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Instant Coffee: Effect of Sugar and Coffee Concentration on pH, Total Soluble Solid, Sucrose and Crude Fiber

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ABSTRACT: Coffee was one of the diversification products from ground coffee. People prefer instant coffee because it has various advantages compared to ground coffee; namely, the way it is served is easier and does not leave annoying dregs or pulp. This research aimed to analyze the quality of instant coffee produced through several parameters such as pH, TSS, crude fiber, and sucrose content. The crystallization agent that is commonly used is sucrose from sugar. The process occurred when the sucrose concentration in the solution was at a supersaturated level; it would coat compound molecules in the form of crystal nuclei and grow into more significant components. This study used a Randomized Complete Design, which consisted of two factors. The first factor was the concentration of sugar (80, 90, and 100%), and the other was the concentration of ground coffee (15 and 30%). The observation parameters were pH, TSS, sucrose content, and crude fiber. The result of Instant coffee produced by treating different concentrations of sugar and coffee powder has a real influence on several parameters, namely pH, TPT, sucrose, and crude fiber. The addition of sugar and coffee also improves the quality of the instant coffee produced.

Keywords: Instant Coffee, Robusta, Sugar, Kristalisasi

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INTRODUCTION

Indonesia is the fourth largest coffee-producing country in the world after Brazil, Vietnam, and Colombia. Around 67% of the total production of coffee is exported, while the remaining 33% is used to meet domestic consumption needs. The demand for Indonesian coffee continues to increase over time. This is shown by the increase in domestic coffee consumption, namely 500 grams/capita/year. Indonesia's estimated coffee consumption level has reached approximately 800 grams/capita/year (Satyajaya et al., 2014). Thus, in approximately 20 years, consumption has increased to reach 300 grams/capita/per year.

In Indonesia, the public generally cultivates two types of coffee: robusta and arabica. Jember is one of the areas famous for its coffee-producing areas. One area that produces large coffee is the Argopura sub-district (Haryati., 2008). The majority of coffee cultivated in Jember is the Robusta type. Robusta coffee has the characteristics of a more bitter taste; the resulting aroma is typically sweet, has varying bean color, and has a rougher texture than Arabica coffee (Budi et al., 2020). Apart from that, in terms of taste, Indonesian Robusta coffee has an advantage in that the body it contains is stronger. In contrast, the other coffee type, Arabica, produced in various regions in Indonesia, has unique and excellent taste characteristics (acidity, aroma, flavor).

Various coffee products currently make coffee very popular and famous with publicity. People have the habit of consuming coffee every day and on every occasion. Various social status groups like coffee drinks for different purposes, some of which prevent neurological diseases, reduce the risk of cancer, and prevent diabetes

(Gaibor et al., 2020). Based on the type of processed coffee on the market, there are two types in circulation. Firstly, ground coffee is a coffee drink made by boiling coffee beans with sugar, and when brewed, the coffee produces dregs. The second is a type of instant coffee where the product is a mixture of coffee, sugar, and milk, which goes through a granulation process first and then is packaged in aluminum foil, plastic, jars, or bottles. According to (Vareltzis., 2020), instant coffee is a dry product that dissolves easily in water, has a caffeine content of no less than 2%, and is no more than 8%, produced entirely from the extraction of coffee beans that have been roasted with water.

People prefer instant coffee because it has various advantages compared to ground coffee, namely the way it is served is easier, it does not leave annoying dregs, etc. (Ghosh and Venkatachalapathy., 2014) and in terms of taste, it has a distinctive taste that is easily obtained because it is instant and easy. Methods for making instant coffee include spray dryers, freeze dryers, etc. One of the simplest ways is co-crystallization, which uses sugar as a filler for instant coffee. According to (Ni'mah et al., 2021), the instant coffee powder was made by crystallization and drying techniques with a cabinet dryer. The results showed that the difference between the two fillers did not affect the physical properties of instant coffee powder, such as yield, pH, solubility, brightness (L*), and yellowishness (b*). Meanwhile, the chemical properties of water content showed a significant difference between the two treatments. The sensory properties of the two treatments have a description of the color tends to be bright and slightly brown, the taste was quite bitter, slightly sweet, quite sour, the aftertaste was medium sour, the aftertaste was low in smoke, the aftertaste was quite detectable, the aroma of coffee was medium, slightly sweet, and slightly caramel-flavored. he crystallization agent that is commonly used is sucrose from sugar. The process occurred when the sucrose concentration in the solution was at a supersaturated level; it would coat compound molecules in the form of crystal nuclei and grow into more significant components.

Based on the analysis above, research was carried out on making instant coffee by co-crystallization using granulated sugar. This research aimed to analyze the quality of instant coffee produced through several parameters such as pH, TPT, crude fiber, and sucrose content.

