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Quality Characteristics of Sourdough Bread with The Addition of Water Yest and Wheat-Mocaf Flours Combination

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ABSTRACT

Sourdough bread embraces health benefits due to the fermentation process carried out in the manufacturing process. The quality of sourdough bread is influenced by the specific microbes (yeast) that develop in the sourdough and the type of flour. The purpose of this study was to determine whether the type of fruit water yeast and the combination of wheat flour and mocaf could affect the quality of sourdough bread. The research design used was a factorial, completely randomized design with two factors and three replications. Water yeast from apple and salaca fruits as the first factors, and the second factor is a combination of wheat flour and mocaf as much as (100:0), (80:20), and (60:40). Physico-chemical and organoleptic characteristics were observed in the study. ANOVA and DMRT further tests were used for data analysis. Research shows the type of fruit water yeast can affect the moisture and carbohydrate content of sourdough bread. The combination of wheat flour and mocaf has a significant effect on the physical (hardness), chemical (content of water, ash, fat, protein, and carbohydrates), and organoleptic qualities (colour and the hedonic quality of texture) The combination of wheat flour and mocaf as much as 60:40 is a combination that produces sourdough bread of the highest quality.

1. INTRODUCTION

Sourdough bread is a type of conventional bread that is processed by a fermentation process so that it utilizes natural microbes in the ingredients (flour and dough ingredients) or in the environment. The difference between sourdough bread and ordinary bread lies in the fermentation process. Regular bread generally uses instant yeast, while sourdough bread uses a natural fermentation process that relies on yeast and lactic acid bacteria. Sourdough bread has several benefits, namely being able to facilitate the digestive system, rich in vitamins and minerals, and can control the glycemic index (Lau *et al*., 2021). Sourdough bread also has a longer shelf life (approximately 7 days) compared to bread

without preservatives (Amaro *et al*., 2018; Anam *et al*., 2019; Denkova *et al*., 2014). The process of making sourdough bread can be done with the help of adding ingredients that contain natural yeast, such as apples and salaca (*salak*) fruit. Apples and salaca contain Saccharomyces cerevisae which can be used as a leavening agent in bread making. Several types of lactic acid bacteria (LAB) that can be found in apple juice include *Lactobacillus brevis*, *Lactobacillus plantarum*, *Leuconostoc mesenteroides*, *Leuconostoc dextranicum*, *Pediococcus acidilactici*, and *Pediococcus pentosaceus* (Savino *et al*., 2012). Meanwhile, salaca contains fructose and glucose which LAB can utilize during the fermentation process so that it can potentially become a probiotic food (Graça *et al*., 2015; Ma'Aruf *et al*., 2011; Purukan *et al*., 2020; Rodríguez *et al*., 2017; Savino *et al*., 2012). Ma'Aruf et al. (2011) explained that yeast (Saccharomyces cerevisae) in salaca fruit can be used as a substitute for yeast in bread making. The expansion of the dough volume using zalacca fruit yeast reached 3.37 cm^3/g. This figure is quite large when compared to commercial yeast, the expansion volume of which is 3.02 cm^3/g. Apart from Saccharomyces cerevisae, fermented salaca fruit also contains LAB (Purukan *et al*., 2020). The use of yeast from apples and salaca is also thought to improve the organoleptic value of sourdough bread.

The process of making sourdough bread also requires other raw materials such as wheat flour because it contains gluten which functions in forming the structure of the final dough (Yan *et al*., 2020). However, wheat flour is an imported commodity with a high value, reaching a total value of US$11.81 million or around 31.34 thousand tons (Kusnandar, 2022) where the bakery industry absorbs 25%. One way to overcome dependence on imported wheat flour is to substitute it with modified cassava flour (mocaf). Mocaf flour is widely used as a substitute for wheat flour around 20-100% in several bakery products (Arsyad, 2016; Bayhaqi & Bahar, 2017; Nur'utami *et al*., 2020). Arsyad (2016) stated that the addition of 100 g of mocaf flour produced the taste, colour, aroma and texture of bakery products, such as biscuits. The research of Bayhaqi & Bahar (2017) show that the best product from mocaf carrot pizza is a product with a mocaf flour substitution of 30%. Nur'utami *et al*. (2020) stated that bread produced using 20% mocaf and a fermentation time of 60 minutes produced quality characteristics such as texture, colour, taste and aroma which were softer, brown in colour towards white, sweeter, and more distinct aroma of bread. The addition of yeast from fruit water and the combination of wheat flour and mocaf flour will affect the quality of the sourdough bread. Based on this, this study aims to characterize the quality of sourdough bread with the addition of water yeast and the wheat-mocaf flours combination in terms of physical, chemical and organoleptic quality.

2. MATERIALS AND METHODS

2.1. Time and Place of Research

The research was conducted in August - November 2021 at the PT. XYZ Laboratory, Bekasi. Meanwhile, texture testing was carried out in the food laboratory of the Bogor Agricultural University (IPB), Bogor.

