1. Physicochemical characterization of white, yellow, and purple sweet potato starch

Physicochemical characterization	Sweet Potato Starch			References
	White	Yellow	Purple	
Physical appearance	Powder	Powder	Powder	Powder (Whistler et al, 1984)
Odour	Sweet	Sweet	Sweet	Sweet flour (Whistler et al, 1984)
Colour	Yellowish white	Light yellow	Purple	-
pH	4.5-5.5	4.5-5.5	4.5-5.5	5.0-7.0 (Whistler et al, 1984)
Density	0.55 g/mL	0.56 g/mL	0.59 g/mL	0.59 g/mL (Iheagwara, 2012)
Boiling point (1 g/10 mL H_2O)	77-78°C	74-75°C	79-80°C	55-85°C (Whistler et al., 1984)
Swelling capacity	7.06 g/g	7.46 g/g	8.60 g/g	(3.40; 3.57; 3.68) g/g Kusumayanti et al, 2015)
Solubility in water	15%	20%	27%	(9.37; 9.56; 8.61) % (Kusumayanti et al, 2015)

Figure 2. The physical appearance of sweet potato starch (A) white, (B) yellow, and (C) purple

Swelling capacity shows the degree of water absorption throughout the swelling technique with purple sweet potato starch which showed the highest yield in comparison with white and yellow sweet potato starch. The results obtained are similar to previous research (Kusumayanti et al., 2015), which showed the swelling capacity of white, yellow, and purple sweet potatoes were 3.40; 3.57; 3.68 (g/g). The swelling capacity of starch is affected by the capability of starch molecules to restrain water via hydrogen bonds, the strength of the micellar network as well as the amylose content, and the amylopectin molecular structure (Iheagwara, 2012). A higher swelling capacity implies a lower level of intermolecular associative forces in the granules. The relatively high resistance to swelling between starch granules is thoroughly associated with the broad and tightly bound micellar structure. The increase in swelling capacity in purple sweet potato starch was also associated with an increase in amylopectin chains and a decrease in amylose content. The amylose and amylopectin content in **Table 3** shows a not very significant difference. The ratio of amylose to amylopectin can influence the number of interactions among starch chains and result in variations in swelling capacity and starch solubility in water. Amylose acts as an inhibitor of starch granule swelling and inhibits the disruption of the amylopectin double helix (Zhang et al., 2018). Amylose will resist swelling and maintain the integrity of the enlarged granules. The low amylose content and a large number of long chains are the key factors affecting the higher swelling power (Wang, et al., 2020).

The highest solubility in water occurred in purple sweet potato starch followed by yellow sweet potato starch and white sweet potato starch. The results obtained are different to previous research (Kusumayanti et al., 2015), which showed the highest water solubility of yellow sweet potatoes with a value of 9.56%, while white and purple sweet potatoes were 9.37% and 8.61%. The solubility in water with the highest value indicates high hydrophilicity and low linear molecular release (Iheagwara, 2012). Solubility in water indicates the value of the degree of dissolution during the starch swelling procedure (Zhang et al., 2018). Swelling capacity and solubility in water measurements have been utilized to reveal the molecular arrangement in starch granules. The differences between samples of sweet potato starch are the basis for the alterations in their respective functional properties, so they can be used for various applications in the food industry (Hong et al., 2018).

Surface Morphology

White, yellow, and purple sweet potato starch granules observed by SEM (**Figure 3**) showed a mixture of large, medium, and small granules that were round, oval, polygonal, semi-oval, and hemispherical. The structure of sweet potato starch granules observed showed that the surface was still smooth, intact, and had not been damaged because the starch had not been modified.

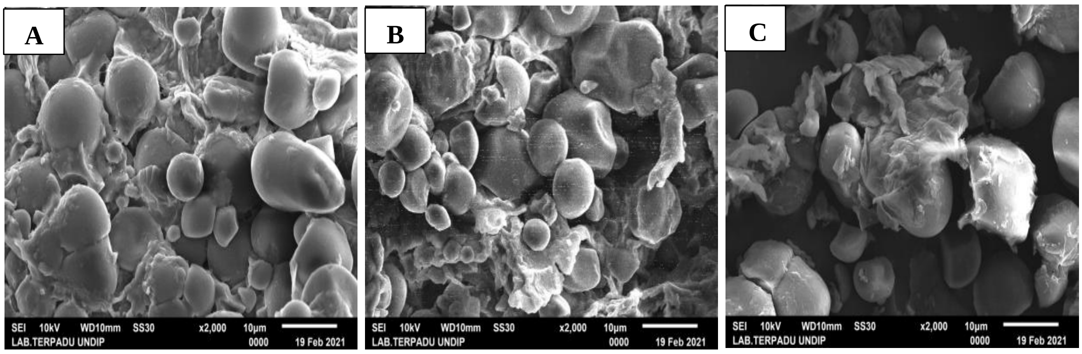

Figure 3. SEM results of sweet potato starch (A) white, (B) yellow, and (C) purple at 2000x magnification

