Final Report

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Rapid Cooling of hot boned trimmings Stage 4

Project Code
2022-1044

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Published by
AMPC

Date Submitted
07/06/2024

Date Published
07/06/2024

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1.0 Executive Summary

EC Throsby is a unique hot boning facility in Australia, looking to achieve efficient chilling of hot boned beef trim prior to packaging and directly from the carcass via a cooling system. To achieve this, time in motion, process flows, line management, chilling times and microbial benchmarks were performed and decided on by trial and error during normal production flow until the critical limits were achieved.

Of all the different methodologies and existing equipment suppliers a benchtop evaluation process was used to decide the most appropriate and economical system to achieve fast chilling of hot boned meat. A nitrogen tunnel system that could be integrated by speed and volume was decided on and purchased to undertake the project.

The liquid nitrogen tunnel freezer is a large-scale freezing machine suitable for large-capacity processing production on Food factory assembly lines. It has the features of strong freezing capability, simple operation, and a high degree of automation. The liquid nitrogen freezer employs new heating technology, temperature control techniques, and liquid nitrogen dispersion technology to ensure uniform and stable control over the processes of programmed heating, constant temperature maintenance, and cooling. It uses liquid nitrogen as a refrigerant to meet cooling and environmental requirements. The tunnel is now being used in full production and operating as designed with the desired cooling rates being achieved with minimal reworks. The project required a high degree of experimentation with different flow rates, nozzle configuration and belt speed and now optimal results are being achieved. EC Throsby is a Hot boning facility in the hunter region catering for export hamburger market in the US and other overseas markets. The main aim of hot boning is to create a bigger economic advantage, but to adhere to cooling guidelines set by the Department of Agriculture, these guidelines are the minimum standards set to avoid high E. coli and microbial counts in exported products, as the USA has stringent rules and regulation surrounding E. coli, EC Throsby has not attempted to achieve, a fresh trim spec for the open market. The project will focus on an inline cooling system to achieve the required temperature in record times avoiding a high microbial count and setting a benchmark from Hoof to Bag in 50 minutes, using a sophisticated preset inline belt cooler to reduce the temperature to well below the Department of Agriculture standards and rendering the product almost active microbial free.

2.0 Introduction

EC Throsby is a Hot boning facility in the hunter region catering for export hamburger market in the US and other overseas markets. The main aim of hot boning is to create a bigger economic advantage, but to adhere to cooling guidelines set by the Department of Agriculture, these guidelines are the minimum standards set to avoid high E. coli and microbial counts in exported products, as the USA has stringent rules and regulation surrounding E. coli, EC Throsby has not attempted to achieve, a fresh trim spec for the open market. The project will focus on an inline cooling system to achieve the required temperature in record times avoiding a high microbial count and setting a benchmark from Hoof to Bag in 50 minutes, using a sophisticated preset inline belt cooler to reduce the temperature to well below the Department of Agriculture standards and rendering the product almost active microbial free. This will offer the market a new product at a higher price point, way below the microbial count guideline of standard beef trim, this will enable manufacturers to gain additional shelf life on fresh products. This could be a benchmark for other processors and industry wanting to reduce the time from hoof to bag. The project will have a lone machine validating the results with a series of test runs and calculations of speed temperature and time. The project has received the blessing of the Department of agriculture (Jason Ollington) in principle on achieving the prescribed guidelines set by the Department of Agriculture. Stage 1 of this project is complete, the project theory has been

successful, in all facets of the trial. Stage 2 is retro fitting the machinery to perform the task, special belts are needed as this.