2.2. Tools and Materials

The tools used in the study were mixers, stoves, stainless steel containers, spatulas, aluminum foil or plastic wrap, spoons, scales, pH meters and measuring cups. In addition to these tools, there are tools used for physical, chemical and organoleptic testing. The ingredients used in the manufacture of sourdough bread consist of several types, namely water yeast ingredients (Malang apples, pondoh salaca, water and

granulated sugar), sourdough starter ingredients (water yeast, flour and sugar), and sourdough bread ingredients (sourdough, wheat flour, mocaf flour, sugar, salt, water and oil).

2.3. Research Methods

The research was carried out using the experimental method. The experimental design used in this study was a factorial complete randomized design, with two factors and three replications. Data analysis was carried out in this study using multivariate analysis of variance (ANOVA) with a significance level of 5% to determine the standard error and to determine the effect of treatment factors. If there was a significant difference in one or both factors, then the analysis was continued with the Duncan Multiple Range Test (DMRT) method. Variables in the study consisted of independent variables, dependent variables, and controlled variables. The independent variables consisted of two factors, namely the type of water yeast (apple water yeast (A1) and salaca water yeast (A2)), and the wheat-mocaf flour combination, namely 100 : 0 (B1), 80 : 20 (B2), and 60 : 40 (B3). The dependent variables included physical quality (hardness value), chemical (moisture, ash, fat, protein, and carbohydrates) and organoleptic quality of sourdough bread (hedonic and hedonic quality on taste, aroma, colour, and texture attributes). The controlled variables were the temperature and fermentation time of water yeast, temperature and pre-fermentation time of sourdough dough, amount of raw materials for sourdough bread making, temperature and resting time of sourdough bread dough, proofing of sourdough bread dough, and baking temperature and time for sourdough bread. In the process of making water yeast, the temperature and fermentation time was 29 °C for 72 h (Ridawati & Alsuhendra, 2019). The temperature and fermentation time of the sourdough dough is 29 °C for 15 h. Resting and proofing were carried out at 29 °C for 45 min and 25 min, respectively. After resting and proofing is complete, the bread dough will go through a retarding process at 5 °C for 8 h. Sourdough bread dough is then baked at 250 °C for 45 min. The equipment used in the study (cutting boards, knives, glass jars, glass bottles, filters, dough hook mixers, and bowls) was also controlled by sterilizing it in boiling water for 15 min then cooling it and spraying it with alcohol before use (Ridawati & Alsuhendra, 2019).

2.4. Procedure

Research is divided into two stages, namely preliminary research and main research. Preliminary research is divided into two, namely determining the fermentation time of sourdough dough and determining the acceptance level of the wheat-mocaf combination for sourdough bread making. Determination of sourdough dough fermentation time is done by determining the time needed to reach the optimal pH of sourdough dough. The pH measurement was carried out using the method from (Casado *et al*., 2017), namely by dissolving 10 grams of sourdough mixture with 90 mL of distilled water-acetone (5: 95) then stirring until homogeneous. The pH of the mixture was measured using a calibrated pH meter. Determining the acceptance level of the flour-mocaf combination is done by making sourdough bread using different flour-mocaf combinations. Sourdough bread is made with reference to research (Putri *et al*., 2019; Riana *et al*., 2020; Ridawati & Alsuhendra, 2019; Xu *et al*., 2019) which has been modified. The ingredients used are sourdough from apple and salaca water yeast, wheat flour, mocaf flour, water, oil, sugar and salt. The combinations of flour and mocaf used were (100 : 0), (70 : 30), (60 : 40), (30 : 70), (100 : 1).

The main research was carried out experimentally to determine the causal relationship between the use of water yeast types and flour combinations on the

quality of sourdough bread. The research was carried out in three stages, namely making water yeast from apples and salaca fruit, making sourdough dough, and making sourdough bread. Making water yeast refers to research (Putri *et al*., 2019; Riana *et al*., 2020; Ridawati & Alsuhendra, 2019) with modifications whose process can be seen in Figure 1. The stages of the process carried out were fruit sorting, washing, size reduction, mixing, fermentation, filtering and storage. The sorting process was carried out by selecting the apples and salaca fruit used in the study. The criteria for ripe apples are green in colour with a few red blotches, no physical defects such as collisions, and are not rotten. The salaca pondoh used is ripe, the skin of the salaca is still intact, there are no physical defects such as collisions, and the flesh is not rotten. Apples and salaca are washed using running water to remove the physical dirt found on the surface of the fruit skin. For salaca fruit, just peel the fruit from the skin. Apples and salaca fruit are cut using a knife and a sterile cutting board into smaller sizes of about 2 x 3 x 3 cm. The purpose of reducing the size is so that the fermentation of the fruit occurs evenly. The next process is mixing. The cut fruit is mixed with water and sugar in a closed and sterile container. Fruit, water and sugar are mixed in a ratio of 24.1%: 72.3% and 3.6%. After being mixed, the container is tightly closed, for the fermentation process to be carried out by storing the mixture at 29 °C for 72 h. The fermentation process is characterized by the presence of air bubbles formed on the surface of the mixture. After 72 h, the water yeast is filtered to separate it from the fruit pieces. Water yeast put in a sterile bottle with a lid. The water yeast is then stored in the chiller until it is used.

