EFFICACY OF DIFFERENT DISINFECTANTS FOR THE CONTROL OF DISEASES

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Summary

A number of different chemicals frequently used for disinfection in the poultry industry were compared to each other, using contact plates on hard surfaces. Of all the products tested, the newly developed boosted Didecyldimethylammonium chloride (DDAC) was found to be the most effective product. The efficacy of this boosted DDAC for the control of specific diseases under experimental or field conditions was also evaluated. The non-toxic boosted DDAC was tested as a means of limiting the impact of Infectious Coryza in experimentally infected chickens. It was demonstrated that the use of this disinfectant resulted in less severe clinical signs in chickens challenged with each of the different serovars of *Haemophilus paragallinarum*. It has been demonstrated that the use of this boosted DDAC on a commercial poultry farm prevented the spread of Newcastle Disease during a naturally occurring outbreak.

I. INTRODUCTION

Disease remains a limiting factor in poultry production in many parts of the world. Two of the more serious diseases are Newcastle Disease (ND) caused by Newcastle Disease virus and Infectious Coryza, caused by *H. paragallinarum*. Control of infectious diseases has mainly been through the use of antibiotics to control bacterial diseases and vaccines for both viral diseases and some bacterial diseases. There are, however, increasing problems with both of these approaches. There is concern about antibiotic resistance and many countries are investigating limiting the use of antibiotics in animals and animal feeds. There is also growing evidence that the selection of more virulent vaccines is selecting for more virulent field isolates of viral diseases. Consequently there is increasing emphasis on the use of disinfectants for the control of infectious diseases.

A novel formulation of a boosted DDAC based product has been developed and extensively tested, both *in vitro* and *in vivo* under experimental conditions and commercial conditions. Part of this development was the establishment and testing of a continuous disinfection program (Bragg & Plumbstead, 2003). This consisted of disinfection at clean out, continuous disinfection of the drinking water and daily spraying or misting with the boosted DDAC product. It was demonstrated that this program significantly reduced the incidence of disease in the experimental group of birds and consistently improved feed conversion ratios in the treated birds.

II. METHODS

a) Evaluation of different products on hard surfaces

Efficacy of different products used for disinfection in poultry houses was done in experimental poultry pens in which the floors were artificially inoculated with a combination of *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Each pen was inoculated with the same volume of the combined bacterial solution. Once the floor had dried, washing and disinfection of the pens commenced, with each product being used according to

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label instructions One pen was used for each product under test. A total of 10 contact plates were collected from each of the pens before any treatment was undertaken.

These plates were incubated at 37°C overnight and all colonies on plates with less than 300 colonies were counted. If there were more than 300 colonies on a plate, it was recorded as “Too many to count” or TMTC and a number of 300 was used for calculation purposes. Washing of the pens was performed with either detergent soap or diluted disinfectant. Once the floor was dry, another 10 contact plates were collected from each pen and were processed according to the methods described above after which each pen was disinfected with the different products. Once the floors were dry another 10 contact plates were collected from each pen and processed according to the methods described above.

b) **Experimental infection of chickens with Infectious Coryza**

Layers, which had been vaccinated with an inactivated IC vaccine, were obtained from a commercial poultry farm at 18 weeks of age. Another group of unvaccinated birds were obtained from the same source at 11 weeks of age, before vaccination against IC had taken place. Half of the vaccinated and unvaccinated birds was continuously treated with the Boosted DDAC product in the drinking water at 100 ppm dilution and were sprayed daily with a 1% dilution of the same product. All remaining birds from each challenge group were left as untreated controls. When the birds were 25 weeks old, each group (of 10 birds per group) was challenged with the different serovars of *H. paragallinarum*, according to the challenge model established by Bragg (2002). The clinical signs in each of the groups of birds were scored daily for 20 days according to the methods described by Bragg (2002) and a disease profile and mean disease score for each group was obtained. A comparison of the clinical disease in the treated and untreated groups of birds was made from the mean disease scores.

c) **Newcastle Disease challenge on a commercial farm.**

A large-scale experiment was undertaken to evaluate the continuous disinfection program on a commercial poultry farm. Three identical poultry houses, each housing 5000 broilers, were used in this experiment. One house was a control house which received only pre-placement disinfection with a gluteraldehyde based product. The two experimental houses were disinfected with the boosted DDAC product before placement of the birds. The drinking water in these houses was continually treated with a 100 ppm dilution of the boosted DDAC product. The air in these two houses was also disinfected with a 1% dilution of the same product on a daily basis. Daily mortalities and other production parameter readings were recorded daily. During this experiment, a severe outbreak of ND occurred on the farm and treatments were terminated on day 20.