3.0 Project Objectives

1. Explore all avenues of cooling Hot Boned meat, in the most efficient way using minimal resources and at a budget.

2. Cooling of Hot Boned Meat in a specific timeframe to comply with standards, that will be set in this project.

3. Cooling of Hot boned meat in an area of limited space, with cooling device in process capability of Hot boned meat.

4. Gauge parameters, of cooling Hot Boned Meat as not to downgrade quality, shape, or visual appearances.

5. Cooling of Hot Boned meat in a way to present an attractive ROI.

6. A maintenance scheduled machine that complies with our current schedule, and after service maintenance and cost.

7. A machine that will comply to the Australian Work Health and Safety Requirements

8. Select a machine that is cost effective in cooling meat (1) short time frame than conventional method (2) More cost effective than the conventional method

Methodology

EC Throsby is a unique hot boning facility in Australia, looking to achieve cooling hot boned beef trim directly from the carcass on to a cooling device, which will cool trim whilst on route to the packing room. To achieve such a task of inline cooling there have been multiple stages to get to the installation of the equipment.
Stage 1 -2021-1075
Detail of tunnel temperatures and meat temperatures. Design and test theory.
Stage 2 - 2021-1169
Bult trial processing, running times, shelf life and quality of final product.
Stage 3 – On going trials with a loan machine installed at EC Throsby's in singleton.
Stage 4 Final – Installation of a nitrogen tunnel designed specifically to produce hot beef at a temperature of around 34°C to cool to 7-11°C, this will create cold transfer within the Octobin creating a final temperature of 1-4°C. tep 1 – Internal awareness, promotion and idea generation of the position and program.

4.0 Project Outcomes

The liquid nitrogen tunnel freezer is a large-scale freezing machine suitable for large-capacity processing production on Food factory assembly lines. It has the features of strong freezing capability, simple operation, and a high degree of automation. The liquid nitrogen freezer employs new heating technology, temperature control techniques, and liquid nitrogen dispersion technology to ensure uniform and stable control over the processes of programmed heating, constant temperature maintenance, and cooling. It uses liquid nitrogen as a refrigerant to meet cooling and environmental requirements. The freezer comes in various specifications and can be designed and manufactured according to requirements. The low temperature can reach -196 ℃. When it comes into contact with food, it quickly absorbs heat upon vaporization. The ultra-low temperature and high heat exchange rate enable rapid freezing. This

rapid freezing results in small ice crystals, helping to maintain the texture of the food, preventing moisture loss, and achieving nearly zero loss, preserving the original colour, Flavors, and quality of the food. The vaporized refrigerating nitrogen gas is evenly controlled and directed to the front end of the freezer, achieving heat exchange, and thereby increasing the efficiency of nitrogen utilization. This equipment, utilizing liquid nitrogen as a refrigerant, represents a new type of device in the food freezing industry. The project undertaking by EC Throsby was intended to speed up the process of Hot Boned beef, this system would eliminate eight hours of lag time.

5.0 Discussion

The nitrogen tunnel was a brilliant in line solution when the cost of CO2 was increasing, however the cost of nitrogen is also now increasing. While this innovation has been critical to the success of producing a high-quality trim for the US market for Throsby, the cost of the consumables now need to be factored into the overall cost of production and should be a consideration prior to implementing.

Conclusions / Recommendations

The tunnel is now in full production and operating as designed with the desired cooling rates being achieved with minimal reworks. The project required a high degree of experimentation with different flow rates, nozzle configuration and belt speed with optimal results now being achieved. The project has been successfully, and significant key learnings on process control have been developed. The capability of this equipment allows us to produce an ongoing supply of trim for the US market with established significant reduction in microbial activity. Throsby stand by this technology for efficient and economical fast chilling; however, the spiralling cost of nitrogen is reducing the value proposition considerably and should be considered. There is a great deal of capability needed to manage this process and this should be calculated into the cost of implementation.

6.0 Appendices

Fig 3 Raw material spec for cooling tunnel

Fig 4 cooling tunnel in operation test phase

Test Results

AF647 23062022.pdf

AF647 27062022.pdf

F647 21062022.pdf

28/06/2022 10:29	13
28/06/2022 10:44	11.5
28/06/2022 10:59	4
28/06/2022 11:14	3.5
28/06/2022 11:29	4
28/06/2022 11:44	4.5
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