MATERIAL AND METHODS

The tools used in this research were an oven MEMNERT LO-201C, a Phillips blender, a sieve, an analytical balance OHAUS CP 214, a desiccator, a refractometer ATC 0-100m, and a pH meter Hanna HI 3220. The main ingredients were Robusta variety coffee beans purchased from a local vendor in Argopura regency. The product was processed naturally. Other ingredients were sugar and mineral water.

Stages of Making Instant Coffee

The coffee beans were roasted at a medium to dark roast level. Roasting was carried out for 10 – 15 minutes. Roasted beans were rested for 24 hours before being ground. The coffee ground was packaged in aluminum foil. Coffee grounds dissolved with distilled water at a temperature of 90˚C with a ratio (of 10 and 30% volume). Extraction was done in 24 hours. Coffee extraction from the last process was cooked until boiling; the next step was adding sugar with concentration (80, 90, and 100% volume) until supersaturated.

The experimental design used for this research was wholly randomized with two factors. The first factor was coffee powder concentration, which consisted of 10% (K1) and 30% (K2). The other factor was the concentration of sugar namely 80 (S1), 90 (S2), and 100% (S3), with three times repetitions, so there were six combinations of treatment namely K1S1 (10% coffee powder + 80% Sugar), K1S2 (10% coffee + 90% sugar), K1S3 (10% coffee powder + 100% sugar), K2S1 (30% coffee powder + 80% sugar), K2S2 (30% coffee powder + 90% sugar) and K2S3 (30% coffee powder + 100% sugar).

Analysis of TPT

Analysis of total soluble solids based on a modification of Paul et al. (2021). Several samples of instant coffee powder were dissolved in distilled or distilled water with a ratio of 1:10 (w/v). The TPT measurements were carried out with a refractometer or hand refractometer. Refractometer (refractive index measurement)

based procedure using either Abbe type or hand refractometer.

Analysis of pH

Analysis of pH based on (Septiyaningrum., 2019). Several samples of instant coffee powder were dissolved in distilled or distilled water with a ratio of 1:10 (w/v). The pH measurements were carried out with a pH meter.

Analysis of Sucrose

The spectrophotometric method determined sugar content (Borji et al., 2017).

Analysis of Crude Fiber

The crude fiber content was determined using the AOAC method (2000).

Data analysis

The data analysis used in this research was variance analysis (ANOVA) using the SPSS 20.0 application with a level of α = 5% to determine the effect of the treatment. The results that show a real influence will be analyzed for further tests using the Duncan Multiple Range Test (DMRT) test.

RESULT AND DISCUSSION

pH

The value of the degree of acidity (pH) was closely related to the acidity of a product. pH analysis of food products is essential to guarantee a product's safety. The acids in coffee that form its distinctive aroma consist of several types, including formic acid, acetic acid, propanoic acid, and hexanoic acid (Oktanauli et al., 2023).

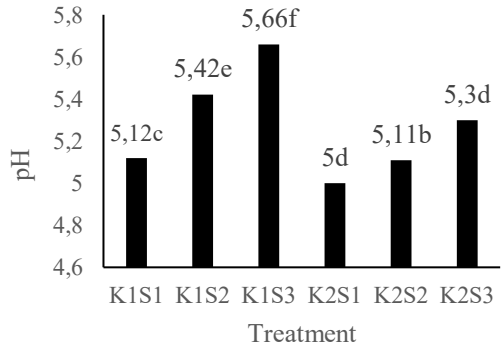

Figure 1. The pH Solid of Instant Coffee

The flavor-forming acids in coffee include acetic acid, malic acid, citric acid, and phosphoric acid (Mursalin et al., 2019). High acidity indicates a good quality aroma and taste in coffee because of volatile acid compounds (aroma-forming) and flavor-forming acids. Based on Figure 1, the treatment with different concentrations of sugar and coffee powder produces a significantly different pH of instant coffee. The pH of the instant coffee produced ranges from 5.00 to 5.66. Based on the result of DMRT, it can be concluded from this graph that the increase in sugar and coffee affects the resulting pH value. The effect of coffee and contrast

According to (Budiyanto et al., 2021), coffee beans naturally contain volatile compounds such as aldehydes, furfural, ketones, alcohol, esters, formic acid, and acetic acid.

