

Thermal imaging use for heat treatment qualification: the case of singeing

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Singeing is dedicated to improving the visual aspect and reducing surface bacterial contamination of pig carcasses. However more needs to be discovered about the variability of the surface temperatures reached after singeing within a production day and on the different parts of the carcasses. Thermal imaging is now widely developed. This study aimed at assessing if and how this technology could be used to study surface temperatures reached after singeing.

Materials and Methods

Thermal imaging acquisition

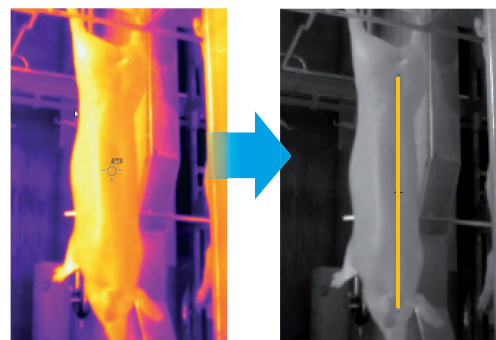
- Flir Camera E60
- **Standardized conditions of acquisition:** room temperature, hygrometry, emissivity (0,98) and reflected temperature were recorded in the camera settings.

Conversion to temperature data by means of the Flir Tool® and ImageJ software (Figure 1).

Three methods of data analysis were developed

- **Method by line profile:** a standard segment is applied along the back of each carcass.
- **Method by mouse over:** superposition of 20 carcass images to obtain an averaged matrix.
- **Method by mouse over and line profile:** A standard segment is applied on the averaged matrix.

Figure 1: image conversion



Result

Statistical comparison of the three methods on 20 carcasses

Mean, variance and distribution (Figure 2) are analyzed to assess which method is the most appropriate. The most simple and accurate of the three methods for our purposes is the line profile (Figure 3).

The same statistical analysis shows that a set of 5 (vs 20 or 10) carcasses were sufficient for the analysis of characteristics of heat treatment.

Figure 2: Mean, variance and distribution by method

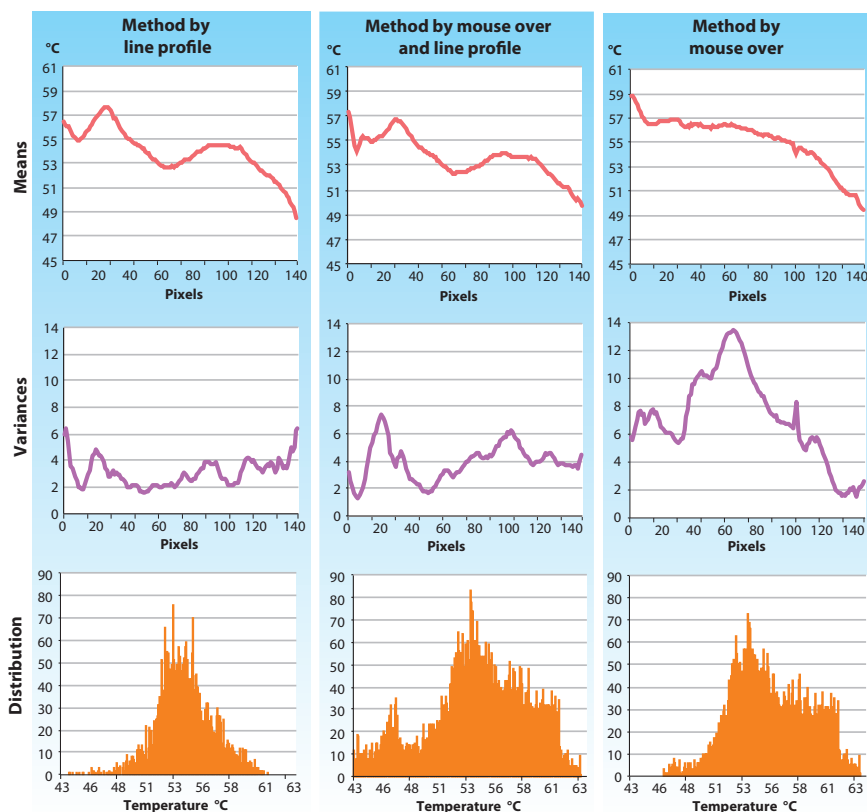
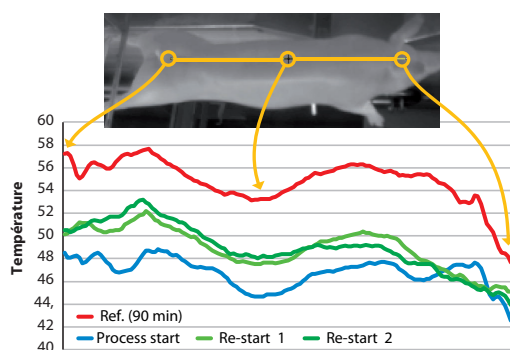


Figure 3: Mean temperatures (5 carcasses) observed in a slaughterhouse at different times



The reference temperature was the temperature of carcasses after 90 minutes of continuous process. This method confirmed **temperature differences on carcass surfaces** (the top part of the carcass is warmer than the bottom part within a range of 2-7°C) and within a production day; **the lowest temperatures were observed when the process started or re-started** (after breaks), on average 4°C.

Conclusions

With this pragmatic method, companies could have access to a measurement tool for characterizing, checking, optimizing and qualifying the efficiency of singeing. This tool can be used to characterize any thermic treatments in the meat industry: thermic treatment, refrigeration, freezing, thawing. Companies could define the most appropriate treatment regarding energy reduction, quality and food safety requirements.

