

# The Effect of Common Detergents on The Causative Virus of Newcastle Disease

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**Abstract.** Newcastle disease is one of the most severe poultry viral diseases due to its ability to cause massive economic losses and about 100% mortality in chickens. Many disinfectants have been used on farms to prevent the disease. However, the use of existing commercial disinfectants nowadays is considered expensive. The purpose of this research is to evaluate the effectiveness of commercial detergents as disinfectants in inactivating the virus. Two commercial detergents containing Alkylbenzene sulfonates, which can dissolve the viral envelope lipid, were tested. More so, three concentrations of 1%, 1.5%, and 2% were used, with contact times of 5, 10, and 15 minutes, respectively. The commercial disinfectant Virkon was employed as a control. The results showed that commercial detergents had the same results compared to control by being able to inactivate the virus with a concentration of 1%, 1.5%, and 2% in 5, 10, and 15 minutes, respectively. This shows that simple and inexpensive household detergents can be used as an alternative for disinfection.

## 1 Introduction

Indonesian poultry farmers continue to face challenges, most notably a contagious chicken disease that causes reduced productivity and mortality. Newcastle disease (ND) [1–3], a highly infectious disease with a high mortality and morbidity rate, is one of the most important and widespread diseases in poultry. Avian paramyxovirus type APMV-1 from the genus *Avulavirus*, family *Paramyxoviridae*, causes the disease [2], [4], [5]. The virus has an envelope, and the single-stranded RNA genome comprises six genes that encode structural proteins, as well as two envelope proteins, the (HN) protein, which is haemagglutinin (H) protein-neuraminidase (N) protein and fusion (F) protein [2], [6].

Newcastle disease causes various clinical symptoms in infected birds, including nervous signs, respiratory disturbances, and enteritis [7]. Clinical symptoms might vary depending on several factors, such as strain, immunity, route of infection, and bird species [2], [7]. Furthermore, this disease has been reported to infect around 236 bird species [8], and its severity produced by each strain of NDV varies significantly [1], [2], [9]. The NDV strains are as follows: the Velogenic, a highly virulent NDV that causes severe nervous and respiratory signs with a 100% mortality rate; the Mesogenic, which causes death only 10%

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of the time, decreased productivity, and respiratory difficulty; and the Lentogenic, which causes mild clinical symptoms with almost no death reports [2], [9]. The ND virus is transmitted directly from infected to healthy chicken through faeces and nasal secretion [7]. The incubation period for NDV ranges from 2 to 15 days, depending on the strain, immunological status, and environmental circumstances [1].

Aside from vaccination, one of the disease prevention strategies is the implementation of biosecurity using proper disinfection [1], [9]. The infection will spread to the polluted surroundings, equipment, and worker without a suitable technique [7]. Commercial disinfectants are commonly used in agricultural disinfection; however, for smallholder farmers, such as backyard farmers, commercial disinfection is too expensive. The purpose of this study is to evaluate the effect of commercial household detergents on the ND virus and their potential for use in farm decontamination.

## **2 Materials and Methods**

### **2.1 Embryonated chicken eggs**

The viral stock was propagated and titrated using specific-pathogen-free (SPF) embryonated chicken eggs, whereas the virus was isolated using specific-antibody-negative (SAN) embryonated chicken eggs.

### **2.2 Virus**

The Newcastle disease virus employed in this study was obtained from the Indonesian Research Center of Veterinary Science in Bogor. It was propagated in 9-11 day old specific pathogen-free (SPF) embryonated chicken eggs using the OIE protocol [4]. In summary, SPF Eggs had 0.1 mL of NDV virus inoculated into their allantoic fluid, with the infected embryonated chicken eggs incubated in a 37°C incubator for four days and monitored daily. The allantoic fluid was extracted and stored for further testing.

### **2.3 Effect of common detergents and disinfectant treatment**

In this study, two commercial household detergents and the disinfectant, Virkon, were used as the control models at concentrations of 1%, 1.5%, and 2%. Subsequently, about 0.5 ml of each concentration were mixed with allantoic fluid containing 105 EID<sub>50</sub>/ml ND virus in a tube at an equal volume incubated at 37°C for 5, 10, and 15 minutes. More so, about 0.2 ml of the treated virus was inoculated into the allantoic fluid of embryo chicken eggs aged 9-11 days. As a control, virus combination with PBSA and detergent solutions without the virus was inoculated into SAN eggs. All inoculated eggs were incubated at 37°C for five days and observed daily, with the dead eggs recorded.