Total Soluble Solid

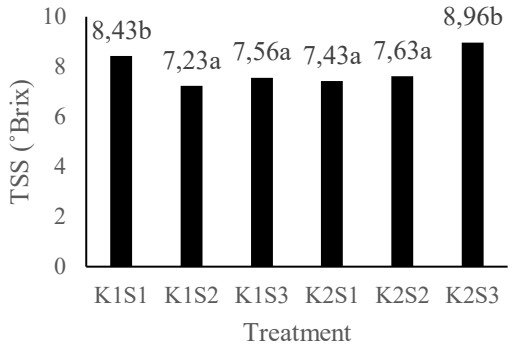

Figure 2. Total Soluble Solid of Instant Coffee

Total soluble solids (TSS) were one of the essential parameters for assuring the maturity status and quality of commodities and their product. Many food products are purchased based on the % TSS content in them, and quality-conscious manufacturers make it a practice to determine the TSS.

Materials classified as soluble in water include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and others. The quality of the sweet taste of a food can be measured by measuring total dissolved solids because sugar is the main component of dissolved solids. The total dissolved solids content includes dissolved substances (organic and inorganic substances), for example, sugar, acid, and salt, so the higher

the addition of the salt solution, the higher the total value (Paul et al., 2021).

Figure 2 shows that treatments with different concentrations of sugar and coffee produce significantly different effects on the total soluble solids produced. The graph explains that the total soluble solid produced ranges from 7.23 to 8.96 ˚Brix. Based on DMRT, The K1S2 sample showed no significant difference from the K1S3, K2S1, and K2S2 samples. This may be because the combination of sugar and coffee concentrations added produces total soluble solids that are not much different. The K2S3 sample (30% coffee and 100%) produced the highest total soluble solids. This is by Mursalin et al. (2019), who explained that increasing sugar concentration causes the total dissolved solids of instant coffee products to be higher.

Sucrose Content

Based on DMRT, sugar has a crystalline shape with an almost uniform size ranging from 0.8 to 1.2 mm. Granulated sugar, the main ingredient in making instant coffee, illustrates the total sucrose contained in the instant coffee produced, according to (Rianto et al., 2018), which explains that 100 grams of granulated sugar contains 100% sucrose, 385 calories, and 5.5 grams of water. The crystallization method uses granulated sugar as the main factor in making instant coffee.

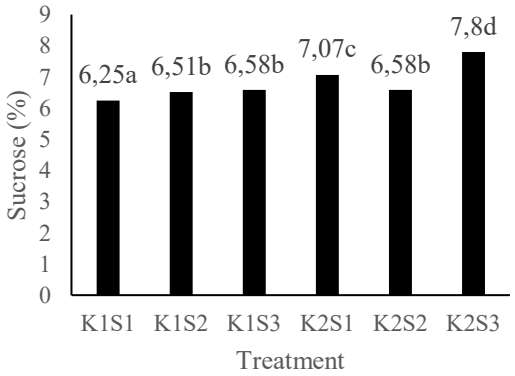

Figure 3. Sucrose Content of Instant Coffee

Crystallization is the process of forming solid crystals from a homogeneous mother liquor. This method utilizes the properties of sucrose, namely that when it is melted, it can form crystals again. In general, the mechanism for crystallization is that when sucrose is heated, it will melt and mix with other ingredients. When the water begins to evaporate, the sucrose will form crystals or solid granules again. Apart from that, sucrose also functions as an ingredient to improve product texture (Pangastuti et al., 2020). Based on Graph 3, adding sugar concentration produces significantly different sucrose levels in the instant coffee. Rianto et al. (2018) granulated sugar contains 100% sucrose, so the K2S3 sample has the highest sucrose content, namely 7.8%.

Crude Fiber Content

Crude fiber is the fraction that remains after undergoing breakdown or decomposition with a strong acid or strong base under controlled conditions. Crude fiber is part of carbohydrates. Conversely, human digestion cannot digest crude fiber (Kusumaningtyas et al., 2022).

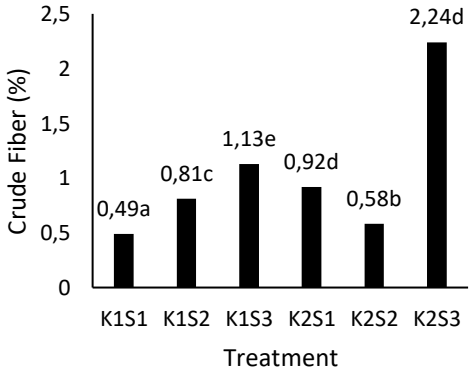

Figure 4. The Crude Fiber Content of Instant Coffee

Based on Figure 4, treatments using different concentrations of sugar and coffee produce significantly different crude fibers. The graph explains that the crude fiber produced ranges from 0.49 to 2.24%. Sample K2S3 showed the highest crude fiber, possibly due to the high concentration of coffee, which produces high fiber.

CONCLUSION

Instant coffee produced by treating different concentrations of sugar and coffee powder has a real influence on several parameters, namely pH, TPT, sucrose, and crude fiber. The addition of sugar and coffee also improves the quality of the instant coffee produced.

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