Table 2. Gelatinization profile of a white, yellow, and purple sweet potato starch

Gelatinization Profile	Sweet Potato Starch		
	White	Yellow	Purple
Peak viscosity (PV)	2800 Cp	1809 Cp	2579 Cp
Hot viscosity (HV)	1687 Cp	1353 Cp	2131 Cp
Breakdown viscosity (BV)	1113 Cp	456 Cp	448 Cp
Final viscosity (FV)	2894 Cp	2081 Cp	3487 Cp
Setback viscosity (SV)	1207 Cp	728 Cp	1356 Cp
Peak time (P_{time})	8.20 min	9.07 min	8.80 min
Peak temperature (P_{temp})	77.30°C	73.65°C	80.10°C

Gelatinization Profile

The gelatinization profile of white, yellow, and purple sweet potato starch is shown in **Table 2**. The PV value is measured to indicate that the starch has a high viscosity. The low PV of yellow sweet potato starch is suitable for producing weaning foodstuffs, while the high PV and BV of white sweet potato starch can use as a thickener or gelling agent.

Purple sweet potato starch has the lowest BV but the highest HV which indicates that purple sweet potato starch has a higher resistance to heat and shear than other starches, where BV is an indication of how easily the starch granule structure breaks or cracks. The SV and FV of purple sweet potato starch were also the highest, indicating a tendency for the starch paste to be retrograded. Higher SV indicates lower stability of the cold viscosity of starch. Thus, high SV and FV will lead to poor stability and a propensity to deteriorate. Yellow sweet potato starch had low SV which would restrict the leaning of starch molecules to rearrange after cooling and low FV which would show the capability of starch to form numerous pastes or gels after cooling was reduced.

The thickening temperature (P_{temp}) is the temperature at which there is a marked rise in viscosity and is continuously higher than the gelatinization temperature. The high P_{temp} of purple sweet potato starch indicates that purple sweet potato starch takes longer to gelatinize during processing, while yellow sweet potato starch which has a relatively low thickening temperature will take a shorter time to start gelatinization and is easier to cook. Peak time (P_{time}) is inversely proportional to PV. Shorter P_{time} in white sweet potato starch (8.20 minutes) showed low resistance to swelling, so it was expected that the starch would expand quickly and be susceptible to disintegration compared to other starches (Iheagwara, 2012).

The essence of starch gelatinization is that water molecules break the bonds between starch particles resulting in hydrogen bonds among regular (crystalline) and irregular (amorphous) starch molecules breaking and forming a hydrophilic colloidal solution. Granule morphology, size, amylose content, crystal structure, and swelling power are factors that affect the gelatinization properties of starch (Wang et al., 2020).

Proximate Analysis

The results of the proximate analysis of white, yellow, and purple sweet potato starch are shown in **Table 3**. The water content of white sweet potato starch has the lowest water content at 11.34%. It indicates that the total solid content of white sweet potato starch is relatively greater than other sweet potato starches. Low water content is required to increase the reactivity of starch because the OH group in starch is less reactive than the OH group in the water. The high-water content will affect the starch hydrolysis faster than substitution. Thus, the low water content will cause the substitution interaction to happen well and increment reactivity. On the other hand, the water content contained will affect the storage of the sample. The lower the water content, the humidity also low so food spoilage microbes become slower to grow and cause an increase in product storage(Abdulrahman & Omoniyi, 2016).

Mineral content is carried out by the direct ashing principle wherein the sample is oxidized using high temperature and the substance left after combustion weighed. The measurement of ash content is closely related to the mineral content in the product. Mineral content shows the inorganic materials in starch that will form complex compounds that cause deposits to establish and have the potential to obstruct the chemical modification of sweet potato starch (Zhang et al., 2018). The mineral content obtained in this research is slightly low (**Table 3**) and also not desired to affect the process of making modified starch.

