Final report

AUSTRALIAN MEAT PROCESSOR CORPORATION

Water Reduced Hand Knife Steriliser with UV

Jarvis Water Reduced Hand Knife Steriliser with UV

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Contents

1.0 Executive summary

The goal of this project was to produce a UV Steriliser that would effectively sterilise hand-knives in meat processing plants, using less water, less power and producing less condensation than traditional knife sterilisers.

A trial of the unit at an Australian beef processing plant highlighted the difficulty of sterilising with fat and other debris on the knife blocking the UV. This prompted a number of alterations to the test unit, to better control water pressure and water temperature prior to the UV application.

AMPC cancelled the project in early 2024, so these latest improvements to the unit are yet to be tested in the field.

2.0 Introduction

Sanitisation (cleaning of physical dirt and microbial remnants) is required on all slaughter floor tools (knives and cutting/rodding implements) between each carcass. The current global practice is to use a sanitising pot containing hot water maintained at >82oC (180 oF). In most process plants this means that two tools are required per station so the operator is not idle between sequential carcasses.

Temperature and time sanitisation of tools are not only part of a HACCP program but are also monitored by audit staff (both internally and externally). As such the temperature is often a lot higher than 82oC, and more water than is required is often passing continuously through a sanitisation pot to ensure HACCP and audit criteria are unquestionably met.

As one can easily deduce, the above process, even if optimally tuned consumes a large amount of water and energy, requires twice the number of cutting implements at each station, and operating at or above 82oC is also a health (burn) risk to staff. Additionally, traditional methods contribute to the build-up of condensation in both kill-floors and boning rooms.

This Project (Stage 2)
Stage 2 will encourage researchers and developers to 'go back to the drawing board' and brainstorm and evaluate (without substantially building) new approaches to sanitisation. This stage can initially be focused (and hence limited to) knife sanitisation.

Future Projects (Stage 3+)
AMPC intends to invest in providers ideas (that are likely to be functional) in Stages 3+ and have these designs built, tested, and evaluated in meat processing plants. The end of the investment program in this area by AMPC will be supporting developed und er a Stage 5 adoption program. Hence AMPC will support a minimum viable level of adoption.

3.0 Project objectives

Goal 1

Develop solutions that reduce the (1) water and (2) energy used for knife and other equipment sanitisers, whilst not impacting on Australia's red meat processing audited HACCP procedures. Hand knife sanitiser, that can effectively sanitise a knife through the use of UV light, whilst simultaneously reducing the amount of steam & condensation that inevitably builds up through traditional sanitisation methods.

Goal 2

(3) Eliminate any potential for human WHS injuries associated with equipment sanitisation. (4) develop a solution that could be applied to other processing equipment and surfaces (including knife and hook storage pouches, mesh safety gear and aprons), and (5) sanitisation approaches that can be incorporated into automated equipment.

Goal 3

A reduction in condensation in the secondary process area.

To summarise, the main goal of the sanitiser is to produce an effective sanitisation of a hand-knife, using less water, less power, and producing less condensation than existing units. To measure these claims, we will conduct the following tests:

Effective Sanitisation – swab tests will be taken of blades using traditional sanitisation at minimum 82oC on a cattle slaughter-floor, with comparisons made to the new UV sanitiser. Testing will need to track protein build -up on the surface area of the knives, and consider different spray and/or UV exposure times to produce an effective sanitisation of the knife that meets or exceeds current accepted standards.

Water Reductions – Water will be collected from the existing/conventional sanitiser drain. This will show a flow rate per minute, which can be equated as volume per number of knife sanitisations. The same method will be used to capture exact water usage of the trial unit.

The fact that the water only engages when the knife is in the sanitiser (via sensor) will see an immediate improvement against most traditional sanitisers that pump water continuously.

Power Savings – the Trial unit has an electric power meter to measure electricity used. Any power consumption for the conventional/existing system can be done as a calculation of energy cost required to heat sanitiser water etc.

As we are using less water, and the water that we do use should not need to be heated to 82oC, we expect to see a reduction in power costs.

Condensation Reduction– The humidity can be monitored in a controlled room environment for both the conventional open top continuous sanitiser and the Trial unit. The conventional sanitiser uses a continuous flow and higher temperature water with an open top, compared to the Trial unit which is mostly closed and has intermittent water usage at a lower temperatures causing less steaming aerosols. The humidity % calculation and inspection of visual room surface droplets can determine baseline differences.

