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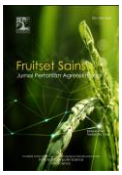

THE DEVELOPMENT OF LEMON PRODUCTS INTO FRUIT JUICE IS BASED ON THE LEVELS OF VITAMIN C AND pH BASED ON COOKING TEMPERATURE

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Abstract

Vitamin C is a type of water-soluble vitamin that is susceptible to heating. The aim of this study was to determine the effect of vitamin C content on heating temperature and the effect of storage time on the pH level of lemon juice. The method used in this study was a completely randomized design with 5 treatments at a temperature variation of 0°C, 60°C, 70°C, 80°C, and 90°C and pH measurements at 4 days of storage. The vitamin C content of a lemon juice before processing is 4.7861%. According to research findings, the most appropriate product is heating at a temperature of 70-800 °C with a pH ranging from 2.3 to 2.6 and no significant color change to the original hue of the juice.

Keywords: Cooking Temperature, Lemon Juice, Vitamin C

Abstrak

Vitamin C merupakan salah satu jenis vitamin larut air yang rentan terhadap proses pemanasan. Tujuan dari penelitian ini ialah mengetahui pengaruh kandungan vitamin C terhadap suhu pemanasan dan pengaruh lama penyimpanan perhadap kadar pH sari buah lemon. Metode yang dilakukan dalam penelitian ini ialah menggunakan Rancangan Acak Lengkap dengan 5 perlakuan pada variasi suhu 0℃, 60℃, 70℃. 80℃, 90℃ dan pengukuran pH pada waktu penyimpanan selama 4 hari. Kadar vitamin C buah lemon sebelum proses pengolahan sebesar 4,7861%. Produk paling ideal berdasarkan hasil penelitian ialah dengan menggunakan pemanasan pada suhu 70-80^{0}C dengan pH berkisar antara 2,3 – 2,6 dengan tidak ada perubahan warna secara siginifikan dengan warna asli dari sari buah.

Kata Kunci: Sari Lemon, Temperatur Masak, Vitamin C

1. Introduction

Consumer interest in natural and sustainable products and food ingredients on a health technology basis is currently increasing as a result of health and environmental issues (Willemsen et al., 2018). Fruit juice processing was established to take advantage of the excess (availability) of fresh fruit on the market, but it is now a major means of acquiring commodity fruit. Almost everyone understands how to create orange juice, but few know how to correctly process it so that the nutritional content, such as vitamins, is not harmed and it continues to provide nutrition to those who drink it. Because heating is a key aspect in the processing of orange juice, it is crucial to pay attention to the temperature utilized in its creation.

Many fruits contain active ingredients, including antioxidants like vitamin C (Fitriyana et al., 2017) . A water-soluble vitamin called vitamin C is vulnerable to heating, which is typically a step in the production of a product (Sekar Ningtiyas et al., 2023). The fruit lemon is loaded with vitamins, nutrients, and minerals. Numerous studies have suggested that oranges help protect against a number of illnesses, including cancer and stroke. Simply said, oranges have only been recognized as a source of vitamin C up until this point. In addition to vitamin C, oranges contain other important nutrients such as carbohydrates (sugars and dietary fiber), potassium, folate, calcium, thiamin, and niacin as well as minerals and vitamins like phosphorus, magnesium, copper, riboflavin, pantothenic acid, and phytochemicals (Rahayu et al., 2019). Approximately 45% of citrus fruit is juice, 26% is pulp, 17% is albedo, 10% is flavedo, and 2% is seed (Fernandes et al., 2010).

Lemons are a fruit that contain a lot of vitamin C. Lemon juice contains 40–50 mg/100 of vitamin C (Sekar Ningtiyas et al., 2023). Drinks contain a lot of acid, which can quickly erode tooth enamel. Demineralization is brought on by various factors, including acid. When enamel is exposed to an acidic environment (PH $\leq$ 5.5), demineralization may take place. The degree of acidity (PH) influences demineralization, and one indicator of it is the dissolution of several minerals found in enamel, particularly calcium (Panigoro et al., 2015). According to prior studies, calcium is released from tooth enamel at a faster rate in environments with lower PH or increased acidity. Low pH will increase the concentration of hydrogen ions, and these ions will harm the minerals found in dental enamel. The harder the enamel on the tooth surface is, the longer it is exposed to acidic beverages (Dewanto, 2014). Lemon contains citric acid with a low pH of 2.74, despite the fact that it offers many health benefits for the body.

