Development of sensors for rapid on-line slaughterhouse detection of boar taint - an approach based on the analysis of VOC profiles

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Introduction: Boar taint is an unpleasant smell found in the meat of some uncastrated male pigs. This smell is due to the accumulation in the adipose tissue, along with other molecules, of skatole and androstenone (Garcia-Regueiro and Diaz 1989; Patterson 1968). This taint has, until now, often been prevented by surgical castration. However, due to animal welfare concerns, production of entire males as well as immunocastration were suggested as alternatives (Bonneau and Weiler 2019). Ensuring that the meat sold to consumers is untainted remains a priority for slaughterhouses. This is hence the driving factor of many researches into the development of new rapid boar taint detection methods (Burgeon et al. 2021).

Our research aims at developing a sensor-based method for the detection of boar taint. To ensure that these sensors correctly detect the taint, a thorough analysis of the volatile organic compounds (VOCs) found in the headspace of back fat must be performed first.

Materials and methods: Through an innovative VOC sampling technique combining both soldering iron, typically used for sensory evaluation in slaughterhouses, and conventional techniques for headspace sampling and analysis (TDU- and SPME-GC-MS), boar and sow fat are heated at high temperatures and VOC emission profiles can be obtained. A linear discriminant analysis (LDA) is then performed to determine whether tainted fat displays a characteristic VOC profile and if so, what molecules are responsible of this taint. To ensure that the trends observed through the LDA are correlated to the presence of the taint, headspace concentrations of the boar taint's major contributors are also analyzed and correlated to their fat content.

Results: The LDA allowed a net distinction in space of untainted and tainted boar fats and sow fats. Sow fats display positive values for both linear discriminant (LD) 1 and 2, while untainted boar fats display negative values for LD 1 and positive values for LD 2 and finally tainted boar fats display negative values for both LD 1 and 2. Positive correlation coefficients were established between headspace concentrations in indole and skatole and their content in adipose tissue (R2= 0.92 and 0.99 respectively), implying that the VOCs analyzed are representative of the actual taint.

Conclusion: Both specific sensors detecting indole and skatole as well non-specific sensors based on the detection of trends in the VOC profiles between the fat types could be developed.

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