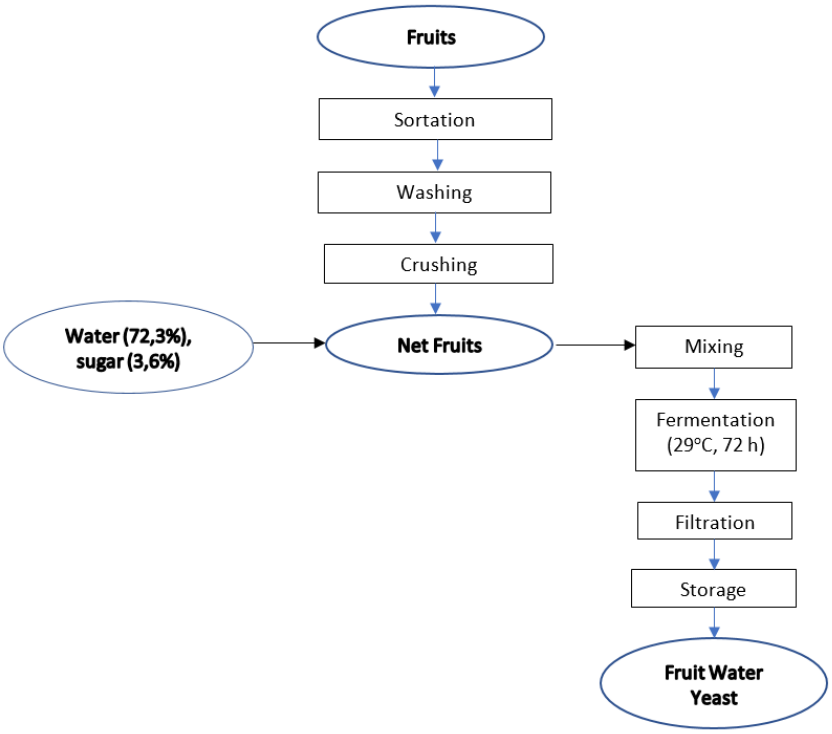

Figure 1. Flowchart of water yeast preparation from apel and salaca fruits

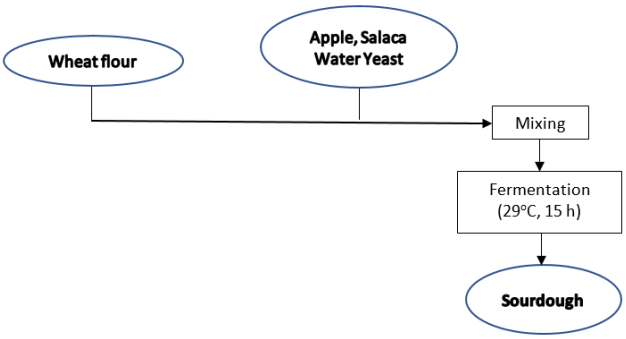

Figure 2. Flowchart of dough preparation for sourdough bread

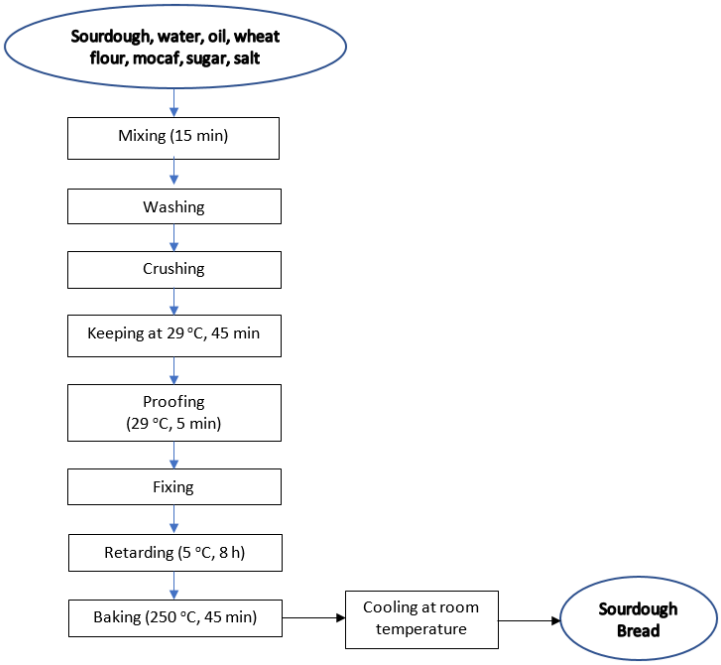

Figure 3. Flowchart of sourdough bred production

The preparation of sourdough dough refers to (Putri *et al*., 2019; Riana *et al*., 2020; Ridawati & Alsuhendra, 2019; Xu *et al*., 2019) which begins with weighing the water yeast and flour in a 1:1 ratio. flour is mixed until homogeneous and the sourdough dough is then fermented at ± 29 °C for 15 h (Figure 2). Sourdough bread making refers to research (Putri *et al*., 2019; Riana *et al*., 2020; Xu *et al*., 2019; Yan *et al*., 2020) which has been modified (Figure 3). The steps taken are mixing the dough, resting, proofing, shaping, retarding, roasting, and cooling. The ingredients that have been weighed are then mixed using a mixer at medium speed for 15 min. The purpose of mixing is to obtain a homogeneous and smooth bread dough. Smooth dough makes bread have a good structure. Resting is done by letting the dough rest for 45 min at ±29 °C in a closed container. The goal is to relax the dough after the mixing process and modify the gluten structure. After the resting process is complete, the dough is removed from the container and then folded to strengthen the bread structure. Next, the dough is proofed or final fermented for 25 min at ±29 °C. The next process is shaping, namely forming the dough before it is cooled in the refrigerator. The goal is to get the final desired shape of the loaf. The next process is retarding which begins with folding the

