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Evaluation of Disinfectants Activity Used in Poultry under Field Condition

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Abstract: The appropriate use of disinfectants in poultry farm is an important and major component of a successful bio-security program. The objective of the study was to determine the most effective of all the disinfectant in reducing microbial load, the effect of time on disinfectant and the effect of organic waste on disinfectant. Salmonella organism place in a broth and the disinfectant reconstituted with distill water in 1:10 dilution was introduced. The opacity tube was used as a standard for clearing. *Salmonella gallinarum* was used to represent pathogenic gram negative bacteria commonly found in poultry farms. The first study is to determine the most effective of all the disinfectant in reducing the microbial load. The disinfectant used are phenol, gluteraldehyde and quaternary ammonium compound. The second study deals with the effect of time (0, 2, 4, 8 and 12 weeks) on the efficacy of disinfectants diluted to working concentrations. The third study determined the effect of organic waste on the concentration of freshly prepared disinfectants and 12 weeks old disinfectantsin the presence of organic waste. The result of the first study showed that the most effective of all the disinfectants under consideration is quaternary ammonium compound. While the result of the second study show that time affected the efficacy of disinfectant as freshly reconstituted disinfectant gave better efficacy than 12 weeks old disinfectant, against Salmonella organism. The result of the third study show that organic waste reduces the efficacy of disinfectant ($p \leq 0.05$) remarkably.

Key words: Poultry, salmonella, disinfectants, prevention, humans, insects

INTRODUCTION

The principle of disease prevention and control within the poultry are based on flock management, bio-security, preventive vaccination and sanitation (Zander *et al*., 1997). Bio-security includes protocols and procedures taken to prevent pathogens from infecting a farm and to prevent the transmission of disease by humans, insects and wild birds. Foot baths and wash stations are also used to reduce pathogen transmission (Davison *et al*., 1999). A sanitation program should include the correct application of disinfectants, proper use of equipment and an efficient monitoring system (Spielholz, 1998).

Studies have shown variations in the degree of efficiency of commercial disinfectants used in poultry facilities. Resistance to commercially available disinfectants involve bacteria that infect newly hatched chicks via the yolk sac (Willinghan *et al*., 1996). Microbial resistance can be either a natural property of an organism or acquired by mutation. Gram negative bacteria tend to be more resistant than gram position organisms such as staphylococcus (McDonnell and Russell, 2001). It is estimated that 1.4 million humans contract Salmonella at a cost $3 billion annually (Eckman, 1994).

Disinfectants acts on microorganism at several target site resulting in membrane disruption, metabolic inhibition and lysis of the cell (Denyer and Stewart, 1998). The disinfectants used in this study are: quaterinary ammonium compound, gluteraldehyde and phenol. The aim is to evaluate the most effective of the disinfectant in reducing microbial load, the effect of time and organic waste on their effectiveness in reducing microbial load.

MATERIALS AND METHODS

Bacterial organism: Organism used was *Salmonella gallinarum* being a representative of 36 salmonella organisms isolated form poultry farm of Michael Okpara University of Agriculture, Umudike.

Disinfectants: Three commercial disinfectants were diluted to the manufacturer's recommended working concentrations with distilled water. The quaternary

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ammonium compound (Duo-cide) (Rx Veterinary products, Grapevine, Tx), consist of 10% alkyl dimethyl ammonium chloride and used as 1:100 dillution in sterile water. The phonolic compound (Germpo); (Biosentry Inc. Stone mountain, GA) contains 7. 92% O. phenylphenol, 9.97% O-benzyl-p-chlorophenol and 1.95% P-tertiary-amyphenol used as 1:100 in sterile distill water. A ready to use 2.5% (Glutacide) was the third disinfectants.

The effectiveness of the disinfectants on the isolate was determined by the technique of modified dilution testaccording to the Robison *et al.* (1998). Stainless steel ring carries were inoculated by soaking for 15 min in a 48 h disinfectant test broth (Difco) of test bacteria in the presence of an organic load (5% horse serum, v/v). The carries were removed with a hooked inoculating needle and allowed to dry for 40 min at 37°C.

The experiment were conducted using 1:10 dilution to determine the most effective of the disinfectant under consideration in reducing the microbial load, effect of time and organic waste on disinfectant activity.

In each experiment, 0.5 mL of 10^8 cfu mL^{-1} of the test organism was added to separate 15 mL of each of the diluted disinfectants.

Each tube with the content was shake for 5 sec and incubated for 24 h at room temperature. A 1: 10 dilution of the disinfectants was disinfectants sample.

The dilution according to the manufacturer instruction was 1:100 quaternary ammonium compound while the final working dilution was 1:1000. The dilution of phenol was 1:100 while the final working dilution was 1:1000. About 2.5% gluteraldehyde ready use has a final working concentration of 1:400. Brown's opacity tubes served as standard for measuring the efficacy of the disinfectants.

