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NUTRITION AND FOOD PROCESSING USING THERMAL PROCESS METHODS

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Abstract

Food processing uses thermal processes to maintain product durability by killing spoilage microbes and pathogens, improving sensory quality, heating products, increasing the digestibility of proteins and carbohydrates, and destroying unnecessary ingredients. The thermal process technique is a preservation technique that uses high temperature and pressure to kill bacteria and pathogens in hermetically packaged food by applying high heat of more than 100 degrees Celsius over a certain period of time. To maintain the safety of food products, thermal processing is a food processing process that inactivates microbes in food. Excessive thermal processing can damage nutritional components and reduce the sensory quality of the product. In addition to killing microbes, thermal processes must consider the quality of the final product by minimizing quality damage.
Keywords: Processing, Food, Thermal, Preservation, Quality..

INTRODUCTION

The thermal process is a preservation technique that uses high temperature and pressure to kill bacteria and pathogens in hermetically packaged food by providing high heat of more than 100 degrees Celsius over a certain period of time. To maintain the safety of food products, the thermal process is a food processing process that inactivates microbes in food (Khairina, 2024). Food processing uses thermal processes to maintain product shelf life by killing spoilage microbes and pathogens, improving sensory quality, heating the product, increasing the digestibility of proteins and carbohydrates, and destroying unnecessary ingredients. Excessive thermal processing can damage nutritional components and reduce the sensory quality of the product. In addition to killing microbes, thermal processes must consider the quality of the final product by minimizing quality damage. Therefore, the thermal process must be optimized to determine the combination of temperature and time required for heating and cooling to meet food safety and quality standards (Yuswita, 2014)

According to Pratama (2016), the process of heating food is an important step to obtain the desired sensory properties. Thermal treatment of food is a processing step that aims to protect the product from the risk of microbial contamination. Thermal processes commonly carried out are sterilization and pasteurization. Sterilization is a thermal process that is commercially carried out at high temperatures over a relatively

long period of time, resulting in the absence of spore-forming microorganisms in normal storage (Yuswita, 2014).

In food processing using thermal methods, there are several types that are commonly carried out, namely pasteurization, blending and sterilization. Pasteurization is a thermal process that involves placing ingredients at temperatures below 100°C to inactivate vegetative cells of pathogenic microbes (Hasan, 2020). The goal of pasteurization is to kill all pathogens in food and extend the shelf life of food by killing spoilage bacteria and inactivating enzymes. Blanching is a short-term heating treatment using hot water or hot steam. Sterilization is a thermal process that aims to kill all microorganisms and their spores.

METHODS

The method used to write this article was literature study, we collected research journals and previous theories that were relevant regarding nutrition and food evaluation using thermal methods. The method used to write this article was literature study, we collected research journals and previous theories that were relevant regarding nutrition and food evaluation using thermal methods.

RESULTS AND DISCUSSION

The food preservation process can be done through a thermal process. The thermal process is a process included in the preservation process that utilizes heat energy. The main purpose of this heat treatment is to kill microorganisms that affect the quality of the packaged product. Thermal processes that are often used in daily life are pasteurization, blanching, sterilization.

Pasteurization

Pasteurization is a thermal process that involves placing ingredients at temperatures below 100°C to inactivate vegetative cells of pathogenic microbes (Hasan, 2020). The goal of pasteurization is to kill all pathogens in food and extend the shelf life of food by killing spoilage bacteria and inactivating enzymes. Pasteurization is a heating process at a relatively low temperature, usually carried out at temperatures below 100°C, with the aim of reducing the number of spoilage microorganisms so that food can be stored for days to months. Pasteurization extends the shelf life of food products by killing or eliminating all pathogenic microorganisms that cause disease and spoilage microorganisms through the heating process (Sobari, 2019). Pasteurized food still

contains few microorganisms per ml, so its shelf life is not very long. Therefore, pasteurized foods should always be stored at low temperatures. For example, pasteurized milk can be stored for about a week if stored in the refrigerator, but only a few hours at room temperature (Tjahjadi, 2012).

There are two types of pasteurization: long-term pasteurization (LTLT), which is heating food to a temperature of approximately 63°C for 30 minutes; This method is effective in killing pathogenic microorganisms without affecting the nutritional value of food and is usually used for products such as milk and juice. Another method is short-term high temperature sterilization (HTST), which involves heating for 15 seconds at a temperature of around 72°C. This method is also effective in killing pathogenic microorganisms and is often used on liquid products such as milk, drinks and sauces (Setiarto, 2020).