dough and forming the dough after proofing is complete. After that, put the dough in a container with a cheesecloth covered and then stored in the chiller (±5 °C) for 8 h. Retarding can help the process of forming flavors in the final bread product, which can increase the organoleptic value (Liu *et al*., 2020; Xiangyu Wang *et al*., 2020). The next process is toasting the bread using a preheated oven. Before the dough is put into the oven, the dough is sprayed with water to fix the crust. The temperature used to bake bread is 250 °C for 45 minutes. After baking, the bread was removed from the oven and then left to cool, then stored in an airtight container until it was analyzed physically, chemically and organoleptic.

2.5. Observation Parameters

The parameters to be observed in the study consisted of physical, chemical and organoleptic quality characteristics. Physical quality characteristics were determined by measuring the hardness of sourdough bread using the LFRA texture analyzer, which was recorded in gram force unit. The chemical quality characteristics consisted of water content and ash (AOAC, 2005), fat (Muthoharoh & Sutrisno, 2017), protein (Normilawati *et al*., 2019), and carbohydrates (by difference). The organoleptic characteristic was analyzed using the hedonic test and hedonic quality on the aroma, colour, texture, and taste attributes of sourdough bread using 5 scales on 25 untrained panelists (Mulyani, 2016).

3. RESULTS AND DISCUSSION

3.1. Preliminary Research

3.1.1. Sourdough Dough Fermentation Time

Determination of sourdough fermentation time using pH as an indicator. Sourdough that can be used for making bread must have an optimum pH of 3.5 - 4.0, because in this pH range, protease activation will occur enzymatically in cereals (Yan *et al*., 2020). Cereal proteases and LAB contribute to the depolymerization of gluten proteins. This is one of the aspects that will determine the quality of the dough and the rheology of the dough. Protein is degraded in the fermentation process with the help of enzymes and acids (Casado *et al*., 2017; Yan *et al*., 2020). Preliminary research results show that dough with apple water yeast and salaca water yeast can be fermented for 15 h before being used. Sourdough dough with yeast in apple juice has a pH of 4.0, while sourdough with yeast in salaca water has a pH of 3.8. Sourdough is fermented for 15 h to reach the ideal pH of 4-6.

3.1.2. Level of Wheat-Mocaf Flour Combination

Preliminary research results show that the flour combination that can still be accepted as bread is a maximum of 60 : 40 (Table 1). Based on the preliminary test, the combinations of flour : mocaf used in the main research were 100 : 0, 80 : 20, and 60 : 40.

3.2. Main Research

The main research was conducted to characterize the quality of sourdough bread by adding fruit water yeast and a combination of wheat-mocaf flour. The main research results can be seen in Table 2 which shows that the addition of mocaf flour to sourdough bread dough tends to increase the hardness value. This is because mocaf does not contain gluten. The use of flour without gluten causes the hardness of the

bread to increase as a result of poor development or reduces the volume of the bread so that it is denser and feels harder (Pato *et al*., 2013). The greater the amount of gluten added to the bread dough, the hardness will decrease considering that gluten can trap CO_2 gas which causes the dough to become softer (Iswara *et al*., 2019). Table 2 also shows that the use of water yeast from apple or salaca did not differ in the hardness parameter of sourdough bread. The ANOVA results showed that the type of water yeast did not affect the hardness of the sourdough bread, but the combination of wheat-mocaf had a very significant effect on the hardness of the sourdough bread. The results of the DMRT further test using levels of 0.05 and 0.01, it was found that the combination of wheat-mocaf was 100 : 0 , 80 : 20, and 60 : 40 are different from each other. The hardness of the best sourdough bread is made from a combination of wheat: mocaf as much as 80: 20 with a hardness value of 919.06 gram force.

Table 1. Summary of preliminary experiment to determine acceptance level for wheat-mocaf flour combination

Parameter	Wheat : Mocaf Flour Combination				
	(100 : 0)	(70 : 30)	(60 : 40)	(30 : 70)	(100 : 100)
Aroma	53%	47%	40%	33%	27%
Taste	47%	47%	33%	13%	0%
Colour	33%	40%	40%	20%	7%
Texture	47%	53%	27%	20%	7%
Average	45%	47%	35%	22%	10%

Table 2. Quality of sourdough bread with the addition of water yeast and the combination of wheat-mocaf flour