Water-soluble vitamins like vitamin C are vulnerable to heating, which is typically a step in the manufacturing of a product. This is due to the fact that light, temperature, and ambient air all quickly destroy vitamin C (Eni Suwarsi Rahayu & Putik Pribadi, 2012). Vitamin C is an antioxidant that can reduce the exposure to free radicals in bodily tissues (Kartikawati & Yudi, 2019). Fruit juice is one of the most often consumed lemon products. One endeavor undertaken to extract more value from lemons is the manufacturing of lemon juice. Fresh, ripe lemons are used to extract the juice (Sekar Ningtiyas et al., 2023). Since fresh fruit spoils quickly, a heating method is used to destroy undesirable enzymes and spoilage microbes in order to meet the demand for high-quality food with a longer shelf life (Kim et al., 2021). Even though the heating procedure is simple, temperature precision is necessary since overheating degrades the quality and freshness of food products (Jiang et al., 2020). The majority of processed lemon products are lemon juices (Suri et al., 2022). However, while cooking with heat, the amounts of active ingredients in lemon juice will decrease (Multari et al., 2020). In light of this, research on ideal temperature and pH criteria is required in order to assess the quality of lemon juice (Zhu et al., 2023).

2. Material and Method

Laboratory experiments were conducted as part of this investigation (El et al., 2022). A completely randomized design with 5 treatments and just one variable—heating temperature—was used for the experiment (Ameliya et al., 2018). The temperature of the heated lemon juice can range from 0°C to 60°C, 70°C, 80°C, and 90°C. Iodometric

titration was used to evaluate vitamin C levels. Using a standardized iodine solution, the vitamin C content of lemon juice is measured by pipetting 10 mL of the sample solution into an Erlemeyer. The solution was added to 1.2 mL of 10% H_2SO4 solution, a few drops of 1% starch solution, and standard I2 solution before being titrated until blue appeared 15 times (Damayanti & Kurniawati, 2017).

The tools used are an orange juice filter, an orange juice squeezer, a measuring cup, a bottle sealer, a gas stove, a stainless steel pan, a thermometer, scales, a food-grade plastic basin, a refrigerator, and a freezer. Materials for the study included a pH meter, a lemon, salt, bottle seals, and bottles. The ingredients are samples of lemon juice, H_2SO4 solution, 1% starch solution, and I2 solution.

3. Results and Discussions

Effect of Temperature on Vitamin C

The results of this analysis include levels of vitamin C in citrus fruit juice and pH levels. This test is intended to determine the effect of temperature on vitamin C levels and the pH of stored lemon juice that has undergone heating from 0°C to 60°C, 70°C, 80 °C, and 90°C. Prior to processing, lemons had an estimated 4.7861% vitamin C content. The readings, however, dropped to 3.1879%, 3.6129%, 3.5688%, and 3.3978% following the heating process at 60°C, 70°C, 80 °C, and 90 °C. Although there was a slight decline in the proportion of vitamin C obtained, there was not much of a decline. The graph shows that the amount of vitamin C has dropped off rather gradually since 60 °C.

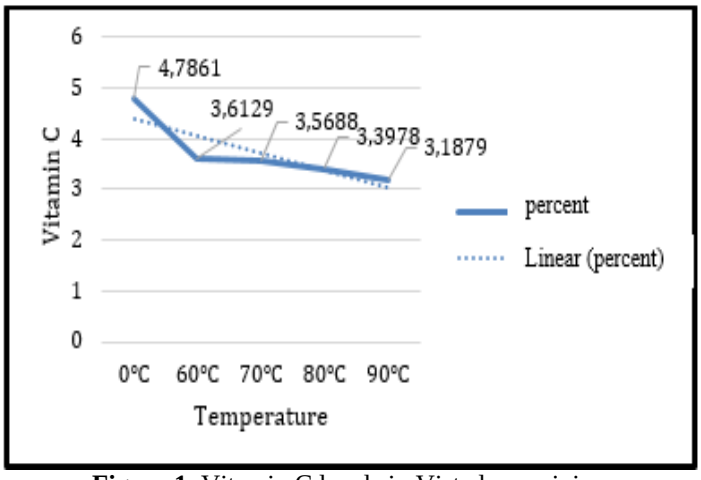

Figure 1. Vitamin C levels in Vista lemon juice

According to Figure 1 above, the amount of vitamin C in lemon juice decreases with increasing heating (boiling) time. Processing causes the vitamin C level to drop (Walufi et al., 2019). Because vitamin C is easily oxidized at high temperatures, the temperature and time required to heat it have lowered (Icha, 2019). This is due to vitamin C's propensity for easy oxidation, which is facilitated by heat. The breakdown of vitamin C increases with increasing temperature and heating time (Octaviani & Rahayuni, 2014). The oxidation process causes a significant amount of the vitamin C present in fruit juice to be lost (Icha, 2019). Ascorbic acid, a form of vitamin C, is oxidized to L-dehydroascorbic