### **2.4 Evaluation of treatment**

All inoculated eggs, whether dead or alive, were stored at 40 ° C before being tested. In addition, allantoic fluid was collected and tested using a haemagglutination (HA) test following the procedure from OIE [4], with all changes in embryos also recorded.

### 3 Result and Discussion

Newcastle disease has a significant impact on farmers because of the morbidity and death of the birds, which can reach 100% [9]. Infected chickens can excrete the virus, which can then spread to poultry equipment, manure, drinking water, air, and surroundings [7]. These contaminated items have the potential to spread the disease to susceptible birds as well as neighbouring farms. Furthermore, commercial disinfectants are commonly used in chicken farms for disinfection. Several viruses, including avian influenza [10–12], West Nile virus [13], and human influenza A/H1N1 [14–15], have been evaluated with common laundry detergents, with varying results. Table 1 shows the effect of commercial household detergents on embryo viability after being inoculated with the treated virus and a control. The results show that no egg died after being incorporated with the treated virus after 5, 10, and 15 minutes, whereas all eggs inoculated with the ND virus died. This report suggests that both common detergents and a disinfectant (Virkon) prevented the virus from causing embryonic death effectively. The fact that no eggs died after being inoculated with detergent and disinfectant without viruses shows that all disinfectants were not harmful to the embryo at concentrations of 1, 1.5, and 2%.

**Table 1.** Effect of commercial household detergents and Virkon on the viability of the embryo

Treatment	Concentration	Embryonic death after Exposure Time (minute)		
		5	10	15
Detergent A +virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent B + virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Virkon + virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent A	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent B	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Virkon	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
ND virus		+++	+++	+++

Note: + + + indicates the embryonic death of inoculated eggs with the treated Newcastle disease virus showed haemagglutination (HA) positive; --- indicates no embryonic death of inoculated eggs.

The effectiveness of household detergents in inactivating the ND virus was presented in Table 2. Both detergents A and B at a concentration of 1%, 1.5%, and 2% were able to inactivate the ND virus in all exposure times for 5, 10, and 15 minutes, respectively, indicating no positivity in the HA test. Similarly, Virkon, which is used as a control for commercial disinfectant also showed no positivity in all concentrations and exposure time.

This report indicates the potential use of common detergents for alternative disinfectants for decontamination of poultry equipment and other materials. Smallholder poultry farmers and commoners can use these detergents for cleaning their chicken's houses or other birds' cages. The positivity found in allantoic fluids from virus inoculated eggs shows that the virus without treatment is still viable and causes embryonic death and hemagglutinating activity. This finding is consistent with the previous study reporting that the detergents can inactivate the avian influenza virus at a concentration of 0.3% for 10 minutes, and 0.6, 0.9, 1.8, and 3.6% for 5 minutes [16].

**Table 2.** Effect of commercial household detergents and Virkon on the viability of ND virus

Treatment	Concentration	HA test after Exposure Time (minutes)		
		5	10	15
Detergent A +virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent B + virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Virkon + virus	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent A	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Detergent B	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
Virkon	1%	---	---	---
	1.5%	---	---	---
	2%	---	---	---
ND virus		+++	+++	+++

Note: + + + indicates the allantoic fluids (AF) from inoculated eggs with the treated Newcastle disease virus showed haemagglutination (HA) positive; --- indicates AF from inoculated eggs with HA negative

Commercial detergents are widely used for cleaning and are considered effective against viruses due to their surfactant property, which affects the lipid component of virus particles [11]. Commercial detergents A and B contain aldehyde oxidizing agents, which can inactivate the ND virus. Both commercial detergents used in this investigation were effective in destroying the virus at concentrations of 1%, 1.5%, and 2% with contact times of 5, 10, and 15 minutes, respectively, which is similar to the efficacy of Virkon solution (commercial disinfectant) to inactivate ND virus.

## 4 Conclusion

Common detergents tested in this study were able to inactivate the ND virus at 1%, 1.5%, and 2% concentrations after a contact time of 5, 10, and 15 minutes, with the same results as Virkon, a commercial disinfectant. According to this study, commercial household detergents can clean and disinfect poultry equipment and chicken houses following proper application. However, further studies are needed to assess its antiviral activity in organic materials such as manure and soil.

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