Parameter	Average values					
	Water yeast of apple			Water yeast of salaca		
	Wheat : Mocaf			Wheat : Mocaf		
	100:0	80:20	60:40	100:0	80:20	60:40
Hardness (*gram force*)	711,25	916,79	1207,59	709,15	921,33	1218,20
Water content (%)	30,88	30,66	30,30	30,58	30,49	29,90
Ash content (%)	0,98	1,49	1,62	0,95	1,48	1,63
Fat content (%)	3,68	3,59	3,14	3,69	3,28	3,28
Protein content (%)	9,17	7,04	6,10	9,10	6,93	6,06
Carbohydrate content (%)	55,29	57,21	58,84	55,67	57,81	59,13
Hedonic taste (%)	45,33	29,33	30,67	36,00	33,33	25,33
Hedonic aroma (%)	40,00	34,67	38,67	36,00	34,67	37,33
Hedonic colour (%)	22,67	25,33	50,67	30,67	26,67	41,33
Hedonic texture (%)	53,33	42,67	44,00	45,33	49,33	26,67

Table 2 also shows that the water content of sourdough bread using apple water yeast tends to be higher when compared to salaca water yeast. Apples have a greater water content, which is about 84%; while salacais around 79-83% (Sudjijo, 2016; Zubaidah *et al*., 2017). Table 2 also shows that the more mocaf added, the water content of the bread tends to decrease. The water content correlates with the starch content where the water content of the product decreases because the starch content

increases. Starch will form a network structure in the form of a gel that can bind water, so that the water content will decrease. Mocaf contains about 87% starch, which is relatively greater when compared to 60-68% wheat flour (Ihromi *et al*., 2018). The results of ANOVA showed that the types of water yeast (apple and salaca) and the combination of wheat-mocaf had a very significant effect on the moisture content of sourdough bread. The best (lowest) sourdough bread moisture content was obtained from a flour-mocaf combination of 60 : 40. Bread with low water content has the potential to have a longer shelf life. Moisture content is often associated with the quality of food ingredients, as a determinant of the stability index during storage, because water is one of the substances needed by spoilage and spoilage microorganisms. The higher the water content, the greater the growth potential of microorganisms, so that the shelf life decreases.

Table 2 shows that the ash content tends to increase with the increase in the portion of mocaf used in the manufacture of sourdough bread. The results of the ANOVA test showed that the type of water yeast did not affect the ash content of the bread, while the wheat-mocaf flour combination had a very significant effect. DMRT further test results showed that the wheat-mocaf flour combinations 100 : 0 and 80 : 20 were significantly different at the 0.01 confidence level, but the wheat-mocaf flour combinations 80 : 20 and 60 : 40 were not significantly different. Mocaf has a lower ash content, which is around 0.4%, while flour is around 1.3% (Majid *et al*., 2017). The results showed that the flour-mocaf 100:0 combination had the best effect on the ash content of sourdough bread. Ambarsari *et al*. (2009) states that the low ash content of flour products will improve the final colour of the product and the level of stability of the dough. The high ash content also makes gluten break down easily so that the bread does not rise properly (Pato *et al*., 2013). However, because the research attempted to suppress the use of flour, the wheat-mocaf flour combination of 80 : 20 can be said to be the combination that produces bread with the best ash content. The ash content of sourdough bread produced from all treatments in the study met the quality requirements of SNI 01-3840-1995, namely a maximum of 3%.

Table 2 also shows that the average fat content of sourdough bread tends to decrease with increasing mocaf. This is because mocaf flour contains 0.4% fat, lower than wheat flour by 1.5-2.0% (Sunarsi *et al*., 2011). Mocaf flour is known to have a higher nutritional content than wheat flour and has a low fat content (Mas'udah, 2020). Mocaf contains higher carbohydrates than wheat flour and has lower gelation than flour. The calcium content in Mocaf is also higher than wheat flour. The results of the ANOVA test stated that the type of water yeast had no significant effect on the fat content of the sourdough bread, but the combination of wheat-mocaf flour had a significant effect. The results showed that the best wheat-mocaf flour combination was 60 : 40, because it had the lowest fat content.

Table 2 reveals that there is a tendency of decreasing the protein content of sourdough bread as the amount of mocaf flour increases. The results of the ANOVA test showed that the type of water yeast did not affect the protein content of the sourdough bread, but the wheat-mocaf flour combination had a very significant effect. From the DMRT, it is known that the protein content of each combination is different from one another. Sourdough bread with a wheat-mocaf flour combination of 100 : 0 is considered as the best because it has high protein. High protein in flour can make bread have a better structure and viscoelasticity, because protein plays a role in trapping CO_2 gas during the fermentation process. This result is inline with Ramadhani *et al*. (2019) stated that the protein contained in flour affects the formation of the structure of bread products. The protein in wheat known as gluten plays a role in the

formation of bread tissue. High protein flours usually give good volume to the product. This agrees with Faridah (2008) that high protein helps provide good volume for finished bread because the gluten in protein is able to trap the gas formed during the dough development process and form the crumb structure of the product. However, because the research attempted to reduce the use of flour, the wheat-mocaf flour combination of 80 : 20 is considered to be the best that produces bread with the highest protein content.