The fat content of sweet potato starch in white, yellow, and purple sweet potatoes showed low values (**Table 3**). This is because some of the fat-soluble in water are also leaching during starch washing. The starch drying process with high temperatures and a long time also affects the low-fat content in starch, where the movement of fat molecules will be faster with the warm-up process so that the distance between fat molecules becomes large and fat is easy to get out of the starch. The fat content in starch can form a complex with amylose which causes interference with the gelatinization process, where the fat will inhibit the amylose release process from the starch granules. Disruption of the starch gelatinization process can also be affected by the starch granule surface which absorbs most of the fat and forms a hydrophobic lipid layer around the granule which inhibits water binding. If this happens, the starch granules will lack water and cannot expand which causes the starch to easily thicken and stick (Wang et al., 2020).

The protein content of white, yellow, and purple sweet potato starch is low (**Table 3**) because during the extraction of the protein dissolves in water, natural hydrolysis of protein occurs into amino acids which causes the protein content to decrease. The low protein content in starch will increase the viscosity and gel strength. The viscosity of starch can decrease with the formation of protein and starch complexes with the granule surface which causes the gel strength to decrease. This resulted in less than the maximum utilization of starch as a thickening agent (Wang et al., 2020). The presence of protein contained in starch cannot be separated from the ability of starch to bind water. Protein can absorb water because it has a hydrophilic carboxyl group. Amino acids whose molecule has a carboxyl group will absorb two hydrogen atoms and one oxygen from a water molecule. The higher the protein content in starch, the more the carboxyl group content so that more water is absorbed.

Table 3. Result of proximate analysis of white, yellow, and purple sweet potato starch

Proximate Analysis	Potato Starch			References
	White Sweet	Yellow Sweet	Purple Sweet	
Water	11.34%	17.03%	13.29%	(Mahmudatussa'adah, 2014)
Mineral	1.12%	1.09%	1.11%	(Mahmudatussa'adah, 2014)
Fat	0.10%	0.09%	0.12%	(Qalsum et al., 2017),
Protein	3.91%	5,21%	4.77%	(Qalsum et al., 2017),
Carbohydrate	82.24%	76.99%	81.59%	(Mahmudatussa'adah, 2014)
Amylose	24.83%	28.17 %	26.92%	(Siroha et al., 2019)
Amylopectin	75.17%	71.83 %	73.08%	(Siroha et al., 2019)

The carbohydrate content of white, yellow, and purple sweet potato starch obtained was high enough to indicate that the starch contained only a small amount of other ingredients. The carbohydrate content of starch is related to the water content obtained, where the higher the carbohydrate content, the lower the water content of the starch. The results showed that white sweet potato starch had the highest carbohydrate content of 82.24% with the lowest water content of 11.34%.

The amylose content of starch acquired is contrarily corresponding to its amylopectin content. High amylose content will cause low amylopectin content. The exploration acquired showed that the most noteworthy amylose content and the least amylopectin content were yellow sweet potato starch (**Table 3**). Amylose has a straight-chain structure, while amylopectin is branched. Amylose has numerous hydroxyl bunches which cause the water ingestion ability to be extremely huge with the goal that the starch granules will expand. High amylose content will expand the water ingestion limit of starch granules and volume development. This is because of the more prominent limit of amylose in restricting hydrogen than amylopectin. Amylopectin is a particle that has fanned chains so the bound water atoms are not effortlessly isolated and cause the item to stay stable during stockpiling. The inclination of amylopectin to shape water-insoluble totals makes the starch thick and tacky. Amylopectin with a more extended fanned chain will in the proximate frame a solid gel.

CONCLUSIONS

In this research, starch samples were isolated from three varieties of sweet potato, specifically white, yellow, and purple. The different varieties of sweet potato starch samples affected their physicochemical characterization. Purple sweet potato starch is more stable to heat and tends to be easily gelatinized than other starches. White sweet potato starch has the highest carbohydrate content, so it has a great swelling capacity. The high amylose content of yellow sweet potato starch affects the difficulty of water absorption which causes an increase in the gelatinization temperature and the structural stability of the starch. Characterization of the three varieties of sweet potato starch was generally different, particularly in the RVA gelatinization profile, swelling capacity, and solubility in water. The proximate analysis resulted in an inverse relationship, the high content of water, protein, and amylose would result in lower mineral, fat, carbohydrates, and amylopectin content of starch. Therefore, the development and usage of sweet potato starch are not only carried out based on the determination of suitable varieties, but also must pay attention to the physicochemical characterization, gelatinization profile, and proximate analysis to be applied in the development of food industry applications.

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