Ohmic heating is a heating method used for thermal method pasteurization. This method uses high temperatures of the material due to fast AC current. Obstacles in materials cause heat (Adilaksono et al., 2014). Microorganisms in materials can be inactivated with this thermal technique. Although the high temperature pasteurization process guarantees product safety, the process also allows damage to the ingredients such as loss of nutrients, color, aroma, taste and other physicochemical properties (Rukmamana, 2023).

Blanching

Blanching is a short-term heating treatment using hot water or hot steam. Blanching is done in two ways, the first is boiling water at a temperature of 88-99 °C for 1.5-12 minutes, and the second is with steam at a pressure of 1 atm and a temperature of 100 °C. (Tjahjadi, 2012). The main objectives of blending are:

1. Inactivates enzymes in materials that can cause unwanted reactions.
2. Removes particles and dirt from the product.
3. The number of microorganisms is reduced
4. Eliminate the air contained in the spaces between cells in the agar material network.
5. Flexes the network so that materials are easily packaged.

The increase in mass, especially blanching by boiling, is influenced by heating, and protopectin is extracted from the middle lamella thereby causing cell walls and softening the sample. Changes in hardness are caused by heating the sample for too long, osmosis of water in the sample, and changes in the sample in the form of a decrease in mass, especially in samples that experience changes in the form of size reduction, which

will cause the volatile compounds contained in the sample such as cut carrots and cut beans to be evaporated and reducing the weight of the sample reduces the weight of the sample, and the aroma that appears is caused by the expansion of gas between cells from vegetable and fruit tissue.

Sterilization

Sterilization is a thermal process that aims to kill all microorganisms and their spores. Bacterial spores are heat resistant and usually require heating to 121°C for 15 minutes or equivalent, meaning all food particles must undergo the same heat treatment. Sterilization usually causes undesirable changes in quality. Therefore, the sterilization stage in food processing is not carried out for too long to avoid excessive damage to the food. During food processing, sterilization is carried out to a safe point, thereby ensuring a long shelf life (Tjahjadi, 2012).

Concentrated sugar or salt solutions are also usually added to the sterilization process to increase durability and resistance to microorganisms. Salt and sugar solutions used as preservatives must be more concentrated than the cytoplasm in the microorganism cells. Therefore, water comes out of the cells and osmosis causes the cells to become dry or dehydrated. In addition, at the end of the exhausting process, the gas that promotes microbial growth is extracted or removed and replaced with inert gas during packaging. The aim of the exhausting process is to reduce or inhibit damage caused by microorganisms during storage (Vishnu, 2015).

The exhausting process during processing aims to remove the gases contained in the sample and jar. This is done to ensure the jar is not damaged during the process. Changes in temperature during the sterilization process certainly affect the texture and aroma of the sample. Changes in sample texture are influenced by hydrolysis of pectin compounds, starch gelatinization, and partial dissolution of hemicellulose, combined with a decrease in turgor or cell pressure.

According to the research results of Karimah et al (2024), the thermal process using high temperatures for a long time can affect the aroma of jamblang fruit extract drinks, but does not affect the color or taste. According to the research results of Maherawati et al (2022), the effective heat adequacy in the pineapple pacri sterilization process is 3,881 minutes which was obtained in the sterilization process at a temperature of 121°C for 15 minutes. Differences in temperature and sterilization time do not affect the brightness, red color intensity, and pH, but affect the yellow color intensity, viscosity, and texture of canned pineapple pacri. The texture of pineapple pacri is not influenced

by sterilization temperature, but is influenced by sterilization time. The pH value of canned pineapple pacri is not influenced by temperature and sterilization time.

CONCLUSION

Food ingredients with high water content and high water activity are susceptible to microbial growth. Therefore, if it is not stored properly, the shelf life of the product will be shortened. One way to prevent this problem is to use a thermal process. This process uses high temperatures to inhibit the growth of microorganisms that can damage food ingredients. The thermal process generally consists of pasteurization carried out at temperatures below 100 °C, sterilization carried out at temperatures above 100 °C, and blanching carried out at temperatures of 88-99 °C. This process uses high temperatures to influence the physical and chemical properties of food ingredients. There are three main factors that influence the heating process: the condition of the food, the ingredients, the type of microorganisms, and the processing method (Azara and Saidi, 2020). These factors form the basis for designing and implementing efficient food heating processes. Various heating techniques are used to improve the quality, safety and shelf life of food. The process of heating beverages involves temperature and time control. One of the most commonly used process techniques is hot filling, which involves a pasteurization step at temperatures below 100°C. The aim of pasteurizing food at pH <4>4.5 is to prevent the growth of pathogenic microorganisms (Fellows, 2017). Generally, the more acidic a product is, the lower the temperature used to prevent microbial growth. This is because microorganisms find it difficult to grow in an acidic environment.

