AMMONIA EMISSIONS FROM POULTRY PRODUCTION

Ammonia production is an inevitable consequence of poultry farming, being released by the breakdown of nitrogen-containing compounds such as manures. When deposited onto land, ammonia can acidify soils and fresh water and 'over-fertilise' habitats through eutrophication. It has a particular effect on some lower plants such as lichens and habitats including them can be permanently damaged. Combined with other pollutants, ammonia is capable of causing cardiovascular and respiratory diseases in humans.

In the UK, agriculture accounts for 87% of all ammonia emissions (2020) and in Wales the percentage is reported to be similar. In 2019, the poultry sector alone was the source of 14% of the UK ammonia total, mainly due to land-spreading of manures and emissions associated with poultry housing.

The UK is committed to a 16% reduction in ammonia emissions by 2030, compared to levels in 2005 and therefore a lot of attention focuses on the agriculture sector. In Wales, the Clean Air Plan[1] provides a pathway for improving air quality, whilst a Welsh Government Code of Good Agricultural Practice[2] provides guidance on reducing ammonia losses from agriculture in Wales.

Emissions from poultry manures

With manures being an important source of ammonia emissions, the key messages for the poultry sector include the benefits of containing manures in covered stores on impermeable surfaces. If field heaps are used, the surface area should be as small as possible (e.g. 'A' shaped) to reduce emissions. A key issue is that wet poultry manure and litter can lead to higher emissions of ammonia and so the priority is to keep them as dry as possible, both during housing and afterwards. This can also increase its value per tonne as a fertiliser and reduce haulage costs and odour risks.

Manure applications should follow normal good practice in order to reduce ammonia emissions. This should include avoiding spreading during frost, snow and heavy rain and taking account of soil conditions at the time. For liquid organic manures, 'precision spreading' methods are preferable to surface broadcasting (splash plate) systems.

Emissions from poultry housing

The use of indirect heating and heat recovery systems and effective ventilation (e.g. to optimise in-house environment and prevent condensation) can all increase litter dry matter content and so reduce ammonia emissions. In addition, emphasis should be placed on the feeds used to ensure that the nutrient supply is matched to flock requirements and stage of production. Improvements in feed utilisation and feed conversion ratio (FCR) provide both environmental and financial benefits. In free range egg production, the move to multi-tier systems (rather than single tier) is consistent with reducing ammonia, because of belt clean-out and frequent manure removal.

Cronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig: Ewrop yn Buddsoddi mewn Ardaloedd Gwledig
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In recent years, some producers have invested in ammonia scrubbing systems for new poultry houses, often in order to obtain planning consent and to attain an environmental permit. These systems typically pass exhaust air from the house through a liquid to capture the ammonia, so that the air released to the atmosphere has a lower ammonia content. Reports have indicated that ammonia emissions reductions of around 80% are possible using scrubbing systems, but the capital and operating costs are high.

The use of additive products supplied via the drinking water, the feed or directly onto the litter has been suggested as an additional means of reducing ammonia emissions from poultry houses.

European Innovation Partnership (EIP) Wales – ammonia reduction from broilers

Between 2020 and 2021 two broiler farmers in Wales took part in an EIP Wales project to investigate whether the use of products currently used mainly to improve gut health and flock performance may also have an impact on ammonia emissions. Working with a specialist poultry ventilation company, a vet and an environmental modeller, they established farm-based trials in two similar broiler houses on each site. One house was used for product testing and the other as a control. They used the following three products, each for one complete broiler flock cycle on each farm:

- **Biocomplex** from Ekogea, a product derived from marine algae.
- **Herban**, a product based on oreganum essential oil.
- **Searup** from Olmix, a product also developed from marine sources.

The order of use was different on the two farms. Given the limitations of the study design, the aim was not to evaluate the three products individually but rather to compare results for the use of all three with the control houses on both farms. The work was undertaken between September 2020 and the summer of 2021, with some delays incurred due to avian influenza and Covid visiting restrictions.

The key measurements and assessments made in the test and control houses were as follows:

- Ammonia concentrations and air flow rates, to enable the ammonia emission factor to be calculated in each case.
- Litter quality, pododermatitis and hock condition assessments at 15, 25 and 35 days by the vet, who also arranged for a litter sample to be taken for analysis at 35 days.
- Normal performance parameters e.g. liveweight for age, FCR, rejects and mortality.

The key findings are set out below.

- Ammonia emission factors (kg per bird place per year) were very similar in both control and test houses, with a slightly lower average being found in the control houses. This is likely to be due to chance, but the generally high values found (compared to standard ammonia emission factors) may be because of the methodologies used. The veterinary visits did not identify unusually high levels of ammonia in the houses.
- The use of the products appeared to result in a slight improvement in litter condition, due to an increase in dry matter content and slightly lower levels of total nitrogen and ammonium nitrogen in the litter. It is not possible to say whether these reflect real differences or whether they were due to chance.
- Performance parameters generally appeared to be un-affected and sometimes, the better performance was in the control houses. Again, this is likely to be due to chance. There

appeared to be a small overall difference in FCR in favour of the test houses. If real, this was calculated to represent an average saving of some 49 grams of feed per bird over the growing period for these two farms. The net value of this could be calculated from the current feed cost, less the cost of the product itself.

Whilst the study did not provide evidence that the three products had an overall impact upon ammonia emissions, it highlighted some potential difficulties in calculating ammonia emission factors. The use of products could provide some marginal gains and help to combat stresses and disease challenges. Both farmers involved now have ammonia monitoring systems in place in one house and plan to continue to use these for their own additional studies. These may incorporate the use of alternative application methods including in-house fogging, feed-based use and litter treatments. The study has raised awareness and highlighted the importance of ammonia emissions in the broiler sector.

Despite the results from this study other practices and methods already exist to reduce ammonia emissions including matching diet formulation to bird requirements throughout the cycle, managing litter quality and correctly storing and applying used litter to land. These currently offer farmers with some solutions to reducing ammonia emissions from broiler production however further research will be required to investigate other supplementary and promising approaches.

[1]https://gov.wales/sites/default/files/publications/2020-08/clean-air-plan-for-wales-healthy-air-healthy-wales.pdf

[2]https://gov.wales/sites/default/files/publications/2019-04/code-of-good-agricultural-practice-guidance-on-reducing-ammonia-emissions.pdf