Welfare and other aspects of controlled atmosphere stunning

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Summary

Controlled Atmosphere Stunning (CAS) systems have the potential to eliminate a number of welfare concerns associated with conventional electrical waterbath stunning, which are still used in the majority of poultry processing plants in the UK. Along with other bird welfare advantages, CAS systems allow birds to be killed without shackling or inverting them live and remove the possibility of birds receiving inadequate current levels that may not stun them sufficiently.

The killing of poultry with gas mixtures does not result in an immediate loss of consciousness, therefore it is important to ensure that the induction of unconsciousness does not cause distress to the birds. In addition to this, the type of gas used must be suitable for a commercial environment. The two major systems currently used within Europe are either a one- or two-phase system:

- The one-phase system can use a gas mixture of: either 30% CO₂ and 60% argon (or other inert gas) or 90% argon (or other inert gas) in atmospheric air
- The two-phase system is humidified in the first phase with 40% CO₂ and 30% O₂ while the second phase uses 70-80% CO₂ in air

There is current disagreement among researchers within the UK as to which gas mixture has the most welfare benefits when killing birds in a CAS system.

Introduction

This review focuses on the welfare issues associated with Controlled Atmosphere Stunning (CAS) systems used for killing poultry within processing plants. CAS systems within Europe have currently been fitted for the killing of broilers, end-of-lay hens, turkeys and ducks.

Before 1982 gas killing within UK processing plants was not considered possible due to line speeds. However, the Farm Animal Welfare Council (FAWC), an independent advisory body to the UK government, recommended that research should be considered regarding the practicality of the use of CO₂. Bristol University carried out extensive research into the most appropriate gases which could be used in a commercial environment (Raj et al 1990) (Raj et al 1992) (Raj and Gregory 1994) (Raj et al 1998). From this research a UK-based company, Anglia Autoflow, began producing commercially-available one-phase equipment in the UK in 1996.

Research was also being carried out by a number of universities and institutes in the Netherlands (Lambooij et al 1999), which helped Stork PMT develop their two-phase gas killing system which was first installed in 1996 at a new broiler processing plant in Belgium.

Gas systems available

One major difference between the two systems currently available is that one kills the birds in the containers, while the other has a tipping system which tips the birds out of the module and carries them loose by conveyor to the gas unit. The second major difference is the type of gas mixture used by the different systems.
Anglia Autoflow uses a single-phase process with:

- either 90% argon (or other inert gas) in atmospheric air
- or a maximum of 30% CO₂ and 60% argon (or other inert gas) in atmospheric air. These gas mixtures kill the birds by anoxia (lack of oxygen).

Stork PMT uses a two-phase system where:

- the first phase is humidified and uses 40% CO₂, 30% O₂ and is used to initially anaesthetize the birds; and
- the second phase is 70-80% CO₂ in air and has a two minute dwell time which irreversibly stuns the birds.

Gas characteristics

When considering fitting a CAS system, the decision needs to be made about which gas mixture you wish to use. In the Humane Slaughter Association's (HSA) opinion the characteristics of an ideal humane and efficient gas mixture include that it must:

- be non-aversive (causes no detectable signs of distress)
- induce loss of consciousness in birds as rapidly as possible
- be capable of killing birds within the system (in the UK)
- be reasonably cheap and safe to use in industrial conditions
- be relatively easy to contain within an open container
- have no side effects on meat quality

UK legislation

Slaughter or killing of poultry within the UK is governed by The Welfare of Animals (Slaughter or Killing) Regulations 1995 (WASK '95) (as amended). Along with other legal requirements for CAS systems, currently within the UK only two types of gas mixture can be used: argon, nitrogen or other inert gases in atmospheric air with a maximum of 2% oxygen by volume or any mixture of inert gases with carbon dioxide provided that the CO₂ does not exceed 30% by volume and the O₂ does not exceed 2%.

The gas mixtures that the UK currently allows were decided following research by Bristol University (Raj et al 1992) (Raj et al 1994). However, further research within the UK may cause legislation to be reconsidered.

Within the UK there are currently two schools of thought about whether the gas mixtures used in the two-phase system have welfare advantages over the gas mixtures used for the one-phase systems. The main issue of contention is whether loss of posture and wing flapping are signs of loss of conscious. These behaviours are seen when killing birds within all gas mixtures.

- Research group 1 believes that loss of posture, wing flapping and other convulsions are only seen in birds being killed by an anoxic gas mixture once the birds are unconscious. They also believe that birds have receptors which are highly sensitive to CO₂ and insensitive to anoxia therefore an anoxic gas mixture is a preferred option on welfare grounds.
- Research group 2 agrees that birds have receptors which are highly sensitive to CO₂. However, they also believe that loss of posture and convulsions are not a sign of loss of consciousness, therefore birds being killed by anoxia may be subject to these uncontrollable movements while still conscious (McKeegan et al 2004) (McIntyre et al 2004). This may be classified as a welfare concern. The argument therefore for using the two-phase system is that wing flapping and convulsions were not seen until birds were measured (by electrical impulses from the brain) to be fully unconscious (McKeegan et al 2004).

This research had not been completed at the time this review was produced and research group 1, who carried out the initial research in the UK, still disagree with current results from research group 2 and feel that further research is needed in this area.
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Welfare advantages of CAS systems
The use of all CAS systems for poultry killing has a number of welfare and commercial advantages in comparison with conventional electrical waterbath stunning. These include:

- leg pain is avoided because birds are not inverted and shackled live
- risk of injury through handling is avoided as birds are killed within their crates
- the possibility of painful pre-stun shocks is eliminated
- the possibility of birds receiving inadequate current levels is eliminated
- the killing of birds using gas mixtures is associated with a lower incidence of broken bones compared to electrical waterbath stunning, which can improve carcase quality

Welfare disadvantages of CAS systems
Some disadvantages of gas killing as far as bird welfare is concerned include:

- there are more moving parts in the system compared with electrical waterbath stunners therefore more breakdowns are a possibility. This may have welfare implications if birds have to be held within the lairage for long periods of time while the breakdown is repaired
- gas systems take up more space than electrical waterbath equipment and may cause vital lairage space to be lost. This will limit the number of birds that can be placed in the lairage and therefore the number of birds which can be held in a sheltered and ventilated area while awaiting slaughter

Conclusions
All gas systems have the potential to eliminate a number of welfare concerns associated with electrical waterbath stunning in large scale slaughterhouses. However, it is not a system which can currently be used in smaller processing plants or on-farm sites due to the size and expense of equipment. The HSA therefore feels it is essential to ensure that further research and development on both affordable CAS systems and alternative stunning/killing systems continues for use in smaller processing plants or on-farm sites.

References