The results of the research in table 2 show that the average carbohydrate content increases with the addition of the amount of mocaf flour on sourdough bread. Mocaf has a higher starch content (87.33%) compared to wheat flour (60% -68%) (Ihromi *et al*., 2018). The starch content is directly proportional to the carbohydrate content in the flour so that mocaf which has a high starch content also has a higher carbohydrate content than wheat flour. The results of the ANOVA test stated that the type of water yeast and the combination of wheat-mocaf flour had a very significant effect on the carbohydrate content of sourdough bread. Apples have a carbohydrate content of 13.81 g/100 g, while salaca fruit has carbohydrates of 19.1 g/100 g, so the addition of these two ingredients will increase the product's carbohydrate content (Hamidah *et al*., 2019; Saleh *et al*., 2018). From the research results, it is known that sourdough bread made using salaca water yeast and a combination of wheat-mocaf flour 60 : 40 produces bread with the highest carbohydrate content.

The results of the research in Table 2 also stated that the more mocaf was added, the panelist's preference level for the sourdough bread taste attribute tended to decrease. The results of the ANOVA revealed that the type of water yeast and the combination of wheat-mocaf flour had no effect on the level of preference for the taste of sourdough bread. The hedonic test results in Table 2 also show that the level of preference for sourdough bread made with apple cider yeast tends to be higher than sourdough bread made with salaca water yeast. The aroma of apples is composed of several components such as β-damascenone, butyl, isoamyl, hexyl hexanoate, ethyl, propyl, and hexyl butanoates (Dian & Sutanto, 2017). The results of the ANOVA test showed that the type of water yeast and the combination of wheat-mocaf flour did not affect the level of preference for the aroma of sourdough bread. Flavor (taste and aroma) in bread is caused by the Maillard reaction that occurs during the process. Proteases contained in flour, both in wheat and mocaf flour, will produce amino acids or peptides in the product, such as the amino acids ornithine, phenylalanine, leucine and methionine which are precursors for producing flavor compounds in bread products (Krissetiana *et al*., 2020).

Table 2 also shows the hedonic test on the colour attributes of sourdough bread. The table shows that the level of preference for the colour of sourdough bread increases with the increasing amount of mocaf flour used. The results of the ANOVA test showed that the type of water yeast did not have a significant effect on the colour preference of sourdough bread, but the combination of wheat-mocaf flour had a significant effect on the colour preference of sourdough bread. The DMRT follow-up test stated that the combination of wheat-mocaf flour 60 : 40 was significantly different from the other combinations. So, substitution of wheat with mocaf flour up to 40% can affect the level of preference for different colours. The combination of wheat-mocaf flour 60 : 40 in the manufacture of sourdough bread produces the best colour as indicated by the highest average likes and likes scores, which is 46%. Bread made with a combination of wheat-mocaf flour 60 : 40 has a yellowish brown colour, while bread made with more flour produces a dark brown product colour (Figure 4). The more flour added to a dough to

be baked, the more brown the final product will be. This is because wheat contains high protein (Saloko *et al*., 2016), while the protein content in mocaf is lower when compared to wheat (Sunarsi *et al*., 2011). The brown colour in the crumb or bread crust is caused by the Maillard reaction process where there is an interaction between amino acids (proteins) and carbohydrates.

Figure 4. Sourdough bread of different wheat-mocaf flour combination

The hedonic test results for sourdough bread made using apple water yeast and salaca obtained fluctuating ratings on texture attributes. The use of apple water yeast with a combination of wheat-mocaf flour 80 : 20 decreased the level of preference, while the use of yeast salaca water, a low level of preference occurred in the combination of flour-mocaf 60 : 40. The results of the ANOVA test showed that the type of water yeast and flour combination -mocaf flour had no significant effect on the preference level of sourdough bread texture. The flour-mocaf combination of 80: 20 has a hedonic score of likes and likes of 46%. The more mocaf flour added, the rougher the texture of the resulting bread will be. The change in texture is influenced by the presence of gluten in a dough. Increasing the number of mocaf results in a decrease in the amount of gluten. Gluten in bread functions as a structure to produce bread with a soft and viscoelastic texture (Saloko *et al*., 2016; Yasa *et al*., 2016).

4. CONCLUSION

The type of fruit yeast has a significant effect on the quality of sourdough bread. The parameters affected by the use of this type of water yeast from apples and salaca are water content and carbohydrate content. Water yeast from salaca fruit is considered to have the best effect on sourdough bread making with lower water content and higher carbohydrate content. The combination of wheat-mocaf flour has a significant effect on the quality of sourdough bread. The qualities affected by the wheat-mocaf flour combination were physical (hardness), chemical (moisture, ash, fat, protein, and carbohydrates) and organoleptic (colour and hedonic quality of texture). The combination of wheat-mocaf flour as much as 60 : 40 in the manufacture of sourdough bread is considered the best combination. This is because this combination gives the best quality to sourdough bread which has higher carbohydrates, lowest water content and fat content, as well as hedonic bread colour. These results indicate that mocaf flour can almost partially replace wheat flour in the manufacture of sourdough bread, so that it can be an alternative step in reducing dependence on wheat flour for bakery products.

