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DEVELOPMENT OF A METHOD FOR MEASURING LOCAL HEAT TRANSFER COEFFICIENTS ON CARCASS-SHAPED OBJECTS

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Abstract

The heat transfer coefficient is an important parameter for the calculation of chilling and freezing times of animal carcasses. Average heat transfer coefficients may be determined fairly simply by back-calculation from experimental temperature-time data or from energy balances. However, on highly irregular shapes such as animal carcasses the heat transfer coefficient is likely to vary with position. Local heat transfer coefficient measurements are much more difficult to perform, since the placement of a sensor may alter the rate of heat transfer significantly.

The development of a heat transfer coefficient sensor for carcass shaped objects was described previously (Harris et al. 1999). This sensor was designed for placement at various positions on fibreglass-models of beef and lamb carcasses (i.e. leg, loin, shoulder etc.), such that the contour of the carcass surface was not altered.

An experimental rig was set up with the aim of performing steady-state measurements of local heat transfer coefficients. The rig comprised a wind tunnel within an environmental chamber in which the carcass was hung. Controlled-temperature water was pumped through the carcass, in order to maintain the surface temperature of the carcass at a desired value. The local heat transfer coefficients could be measured as a function of air velocity, turbulence intensity, and sensor position. Since the temperature difference between the air stream and the carcass surface could be controlled, natural convection effects could also be examined. The results of these types of experiments would be useful for examining ways of maximising cooling rates and/or increasing the uniformity of heat transfer rates over the carcass surface.