BIBLIOGRAPHY

Adilaksono, I. C., Susilo, B., & Sugiarto, Y. 2014. Design of Automatic Fruit Juice Pasteurization Machine Based on Ohmic Heating Technology. In Jurnal Teknologi Pertanian (Vol. 15, Issue 2).

Azhari, E., Et Al. 2023. “Sterilisasi produk siap saji: Cakalang (*Katsuwonus pelamis Linnaeus* 1778) dalam Kemasan *Retort Pouch*”. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 26(1), 77–86.

Fellow, A., Abdalla, A., Elsayed, A., Gamuhay, B., Abu- Khadra, A., Hassan, M., Ataalla, M., & Mohamed, A. (2017). Survey on the Moisture and Ash Contents in Agricultural Commodities in Al-Rass Governorate, Saud

Arabia in 2017. Assiut Journal of Agricultural Sciences, 48(6), 55–62. https://doi.org/10.21608/ajas.1999.5752

Hasan, I., N. Wulandari, & F. S. Budi. 2021. Penerapan Proses Panas pada Industri dan Menengah Pangan Bir Pletok Wilayah Jakarta Selatan. Jurnal Standarisasi. 23(1): 85- 98\

Karimah, S. A., Noviasari, S., & Haryani, S. 2024. Pengaruh Kombinasi Proses Termal pada Minuman Ekstrak Buah Jamblang terhadap Tingkat Kesukaan Panelis. *Jurnal Ilmiah Mahasiswa Pertanian*, *9*(1), 374-380.

Khairina, R., Sari, D. K., Fitrial, Y., & Khotimah, I. K. `2024. Thermal Process Technology Transfer of Masak Habang Snakehead Fish in Poklahsar, Lepasan Village, Barito Kuala: Transfer Teknologi Proses termal Ikan Gabus Masak Habang Di Poklahsar Desa Lepasan Barito Kuala. *JATI EMAS (Jurnal Aplikasi Teknik dan Pengabdian Masyarakat)*, *8*(4), 93-98.

Maherawati, M., Nurhikmat, A., Santoso, A., Rahayuni, T., & Hartanti, L. 2022. Pengaruh Proses Termal Terhadap Karakteristik Fisikokimia Pacri Nanas Kaleng. *Jurnal Aplikasi Teknologi Pangan*, *11*(1), 34-39.

Pratama, Y., & S. B. M. Abduh. 2016. Perlakuan Panas Mendidih pada Pembuatan dalam Kemasan (Kajian pada Industri Skala Kecil). Jurnal Pangan dan Gizi. 7(13): 1-11.

Rukmamana, J., Gozali, T., Triani, R., & Salam, W. Q. 2023. Pengaruh Suhu Pasteurisasi Dengan Menggunakan Metode Ohmic Heating Terhadap Karakteristik Minuman Fungsional Sari Buah Jeruk Lemon. *Jurnal Penelitian Pertanian Terapan*, *23*(4), 590-600.

Setiarto, R. Haryo Bimo. 2020. Konsep HACCP, Keamanan, Higiene dan Sanitasi Dalam Industri Pangan. Bogor: Guepedia.

Sobari, Enceng. (2019). Dasar-Dasar Proses Pengolahan Bahan Pangan. *Polsub Press*.Subang.

Tjahjadi, C. 2012. Pengantar Teknologi Pangan Volume I. Jurusan TeknologiIndustri Pangan Fakultas Teknologi Industri Pertanian UniversitasPadjadjaran, Jatinangor.

Wisnu, L., Kawiji, K., & Atmaka, W. 2015. Pengaruh suhu dan waktu pasteurisasi terhadap perubahan kadar total fenol pada wedang uwuh ready to drink dan kinetika perubahan kadar total fenol selama penyimpanan. *Jurnal Teknologi Hasil Pertanian*, *8*(2), 71-76.

Yuswita, E. 2014. Optimasi Proses Termal untuk Membunuh Clostridium botulinum. Jurnal Aplikasi Teknologi Pangan. 3(3):5-6.