**III. RESULTS**

a) **Evaluation of different products on hard surfaces**

The bacterial counts on the contact plates collected from the different pens can be seen in Table 1. These results are the mean bacterial counts from all 10 plates collected from each pen.
Table 1. Mean numbers of bacterial colonies on 10 contact plates collected from each of the different pens before treatment, after washing and after disinfection with different products. (Standard error in brackets)

<table>
<thead>
<tr>
<th>Active of products used</th>
<th>Mean count before treatment</th>
<th>Methods of washing</th>
<th>Mean count after washing (Standard error)</th>
<th>Methods of disinfection (Standard error)</th>
<th>Mean count after disinfection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boosted DDAC</td>
<td>300*</td>
<td>100 ppm of product</td>
<td>26.0 (2.1)</td>
<td>1:100</td>
<td>11.2 (1.0)</td>
</tr>
<tr>
<td>Peroxygen Acid</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:100</td>
<td>25.8 (2.2)</td>
</tr>
<tr>
<td>20% Glut*</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:200</td>
<td>80.8 (5.2)</td>
</tr>
<tr>
<td>12.5 % Glut.</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:128</td>
<td>172.3 (32.2)</td>
</tr>
<tr>
<td>Iodine based product</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:100</td>
<td>132.4 (7.1)</td>
</tr>
<tr>
<td>Mixture of Glut and QAC</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:200</td>
<td>56.8 (6.1)</td>
</tr>
<tr>
<td>Phenol bases products</td>
<td>300</td>
<td>1:1000 detergent soap</td>
<td>300</td>
<td>1:100</td>
<td>95.0 (7.7)</td>
</tr>
</tbody>
</table>

* Plates marked as TMTC.
# Glutaraldehyde

b) Experimental infection of chickens with Infectious Coryza

Table 2. Mean disease scores (calculated from the mean daily disease score over 20 days) obtained when vaccinated and unvaccinated layers were challenged with the different serovars of H. paragallinarum and treated with the full continuous disinfection program, or not treated. (Highest recorded daily disease score in brackets). Mean disease scores of 0.00 represent no clinical signs at all, with a mean disease score of 6 being the highest possible score.

<table>
<thead>
<tr>
<th>Serovar used for challenge</th>
<th>Vaccinated birds</th>
<th>Unvaccinated birds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treated *</td>
<td>Untreated</td>
</tr>
<tr>
<td>A-1</td>
<td>0.03 (0.2)</td>
<td>0.12 (0.6)</td>
</tr>
<tr>
<td>B-1</td>
<td>0.01 (0.2)</td>
<td>0.02 (0.2)</td>
</tr>
<tr>
<td>C-2</td>
<td>0.15 (2.0)</td>
<td>0.87 (2.4)</td>
</tr>
<tr>
<td>C-3</td>
<td>0.30 (0.8)</td>
<td>0.43 (1.2)</td>
</tr>
</tbody>
</table>

* Treated with full continuous disinfection program which consisted of continuous drinking water treatment with 100 ppm of the boosted DDAC product and daily spraying with a 1% dilution of the same product from placement date.

c) Newcastle Disease challenge on a commercial farm.

The objective of this project was the evaluation of the continuous disinfection program on a commercial farm under normal circumstances. The outbreak of Newcastle disease on this farm was not expected. Other houses on the site showed clinical signs of ND on Day 15 of this experiment. Graphical representations of the daily mortalities from Day 15 are presented in the Fig 1.
Fig 1. Graphic representation of the total number of mortalities in the three experimental houses after the first clinical signs of ND was recorded on the farm. House 1 and 6 were test houses while House 9 was the control house.

IV. DISCUSSION

a) Evaluation of different products on hard surfaces

It can be seen from Table 1 that the lowest number of bacteria surviving after disinfection was found in a newly developed product containing a boosted DDAC as active ingredient. This product was consistently found to be the most effective in all subsequent similar experiments performed in different countries around the world.

b) Experimental infection of chickens with Infectious Coryza

It can be seen from Table 2 that the mean disease score was highest in the birds challenged with serovar C-3. In all cases, the mean disease score for the treated birds was lower than that of the untreated birds. It was also found (data not shown) that the duration of infection was significantly reduced in the treated group of birds. The results of this experiment demonstrates that the full continuous disinfection program with the boosted DDAC product reduced the impact of Infectious Coryza caused by all four serovars in vaccinated and unvaccinated birds.

c) Newcastle Disease challenge on a commercial farm.

It can be concluded from this data that a full continuous disinfection program with a novel boosted DDAC prevented the spread of Newcastle disease in the two experimental houses on a commercial farm. Clinical signs of Newcastle Disease was seen in these two houses four days after the full continuous disinfection program was stopped.

REFERENCES