4.0 Methodology

Step 1 – Finalise concept design.

Step 2 – Build the spray-rinse prototype.

Step 3 – Factory test the Spray-Rinse for removal of fat and protein particles on knife. Variables include angle of spray contact, water pressure, water temperature, types of sprays, types of control-valves, and optimum materials to ensure no damage to knives.

Step 4 – Site testing including establishment and testing of baseline measurements.

Step 5 – Manufacturing.

5.0 Project outcomes

Initial trials of the test unit began in the Offal room at a NSW Beef plant in July 2022. The Offal room was chosen to conduct the trial as the level of contamination on individual knives was expected to be high due to the common build-up of fat and other debris on knives used in this area.

Swabs were taken by plant staff to identify the number of Colony Forming Units (CFM/cm2), in particular:

Two baselines were taken

1. Traditional sanitiser using room temperature water 30 degrees
2. Traditional sanitiser using 82 degrees water

Preliminary results taken

1. UV sanitiser using room temperature water 30 degrees – 5 seconds under UV light
2. UV sanitiser using 82 degrees water – 5 seconds under UV light

Tests of both the Traditional and UV Sanitiser were carried out at both 30 and 82 degrees Celsius. These results were submitted as part of Milestone 4 and produced a wide range of CFM/cm2 counts. It was immediately obvious that both the UV & traditional sanitisers using a 30 degree rinse were unable to adequately remove the concentration of fat on the knives. The length of time the blade is exposed to the UV light becomes irrelevant when fat and debris is not able to be removed from the knife.

Better results were obtained using an 82 degrees rinse under both the traditional and UV sanitisers to remove the fat concentrations on the knife, noting far less water was required with the motion-activated sensor in the UV sanitiser than the continuous stream of the traditional sanitiser.

The UV unit was removed from site in August 2022, with the following changes made to the unit:

• A water mixing valve was added to control the water temperature. To remove the fat, hotter water (than 30 degrees) is required. If we are able to remove the fat at 60 or 70 degrees for instance, we will still make savings on water heating costs and contribute to reduced condensation.

• A temperature probe with a Digital Display was added, with the expectation that this would produce a more accurate and reliable measure of temperature readings in real-time, as compared to the existing dial type gauge. This upgraded probe would also ensure more accuracy with water mixing temperatures.

• A high temperature-rated inline booster pump was added to enhance the water sprays. Different sites have access to water at different water pressures. Adding the booster will ensure we can achieve a consistent water pressure to increase the chance of removing debris and fat from the knife.

• The water sprays were moved inside the lid of the canister, again with the aim of improving the removal of debris from the knife blade.

• A bypass line and valve were added, allowing the system to be manually operated without UV during the testing phase to better highlight the effectiveness or otherwise of the UV sterilisation.

For each trial, water pressure needs to be elevated to a reliable and constant (yet-to-be-determined) maximum pressure, with variables such as wash time & water temperature being gauged against that maximum water pressure.

These changes have been made to the unit but are yet to be trialled in the field following the cancellation of this project.

6.0 Discussion

The obvious challenge after the first round of testing was removing the build-up of fat and other debris on the knife to enable the UV lights to adequately sterilise the blade.

The build-up of fat and debris is not consistent and can vary considerably across each knife sterilisation at a single station, to say nothing of the likely variation across different species & breeds, or even different areas of the abattoir where this unit may be in use. The unit therefore needs to be able handle a mixture of scenarios with varying levels of debris on the knife. It is hypothesised that increasing the water pressure first, and temperature second, would be the most effective way to remove this build-up.

As this project is now cancelled, Jarvis will look for other Processors who would be willing to continue testing of this unit.

7.0 Conclusions / recommendations

It is our aim to produce a unit that can be easily adjusted by the processor to efficiently control the variables of water pressure and water temperature to remove all debris from the knife before UV sterilisation. Different sites, and even different locations within the same site (Slaughter-floor, Boning room, Offal room etc) are likely to have different challenges in removing knife debris, so the utilisation of a unit such as this where individual variables can be controlled give us the best chance of achieving our goal of effective sterilisation of the knife, reduced power requirements, reduced water requirements and reduced condensation build-up.

8.0 Bibliography

N/A

9.0 Appendices

N/A