# EFFECTIVENESS OF HIGH PRESSURE PROCESSING FOR TOMATO PRODUCTS.

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**Annotation**. In the article, the writer presents information regarding effectiveness of High Pressure Processing for tomato products. High Pressure Processing (HPP) represents a non-thermal method for food preservation that enhances the shelf-life and safety of tomato-based products while maintaining their nutritional integrity, flavor, and visual quality

**Keywords:** High Pressure Processing (HPP) heating, boiling, vacuum, pasteurization, concentration, pressure, viscosity.

**Аннотация**. В статье автор представляет информацию об эффективности обработки томатов под высоким давлением. Обработка под высоким давлением (HPP) представляет собой нетермический метод консервирования пищевых продуктов, который увеличивает срок хранения и безопасность продуктов на основе томатов, сохраняя при этом их питательную ценность, вкус и внешний вид.

**Ключевые слова**: обработка под высоким давлением (HPP), нагрев, кипячение, вакуум, пастеризация, концентрация, давление, вязкость.

**Annotatsiya**. Maqolada yozuvchi pomidor mahsulotlarini yuqori bosimli qayta ishlash samaradorligi to'g'risida ma'lumot beradi. Yuqori bosimli ishlov berish (HPP) oziq-ovqat mahsulotlarini saqlash uchun termal bo'lmagan usulni ifodalaydi, bu pomidorga asoslangan mahsulotlarning yaroqlilik muddati va xavfsizligini oshiradi, shu bilan birga ularning ozuqaviy yaxlitligi, ta'mi va ko'rish sifatini saqlaydi

**Kalit so'zlar**:, Yuqori bosimli ishlov berish (HPP) isitish, qaynatish, vakuum, pasterizatsiya, kontsentratsiya, bosim, viskozlik.

## Introduction

The processing of tomatoes plays an essential role within the food sector, converting fresh tomatoes into various products such as sauces, pastes, and canned items. This transformation not only minimizes waste but also prolongs the shelf life of the products and caters to the consumer's desire for convenience. Ripe tomatoes exhibit a significant vulnerability to spoilage caused by various fungal genera, which can be attributed to their delicate skin structure and the adverse effects of environmental conditions such as inclement weather or improper harvesting methods throughout their cultivation. The industry is responding to emerging challenges and opportunities by incorporating automation and


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sustainable practices. High Hydrostatic Pressure (HHP) demonstrates superior efficacy compared to thermal methods in preserving phenolic compounds. Studies indicate that HHP treatment conducted at room temperature exerts negligible influence on the anthocyanin levels present in a variety of fruits and vegetables. Pressure processing is an effective method for inactivating microorganisms while maintaining covalent bonds largely intact at relatively low temperatures (0-40 °C). This limited impact of high pressure processing (HPP) on covalent bonds distinguishes this technique, as it exerts minimal disruption on the chemical composition of food.

To mitigate the impacts of high-temperature processing while preserving the nutritional integrity of food, various non-thermal food preservation methods have been developed. Among these methods, High Pressure Processing (HPP) has emerged as a widely utilized technique in commercial food processing over the past 25 years. This method is particularly effective in eliminating microbial contamination in food products. A distinctive aspect of HPP is its limited influence on covalent bonds, resulting in minimal alteration of food chemistry. Industrial high-pressure systems typically comprise a high-pressure vessel, a means for pressure generation, an optional temperature control device, and a material handling system. High-pressure processing presents a significant opportunity for food manufacturers to create a new array of enhanced, shelf-stable food products that surpass those produced using traditional methods; however, further research is necessary to advance the technology and reduce associated costs. Tomato processing refers to the transformation of fresh tomatoes into a variety of market-ready forms. This procedure encompasses a series of steps, including washing, crushing, heating , vacuum evaporation, boiling and packaging. The primary objective is to yield products of superior quality while adhering to safety regulations. Contemporary processing facilities employ automation technology to enhance operational efficiency and minimize labor expenditures. Moreover, a significant emphasis is placed on sustainability, with numerous organizations integrating environmentally responsible practices such as water reclamation and waste minimization. The procedure typically initiates with the collection of fully ripe tomatoes, followed by sorting and washing. Subsequent to crushing, the resulting pulp is subjected to cooking and concentration to create sauces or pastes. The final stages involve canning and packaging, which are essential for preserving the product's freshness over longer durations. As consumer inclinations trend toward organic and clean-label options, processing techniques are evolving to satisfy these preferences. Tomato processing constitutes a multifaceted yet vital component of the food supply chain, adeptly balancing quality, safety, and sustainability. Canned tomatoes serve as a fundamental ingredient in kitchens and