REFERENCES

Amaro, M., Ariyana, M.D., Werdiningsih, W., Handayani, B. R., Nazaruddin, N., & Widyastuti, S. (2018). Penambahan bakteri asam laktat untuk meningkatkan

kualitas, keamanan dan daya simpan roti. *Pro Food*, ***4***(2), 333. https://doi.org/10.29303/profood.v4i2.84

Ambarsari, I., Sarjana, & Choliq, A. (2009). Rekomendasi dalam penetapan standar mutu tepung ubi jalar. *Jurnal Teknologi Dan Manajemen Agro Industri*, ***11***(3), 212–219.

Anam, C., Rustanto, D., & Parnanto, N.H. (2019). Karakteristik kimia dan penentuan umur simpan roti tawar dengan penambahan kalsium propionat dan nipagin. *Jurnal Ilmu Pangan Dan Hasil Pertanian*, ***2***(2), 121. https://doi.org/10.26877/jiphp.v2i2.3126

Arsyad, M. (2016). Effect of mocaf flour addition towards the quality of biscuit production. *Jurnal Agropolitan*, ***3***(3), 52–61.

Bayhaqi, A., & Bahar, A. (2017). Pengaruh subtitusi tepung moncaf (modified cassava flour) dan penambahan puree wortel (*Daucus carota* L.) terhadap hasil jadi pizza. *Jurnal Tata Boga*, ***5***(1), 1–7.

Casado, A., Álvarez, A., González, L., Fernández, D., Marcos, J.L., & Tornadijo, M.E. (2017). Effect of fermentation on microbiological, physicochemical and physical characteristics of sourdough and impact of its use on bread quality. *Czech Journal of Food Sciences*, ***35***(6), 496–506. https://doi.org/10.17221/68/2017-CJFS

Denkova, R., Ilieva, S., Denkova, Z., Georgieva, L., Yordanova, M., Nikolova, D., & Evstatieva, Y. (2014). Production of wheat bread without preservatives using sourdough starters. *Biotechnology and Biotechnological Equipment*, ***28***(5), 889–898. https://doi.org/10.1080/13102818.2014.965057

Dian, V., & Sutanto, S. (2017). Formulasi dan Aplikasi Sirup Berflavor Buah Pada Minuman Capucino Serta Tingkat Penerimaan Konsumen Terhadap Minuman Capucino Berflavor Buah-buahan. [*Undegraduate Thesis*]. Faculty of Agricultural Technology, Universitas Katolik Sugiyapranata, Semarang.

Faridah, N., Kurniawan, A., Yuniar, V., & Pamungkas, W.C. (2008). Pertumbuhan ikan patin yang diberi pakan keong mas hasil pelunakan dengan ekstrak daun pepaya sebagai sumber protein tambahan. *Final Report Student Creativity Program* (*PKM*). Institut Pertanian Bogor.

Graça, A., Santo, D., Esteves, E., Nunes, C., Abadias, M., & Quintas, C. (2015). Evaluation of microbial quality and yeast diversity in fresh-cut apple. *Food Microbiology*, ***51***, 179–185. https://doi.org/10.1016/j.fm.2015.06.003

Ihromi, S., Marianah, M., & Susandi, Y. A. (2018). Subsitusi tepung terigu dengan tepung mocaf dalam pembuatan kue kering. *Jurnal Agrotek UMMat*, ***5***(1), 73. https://doi.org/10.31764/agrotek.v5i1.271

Iswara, J.A., Julianti, E., & Nurminah, M. (2019). Characterization texture of sweet bread from flour , starch , fiber and anthocyanin pigment of purple sweet potatoes. *Jurnal Pangan dan Agroindustri*, ***7***(4), 12–21.

Krissetiana, H., Kiswanto, Y., & Suyanto, R. (2020). Perlakuan proofing terhadap sifat sensoris roti mocaf. *Jurnal Teknologi Dan Industri Pangan*, ***5***(1). https://doi.org/10.33061/jitipari.v5i1.3638

Lau, S.W., Chong, A.Q., Chin, N.L., Talib, R.A., & Basha, R.K. (2021). Sourdough microbiome comparison and benefits. *Microorganisms*, ***9***(7). https://doi.org/10.3390/microorganisms9071355

Majid, U., Nurdin, M., & Ohorella, I. 2017. Pengaruh subtitusi tepung mocaf terhadap kualitas cake mocaf. *Prosiding Seminar Nasional Mewujudkan Kedaulatan Pangan melalui Penerapan Inovasi Teknologi Pertanian Spesifik Lokasi pada Kawasan Pertanian*: 302-309.

Ma'Aruf, A.G., Asyikeen, Z.N., Sahilah, A.M., & Khan, A.M. (2011). Leavening ability of yeast isolated from different local fruits in bakery product. *Sains Malaysiana*, ***40*** (12), 1413–1419.

