Fate of pathogens in a simulated bioreduction system for livestock carcasses

Ceri Gwyther

c.l.gwyther@bangor.ac.uk
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Introduction
What is bioreduction?
Aims and hypothesis
Methods
Results and discussion
Conclusions
Introduction

- Animal By-Products Regulations (2002) prohibited the burning and burial of fallen (dead) stock on farms
- Collection vehicles pose a probable biosecurity risk
- Bioreduction could provide a biosecure method of fallen stock storage prior to ultimate disposal

What is Bioreduction?

Bioreduction is the **aerobic degradation** of animal by-products in a partially sealed vessel containing **water**, where the contents are **heated and aerated**.
What is Bioreduction?

It should **not** be mistaken for anaerobic digestion (*biodigestion*)
An incision into the abdomen releases the microorganisms.

What is Bioreduction?
Aims and Objectives

Primary Aim: To provide evidence to the European Food Safety Authority on the biosecurity of bioreduction

Hypothesis: The conditions within the bioreduction vessels will not encourage the growth of pathogenic microorganisms
Methods: Assessing Biosecurity

2. www.student.britannica.com (15/08/09)
Gwyther et al., 2011. Fate of pathogens in a simulated bioreduction system for livestock carcasses. Submitted for peer review
Methods

Gwyther et al., 2011. Fate of pathogens in a simulated bioreduction system for livestock carcasses. Submitted for peer review.
Carcass constituents

- Lamb Chops
- Sodium Alginate
- Liver
- Blood

82%

Results: Liquor

- **Salmonella spp.** (log_{10} CFU ml^{-1})
- **E. faecalis** (log_{10} CFU ml^{-1})

- ● = Inoculated mini bioreduction vessels
- ▲ = Control mini bioreduction vessels
- - - - = 5 log reduction

Graphs show the reduction in bacterial populations over time (Days).
Results: Liquor

- **E. coli O157** (Log$_{10}$ CFU ml$^{-1}$)
  - **●** = Inoculated mini bioreduction vessels
  - **▲** = Control mini bioreduction vessels
  - **---** = 5 log reduction

- **Campylobacter spp.** (log$_{10}$ CFU ml$^{-1}$)
  - **●** = Inoculated mini bioreduction vessels
  - **▲** = Control mini bioreduction vessels
  - **---** = 5 log reduction
### Results: Air

<table>
<thead>
<tr>
<th>Day</th>
<th>Salmonella spp.</th>
<th>E. faecalis</th>
<th>E. coli O157</th>
<th>Campylobacter spp.</th>
<th>Total viable counts*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>31.9 ± 21.2</td>
<td>15.6 ± 10.9</td>
<td>ND</td>
<td>ND</td>
<td>15.7 ± 6.3</td>
</tr>
<tr>
<td>24</td>
<td>ND</td>
<td>4.4 ± 4.4</td>
<td>ND</td>
<td>ND</td>
<td>147.8 ± 126.7</td>
</tr>
<tr>
<td>57</td>
<td>ND</td>
<td>1.1 ± 1.1</td>
<td>ND</td>
<td>ND</td>
<td>2925.6 ± 2917.2</td>
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<tr>
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<td>ND</td>
<td>ND</td>
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<td>41.3 ± 31.3</td>
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ND = None detected

<1000 CFU m³ – uncontaminated air

1000-3000 CFU m³ – moderately contaminated air

>3000 CFU m³ – strongly contaminated air

Results: Air

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*Salmonella* spp. not detected after Day 0
## Results: Air

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*E. faecalis* showed a decrease in numbers over time.
• Bioreduction is efficient at removing pathogens in both liquor and air
• Shows potential as a novel method of storing dead livestock
• Findings are being validated under field conditions
Acknowledgements

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Prof. Peter Golyshin

Bangor University
BPEX
Any Questions?

Ceri Gwyther
c.l.gwyther@bangor.ac.uk