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the foodservice industry. The production method encompasses peeling, dicing, and sealing the tomatoes in sterilized containers. Notable advancements in this field include the adoption of vacuum-sealing techniques and the use of BPA-free packaging to improve both safety and sustainability. Canning is a widely utilized preservation technique; however, it is associated with a limited shelf life and poses environmental risks. The influence of integrated high-pressure thermal treatments on attributes such as consistency, viscosity, coloration, lycopene concentration, enzyme activity, and microbial presence was assessed and contrasted with traditional pasteurization and sterilization methods applied to tomato puree. The results indicated that high-pressure processing at room temperature (HPP) enhanced both color and viscosity relative to heat pasteurization; however, it did not significantly alter the water retention capacity or lycopene concentration. Following the application of high-pressure sterilization (HPS) procedures paired with elevated initial temperatures (80°C), and employing one or two pressure pulses, a product exhibiting ambient stability was successfully achieved. Specifically, the HPS treatment (utilizing one pulse at 700 MPa for 30 seconds at 90°C) significantly diminished the contamination level of B. stearothermophilus spores in meatballs prepared with tomato puree by at least 4.5 log units. Furthermore, this HPS method led to over 99% inactivation of the enzymes polygalacturonase and pectin methylesterase. Comparatively, HPS-treated products demonstrated a lower viscosity than those subjected to traditional sterilization methods, along with enhanced water-binding capacity. Additionally, there was a notable improvement in color perception, and the retention of lycopene content was achieved, in contrast to the conventional sterilization process, which resulted in approximately 40% loss of this pigment.

Advantages of HPP:

1. Elimination of microorganisms and enzymes
2. Alteration of biopolymers
3. Preservation of quality attributes, including color and flavor
4. Modifications in product functionality
5. High pressure application is not constrained by the dimensions or shape of the food item
6. High pressure operates independently of time/mass, functioning instantaneously and thereby shortening the processing duration
7. It does not disrupt covalent bonds, thus preventing the emergence of artificial flavors and maintaining the intrinsic taste of the products
8. The process can be conducted at ambient temperature, thereby minimizing the requirement for thermal energy in conventional food processing



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9. Given that high pressure processing is isotropic (uniform throughout the food), it ensures that the preservation is consistent throughout, without any particles evading the treatment

10. The method is ecologically sustainable as it solely relies on electrical energy and generates no byproducts.

**Conclusion**

High Pressure Processing (HPP) represents a non-thermal method for food preservation that enhances the shelf-life and safety of tomato-based products while maintaining their nutritional integrity, flavor, and visual quality. From a physicochemical standpoint, HPP exerts less aggressive effects on food compared to traditional thermal treatments: it does not disrupt or form covalent bonds and does not lead to the formation of new compounds due to molecular degradation, as seen in standard heat processing. Nonetheless, HPP is capable of altering weaker interactions, such as hydrophobic and electrostatic bonds that occur in macromolecules like proteins and polysaccharides This technology effectively inactivates microorganisms without compromising the nutritional quality of food or substantially affecting enzymatic functions. To mitigate the proliferation of residual microorganisms, minimize enzymatic reactions, and preserve sensory qualities, it is essential to store tomato products at low temperatures.

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