APPLICATION OF "SPECIFIC" SENSORS IN THE MEAT SECTOR

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INTRODUCTION

The anatomy of anima]s and the physical properties of meat are important factors determining the design of equipment for animal handling and meat processing.

In connection to this the need for fast and reliable instruments suitable for the acquisition of updated information on health aspects of animals - in this paper pigs - and on physical and chemical parameters of meat has stimulated the application of novel sensors.

Possibilities of several sensors for the meat sector, namely a **magnetic transponder** tag for the individual and reliable identification of livestock from birth to slaughter, the evaporimeter for the quantitative measurement of water evaporation and a surface wetness sensor, are discussed.

MAGNETIC TRANSPONDER TAG

For a day-to-day management of the fresh meat business it is important to gather and disseminate all relevant information on supply of pigs, weight, integrated quality assurance "from gate to plate", production planning, grading and logistics. The transponder, an automatic and error-free magnetic device for the identification of livestock from birth to slaughter, will be described.

The automatic and error-free transfer of information from the pig (piglet) to the carcass is being thoroughly discussed. In the Netherlands several **electronic** devices suitable for implantation are now being tested for:

- the method of reading the identification with the interrogation equipment;
- the recovery of the device;
- the costs in relation to the benefits;
- the combination of automated control with carcass classification; and
- fool-proof implantation methods.

A new system has now been added to the available electronic devices, viz. a tiny unit containing an electromagnetic coil and a micro-chip sealed in a glass envelope. The chip has been preprogrammed with a unique and unalterable code chosen from over 34 billion individual code numbers. When the transponder is activated by a low-frequency radio signal it transmits the code. The detection unit consists of a reader, a controller system and a number of transponders. In pigs the transponder can be implanted in the nose or in another place or made suitable as an ear-tag. Both possibilities are being tested now and have already yielded satisfying results. The reading can be done automatically or with a hand-scanner. The reader can be used in a simple "read only" mode or coupled to a computer, printer or modem to store or send out tag numbers.

EVAPORIMETER AND SURFACE WETNESS SENSOR

In pork handling and processing, specific sensors are needed for fast and reliable determination of some physical parameters. These parameters are the evaporation from the surface of meat and the relative wetness at the surface of meat after slaughtering and during cooling. The evaporation can be determined by measuring the water vapour transport from the meat surface with the evaporimeter (Paardekooper, 1987; Paardekooper et al., 1987), and the relative wetness can be measured with the surface wetness sensor (Paardekooper et al., 1987).

Operating principle of the evaporimeter.

The water vapour transport is determined by measuring the relative humidity and the temperature at two points situated at different distances from the surface. The evaporation rate is computed according to the law of diffusion. The measurements can only be performed at low air velocity.

The calibration is performed by using the headspace in closed vessels over saturated salt solutions of, for example, lithium chloride, magnesium nitrate and potassium sulphate.

Operating principle of the surface wetness sensor. Surface wetness is determined by measuring the electric conductivity of the surface. This surface can be considered as a liquid film. The electric conductivity of a liquid film is dependent on the thickness of the film (m) and the specific conductivity of the liquid (S/m).

The surface wetness sensor has seven strips of stainless steel situated in parallel which have to be pushed into the surface (the liquid film).

An electronic circuit indicates on a display the electric conductivity of the liquid film between the electrodes. Calibration is done by an automatic zero setting. With the "TEST" button and the calibration screw the maximum display reading (100%) can be adjusted.

Experiments

Experiments were carried out with bellies, hams and shoulders by measuring evaporation rate and surface wetness of lean meat, fat and rind at different room temperatures after slaughtering and deboning. Room temperature, relative humidity of the room and air velocity were controlled. Surface temperatures of the meat were also measured.

The first experiment with bellies at constant room temperature (2°C), relative humidity (75%) and air velocity (0.1 m/s) showed that there is condensation of moisture on bellies after cooling for about one day. The second experiment with bellies at varying room temperatures (O°C or 15°C) confirmed the condensation of moisture to the surface and reveals an increase of the surface wetness with increasing surface temperature.

Experiments with hams at constant room temperature (9°C), relative humidity (75%) and air velocity (0 m/s) and shoulders at constant room temperature (4°C), relative humidity (84%) and air velocity (0 m/s) showed that there are hardly any differences between the evaporation rates of meat, fat and rind.

The surface wetness of meat, fat and rind however strongly differ. The meat layer is wet at the start and dries slowly during the first few hours. The fat layer is also wet at the start and dries very quickly. The rind layer is constantly dry.

On the meat and the fat layers a relative dry film is formed during evaporation. This can be measured and can also be seen by the eye. After removal of this film a wet layer is formed again.

CONCLUSIONS

The experiments described confirm that evaporation rate and surface wetness can be measured. It is not possible to do this continuously because a film is formed. Film formation disturbs the continuous evaporation of water. At this moment the application is restricted to gather in situ information on evaporation behaviour of meat under practical circumstances.

The same conclusions can be drawn for the surface wetness sensor although there is a possibility to develop a method for measurement of conductivity of the layer beneath the relative dry film.

The magnetic transponder tag is being tested and has already yielded satisfying results.

REFERENCES

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