Secondly is the effect of disinfectants (old and freshly prepared) on Salmonella organisms at various time. Thirdly, the effect of organic waste on disinfectant activity was also studied. Chicken litter served as organic waste comprising of wood shaving and feaces. About 10 g of organic waste was dried and ground into powdery form, mixed with 20 mL of distil water and filtered with muslin cloth before use. The organic waste was added to the test tube at concentrations 0, 0.5 and 1.0%. Data in the experiment conducted were analyzed using (ANOVA).

RESULTS AND DISCUSSION

The results shows that quaternary ammonium compound have more efficacy than the others disinfectants (Fig. 1). It reduced Salmonella load significantly. The result shows that fresh prepared quaternary ammonium compound and gluteraldehyde were more effective against Salmonella than 12 weeks old disinfectant (Fig. 2). There is a significant difference ($p<0.05$). This could possibly due to oxidative activity during the storage period. The result shows the organic waste reduce the efficiency of the disinfectants, the organic waste are feaces and litter (Fig. 3).

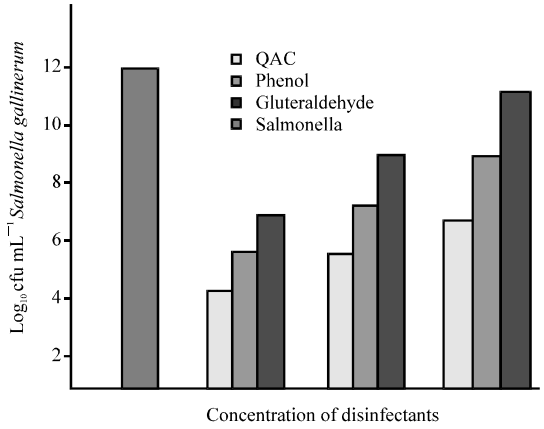

Fig. 1: Effect of disinfectants on salmonella at various concentration of 0.5, 0.8 and 1.0 mL

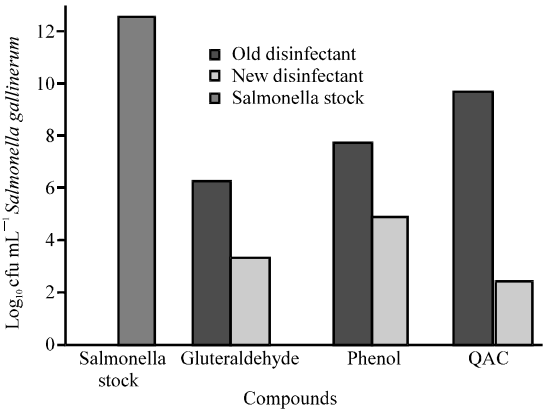

Fig. 2: Effect of disinfectants against salmonella using freshly prepared old solution

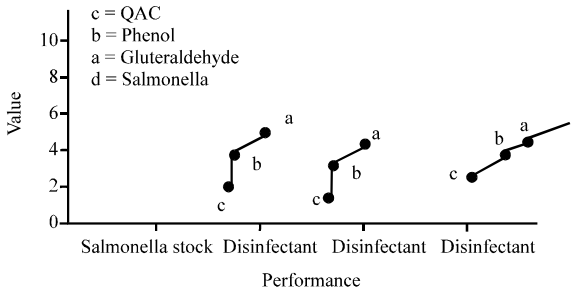

Fig. 3: Effect of Organic waste (Ow) on disinfectant at room temperature against Salmonella

The goal of use of disinfectants it to reduce the risk of microbial infection in poultry farms. A great number of disinfectants are used in poultry farms. Quaternary ammonium compound, phenol and gluteraldhyde were used in this investigation. Once disinfectants are diluted, it is advisable to make use of it immediately in order to get a maximum result in terms of efficacy than when used after several weeks of storage as demonstrated in this study. The interference of organic matter on disinfectant efficacy was also seen to have negative impart. This was in agreement with the findings of North and Bell (1990). Most microbes needed increased contact time with the disinfectant before they could be rendered harmless.

In addition, disinfectant preparations and concentrations need to be carefully scrutinized as was demonstrated in effect of disinfectants on Salmonella at various concentrations. This finding was in agreement with Ruano *et al.* (2001) target were important factors to be considered when using disinfectants. Similar findings was reported by Prince *et al.* (1991). Organic waste provides a barrier that shields microorganism form having direct contact with the disinfectants, this findings was also reported by Dvorak (2005).

CONCLUSION

The quaternary ammonium compound was more effective in reducing microbial load than the other disinfectants. Freshly prepared disinfectants were more effective in reducing microbial load than old disinfectants. A reduction in effectiveness of the disinfectant was significantly high due to the presence of organic waste which hindered performance. Bio-security and an effective disinfectant program remains the preferred way by which pathogen can be reduced.

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