Bactericidal Efficacy of Quaternary Ammonium Compound on Carriers with Food Additive Grade Calcium Hydroxide against Salmonella Infantis and Escherichia coli

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Abstract : Cleaning and disinfection are key components of routine biosecurity in livestock farming and food processing industry. The usage of suitable disinfectants and their proper concentration are important factors for a successful biosecurity program. Disinfectants have optimum bactericidal and virucidal efficacies at temperatures above 20°C, but very few studies on application and effectiveness of disinfectants at low temperatures have been done. In the present study, the bactericidal efficacies of food additive grade calcium hydroxide (FdCa(OH)), quaternary ammonium compound (QAC) and their mixture, were investigated under different conditions, including time, organic materials (fetal bovine serum: FBS) and temperature, either in suspension or in carrier test. Salmonella Infantis and Escherichia coli, which are the most prevalent gram negative bacteria in commercial poultry housing and food processing industry, were used in this study. Initially, we evaluated these disinfectants at two different temperatures (4°C and room temperature (RT) (25°C ± 2°C)) and 7 contact times (0, 5 and 30 sec, 1, 3, 20 and 30 min), with suspension tests either in the presence or absence of 5% FBS. Secondly, we investigated the bactericidal efficacies of these disinfectants by carrier tests (rubber, stainless steel and plastic) at same temperatures and 4 contact times (30 sec, 1, 3, and 5 min). Then, we compared the bactericidal efficacies of each disinfectant within their mixtures, as follows. When QAC was diluted with redistilled water (dW2) at 1: 500 (QACx500) to obtain the final concentration of didecyl-dimethylammonium chloride (DDAC) of 200 ppm, it could inactivate Salmonella Infantis within 5 sec at RT either with or without 5% FBS in suspension test; however, at 4°C it required 30 min in presence of 5% FBS. FdCa(OH)2 solution alone could inactivate bacteria within 1 min both at RT and 4°C even with 5% FBS. While FdCa(OH)2 powder was added at final concentration 0.2% to QACx500 (Mix500), the mixture could inactivate bacteria within 30 sec and 5 sec, respectively, with or without 5% FBS at 4°C. The findings from the suspension test indicated that low temperature inhibited the bactericidal efficacy of QAC, whereas Mix500 was effective, regardless of short contact time and low temperature, even with 5% FBS. In the carrier test, single disinfectant required bit more time to inactivate bacteria on rubber and plastic surfaces than on stainless steel. However, Mix500 could inactivate S. Infantis on rubber, stainless steel and plastic surfaces within 30 sec and 1 min, respectively, at RT and 4°C; but, for E. coli, it required only 30 sec at both temperatures. So, synergistic effects were observed on different carriers at both temperatures. For a successful enhancement of biosecurity during winter, the disinfectants should be selected that could have short contact times with optimum efficacy against the target pathogen. The present study findings help farmers to make proper strategies for application of disinfectants in their livestock farming and food processing industry.

Keywords : carrier, food additive grade calcium hydroxide ($FdCa(OH)_2$), quaternary ammonium compound, synergistic effects
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