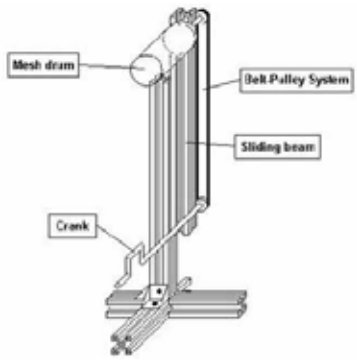
Salmon Surface Decontamination with Steam for the Food Processing Faraday Partnership Ltd

Introduction



Food poisoning costs the UK around £180 million per annum (POST 2003). Proper cooking can substantially reduce the dangers of infection from food-borne pathogens; however foods that are not cooked before consumption, such as smoked salmon, pose a significant risk. Trials at FRPERC have shown treatment with atmospheric steam to be an effective method of reducing surface bacteria; however the areas of the treated product in contact with the product support are not exposed to the steam and thus were not treated. Development work funded by the Food Processing Faraday Partnership (FPFP) under their 'FastTrack' scheme has recently been completed to produce a product handling system to avoid these untreated areas.

Development

In the steam treatment equipment (right), steam is admitted into a process chamber with a closed top and open base. Because the steam is less dense than air, the vessel naturally fills with steam at atmospheric pressure (approx. 1bar) and temperature (approx. 100°C). The products to be treated are currently introduced through the open base with a pulley system and held in the steam environment for the required treatment time.

A brainstorming session led to a number of conceptual approaches for handling systems: alternating gripping fingers, rotating mesh drum, pin grippers, 'pancake' turning. The mesh drum was selected as the most promising concept because less product damage was expected and it is applicable to other non-flat food types such as berries.

After several design iterations, the final design consists of a mesh drum (ø15cm) mounted on a vertically sliding beam (below).

The top of the sliding beam is attached to the existing steam unit insertion pulley system. This lifts the mesh drum into the steam environment and holds it there for the required treatment time using the existing timing and insertion system. The mesh drum shaft passes though dry running bushes mounted on the sliding beam to a belt pulley. Further down the beam there is a second belt pulley connected to a hand crank. This lower pulley is located such that it does not enter the steam zone when the drum is raised. The drum is turned via belt drive between the two pulleys. The sliding beam runs on plastic sliding elements on the fixed base stand. All components entering the steam zone are rated for operating at 100°C. The dry running bushes and open construction of the handling mechanisms reduce the impact of any condensation on the system operation.

Effect of treatment duration on salmon surface appearance.

To determine the effect of treatment duration on salmon surface appearance salmon sections were introduced into the steam atmosphere for 5, 10, 15 and 20 seconds. Samples were then wrapped and stored in a cold room operating at a nominal 1°C. Samples were inspected daily. Immediately after treatment all samples showed surface discolouration, however this faded after 3 days storage for the 5s and 10s treatments. The 20s treatment samples did not recover fully. The 15s treatment samples were on the borderline of acceptability. Microbiological tests of the steam decontamination effect were performed with this treatment duration.

Microbiology

Microbiological trials considered total viable counts (TVC) and listeria reduction achievable with a 15s steam treatment. Large salmon sections (approx ¼ fish each) were inoculated with listeria monocytogenes at 1 of 3 levels. Test samples were treated in the rig using the mesh drum turning device. Control samples remained untreated. Listeria and TVC levels were established for all samples. Unfortunately many results were below detectable levels so only general conclusions could be drawn from the study.

The listeria results showed 90% of treated samples and 30% untreated samples to be below detection limits. This suggests treatment had reduced listeria levels. Furthermore listeria presence was detected on 100% of untreated samples but 20% of treated samples had no detectable listeria.

TVC results showed a mean level of 6.28log10 on untreated samples and 4.60log10 on treated samples. This represents a mean TVC reduction of 1.68log10 due to steam treatment.

The evenness of the treatment over the product surface has been substantially improved using the tumbling mesh drum. Further microbiology is required at lower detection limits to ascertain true reductions and confirm steam decontamination effects.

Conclusions

This work has shown that a salmon section turning mechanism has been successfully constructed. This device is also suitable to treatment of other product shapes.

Reductions in listeria and total bacterial levels can be achieved with an atmosphere pressure steam treatment (100°C) for 15s.

Whilst surface change is apparent immediately after treatment, the salmon sections recover appearance during subsequent cold storage.

Further microbiological analysis is required to fully enumerate the efficacy of the process.

References

POST 2003. Food Poisoning. Postnote January 2003 Number 193. Parliamentary Office of Science and Technology (POST), 7 Millbank, London. SW1P 3JA.

Contacts

please contact us on +44 (0)1472 582400 or email us on frperc@grimsby.ac.uk