Mas'udah, N. (2020). *Mie Sehat: Sebagai Usaha Pengereman Impor Terigu dengan Menggunakan Bahan Substitusi Alami*. Pasuruan: Lembaga Academic & Research Institute. 119 pages

Nur'utami, D.A., Fitrilia, T., & Oktavia, D. (2020). Pengaruh lama fermentasi terhadap karakteristik sensori dan daya kembang roti mocaf (modified cassava flour). *Jurnal Agroindustri Halal*, ***6***(2), 197–204. https://doi.org/10.30997/jah.v6i2.3255

Pato, U., Restuhadi, F., Ali, A., Ulfah, R., & Mukmin. (2013). Evaluasi mutu dan daya simpan roti manis yang dibuat melalui substitusi tepung terigu dengan pati sagu dan mocaf. *Jurnal Sagu*, ***11***, 1–12.

Purukan, C., Siampa, J.P., & Tallei, T.E. (2020). Enkapsulasi bakteri asam laktat hasil fermentasi buah salak (*Salacca zalacca*) lokal menggunakan aginat dengan pewarna kembang sepatu (*Hibiscus rosa-sinensis* L.). *Jurnal Bios Logos*, ***10***(2), 93. https://doi.org/10.35799/jbl.10.2.2020.29045

Putri, D.N., Windiana, L., & Mardhiyah, N. (2019). Analisis Keberhasilan Program Pendampingan Pengembangan Produk UMM Bakery Metode Frozen dan Sourdough Sebagai Upaya Meningkatkan Umur Simpan dan Efisiensi Produksi Roti di UMM Bakery. *VIABEL: Jurnal Ilmiah Ilmu-Ilmu Pertanian*, ***13***(2), 1-10. https://doi.org/10.35457/viabel.v13i2.769

Ramadhani, Z.O., Dwiloka, B., & Pramono, Y.B. (2019). Pengaruh substitusi tepung terigu dengan tepung pisang kepok (*Musa acuminata l.*) terhadap kadar protein, kadar serat, daya kembang, dan mutu hedonik bolu kukus. *Jurnal Teknologi Pangan*, ***3***(1), 80-85.

Riana, A., Cahyana, C., & Ridawati. (2020). Pengaruh penggunaan ragi alami ekstrak buah pepino (*Solanum maricatumaiton*) pada pembuatan kue bika ambon medan terhadap daya terima konsumen. *Journal of Nutrition and Culinary (JNC)*, ***1***(1), 1–11.

Ridawati, & Alsuhendra. (2019). Perbandingan kualitas roti bun dengan penggunaan adonan asam dari ragi sari mentimun dan sari ciremai. *Sebatik*, ***23***(2), 574–581. https://doi.org/10.46984/sebatik.v23i2.814

Rodríguez, M.E., Pérez-Través, L., Sangorrín, M.P., Barrio, E., Querol, A., & Lopes, C.A. (2017). Saccharomyces uvarum is responsible for the traditional fermentation of apple chicha in Patagonia. *FEMS Yeast Research*, ***17***(1), 1–11. https://doi.org/10.1093/femsyr/fow109

Saloko, S., Handito, D., Cicilia, S., & Dwiani, A. (2016). Karakteristik fisikokimia dan sensoris produk patiseri berbasis mocaf. *J.Rekapangan*, ***10***(1), 36–43.

Savino, M.J., Sánchez, L.A., Saguir, F.M., & de Nadra, M.C.M. (2012). Lactic acid bacteria isolated from apples are able to catabolise arginine. *World Journal of Microbiology and Biotechnology*, ***28***(3), 1003–1012. https://doi.org/10.1007/s11274-011-0898-9

Sudjijo, N. (2016). Karakterisasi dan evaluasi 10 aksesi salak di sijunjung sumatera barat. *Buletin Plasma Nutfah*, ***15***(2), 75. https://doi.org/10.21082/blpn.v15n2.2009.p75-79

Sunarsi, S., Sugeng A.,M., Wahyuni, S., & Ratnaningsih, W. (2011). Memanfaatkan singkong menjadi tepung mocaf untuk pemberdayaan masyarakat Sumberejo. *Seminar Hasil Penelitian dan Pengabdian Kepada Masyarakat*, ***1***, 306–310.

Xu, D., Zhang, Y., Tang, K., Hu, Y., Xu, X., & Gänzle, M.G. (2019). Effect of mixed cultures of yeast and lactobacilli on the quality of wheat sourdough bread. *Frontiers in Microbiology*, ***10***, 02113. https://doi.org/10.3389/fmicb.2019.02113

Yan, B., Yang, H., Wu, Y., Lian, H., Zhang, H., Chen, W., Fan, D., & Zhao, J. (2020). Quality enhancement mechanism of alkali-free Chinese northern steamed bread by sourdough acidification. *Molecules*, ***25***(3). https://doi.org/10.3390/molecules25030726

Yasa, I.W.S., Zaini, A.M., & Hadi, T. (2016). Mutu roti berbahan dasar mocaf: Formulasi dan metode pembuatan adonan. *Pro Food (Jurnal Ilmu Dan Teknologi Pangan)*, ***2*** (2), 120–126. http://jurnal.unram.ac.id/index.php/profood/index

Zubaidah, E., Putri, W.D.R., Puspitasari, T., Kalsum, U., & Dianawati, D. (2017). The effectiveness of various salacca vinegars as therapeutic agent for management of hyperglycemia and dyslipidemia on diabetic rats. *International Journal of Food Science*, *2017*. https://doi.org/10.1155/2017/8742514