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acid, a chemically unstable compound that can transform back into L-acid. -diketogulonate, which is devoid of vitamin C's functional properties. The greatest loss of vitamin C during food preparation is caused by chemical deterioration. Fruits and other vitamin C-rich foods typically lose weight due to non-enzymatic browning processes. The amount of ascorbic acid lost during processing is roughly 7–14 mg per ml of fruit juice (deMan, 1997).

pH Against Vista Lemon Juice Storage Period

The term pH, or degree of acidity, is used to describe how acidic or basic a material, solution, or item is (Purwanti & Unzilatirrizqi, 2022). Acids and bases are chemicals that are frequently treated in both industrial and everyday settings . The findings of the study indicate that the pH changes with different temperature changes and storage durations.

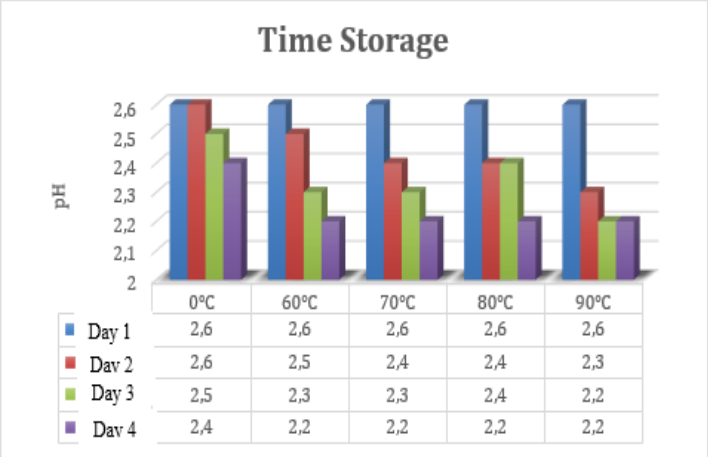

Figure 2. pH Against Vista Lemon Juice Storage Period

The same method—pouring the juice from the bottle into a bowl or baking glass before dipping the pH meter into it—was used to observe the effects of storage time on the pH of lemon juice at the same time every day, which was in the morning. According to Figure 2 above, the pH value of lemon juice decreases as storage duration increases. All temperature treatments, which ranged from 0 °C to 900 °C, were kept in storage for 4 days. The research's findings had a pH between 2.2 and 2.6. The stability of the mandarin orange peel extract is impacted by storage at a certain temperature and initial pH (Perdisen et al., 2021). This is because a rise in temperature will result in the addition of H+ to the solution, and a storage period's effect on pH decline will also increase (Rahman et al., 1992). Because acids infiltrate the fruit while it is being stored, storage time has a substantial impact on pH decline (Djubaedah et al., 2004).

Higher temperatures are being used, which will hasten pH decline (Wulandari et al., 2022). The inclusion of starch or sugar in the ingredients as well as the addition of citric acid both contribute to the pH reduction . The negative charges on particles are drawn to sugar molecules. Specifically, its hydroxyl groups are responsible for this characteristic. The pH level will decrease as a result of the H+ ion concentration in solution rising due to the evacuation of OH ions from the sugar molecule's immediate vicinity. In addition, the

amount of time that a substance is stored has been linked to pH decline (Rahman et al., 1992). This is because acid-producing microorganisms are assumed to be active throughout storage.

4. Conclusion

Lemons had a vitamin C level of 4.7861% before heating; it fell to 3.6129%, 3.5688%, 3.3978%, and 3.1879% after heating at 60°C, 70°C, 80 °C, and 90 °C. Vitamin C levels drop in direct proportion to heating. The length of storage affects pH. According to research findings, the most ideal product is to use heating at a temperature of 70-800 °C with a pH ranging from 2.3 to 2.6 and no significant color change to the original hue of the juice. Suggestions for future research on the pasteurization method used to maintain a high vitamin C content and compare it to various types of fruit with a high vitamin C content.

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