ICA

EFFECTIVE DISINFECTION OF HARD SURFACES IN THE PIG INDUSTRY WITH

Virukill®

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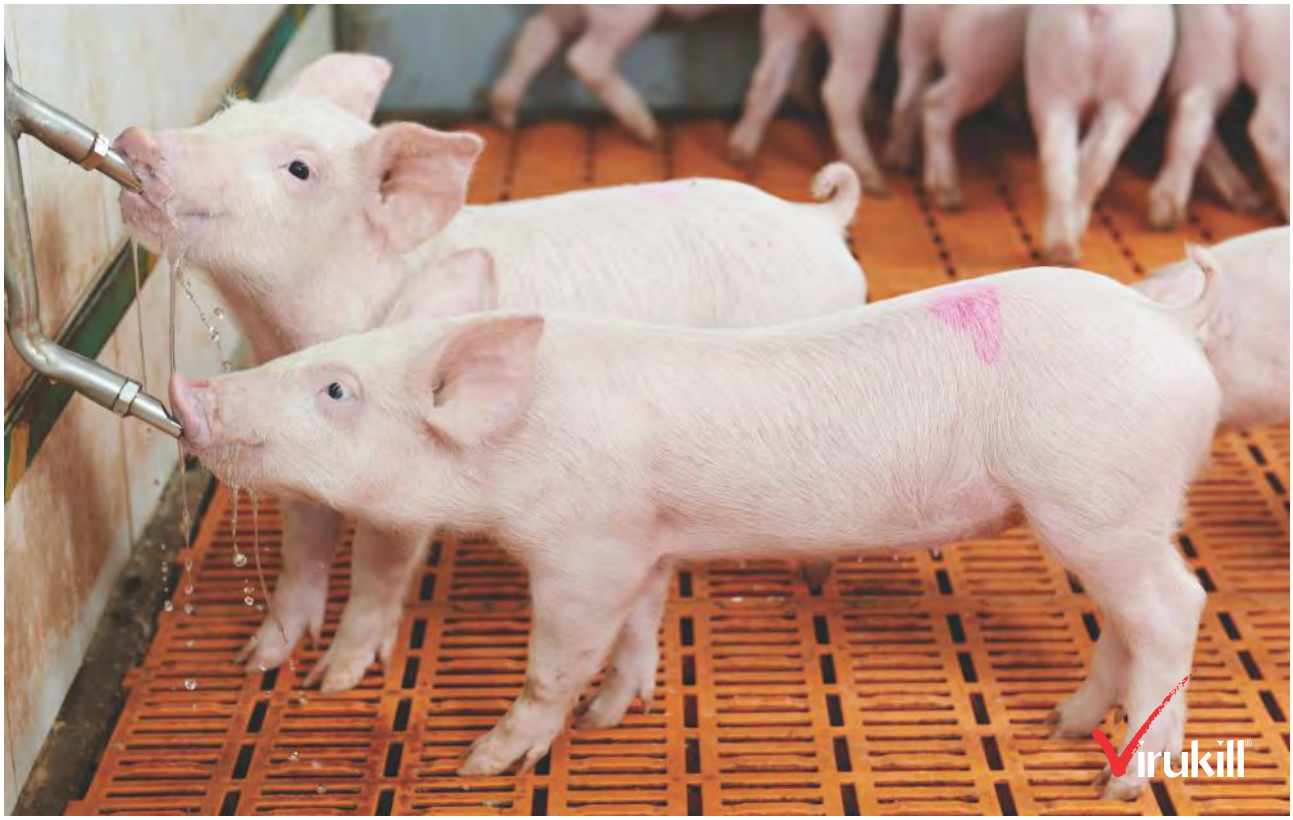
Disinfection is a critical, but often overlooked tool in effective disease management!



THE IMPORTANCE OF EFFECTIVE DISINFECTION AND BIOSECURITY

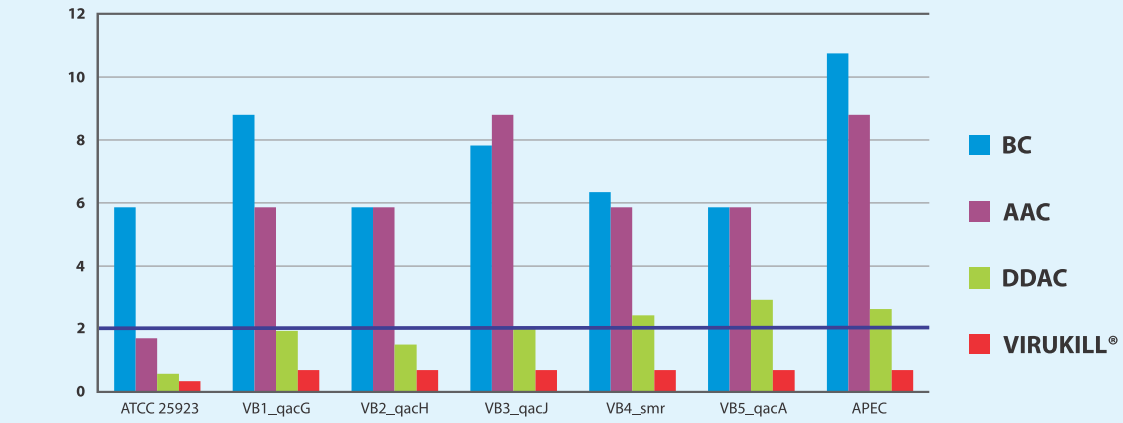
There are ever increasing problems with disease control in veterinary and human medicine. This is mainly due to the development of antibiotic resistant strains of bacteria. Every effort must be made to ensure the careful and prudent use of antibiotics to prevent those which are still effective from developing resistance. The use of a good quality disinfectant, like ***Virukill®***, can greatly assist in the fight against infectious diseases caused by, not only bacteria, but viruses and fungi as well. ***Virukill®*** is your complete tool for all of your disinfection and biosecurity needs in any animal production facility.

WHAT IS VIRUKILL®?

Virukill® is a novel and unique disinfectant based on the active ingredient didecyldimethylammonium chloride (DDAC), which, if used correctly will have a significant impact on disease management in a post antibiotic era.

There are many other DDAC based products on the market. ***So what makes Virukill® different?*** The patented formulation of ***Virukill®*** has increased the efficacy to at least 5 times more than other generic DDAC based products. This can be seen when looking at the minimum inhibitory concentrations (MIC) of different generations of QAC based disinfectants in the following graph.

These DDAC based products are not the same as Virukill®



Minimal inhibitory concentration (MIC) for strains tested against the QACs with a 16 h contact time benzalkonium chloride (BC), alkylbenzyldimethyl-ammonium chloride (AAC), didecyldimethyl-ammonium chloride (DDAC) and Virukill®.

WHY IS VIRUKILL® NOVEL?

Virukill® is a patented novel formulation of the best of the DDAC based disinfectants. The modification has taken the strong point of QAC disinfectants (**safety**) and have made ***Virukill***® substantially less toxic than any other product with the same level of efficacy.

The modification of ***Virukill***® has taken the weak point of QAC based disinfectants (poor efficacy against viruses) and made ***Virukill***® highly effective against viruses. (Hence the name ***Virukill***®). ***Virukill***® has been extensively tested and been found to be effective against all major pathogens including naked viruses (including Parvovirus and Reovirus), enveloped viruses (including Influenza virus), Gram positive bacteria (including *Staphylococcus*, *Streptococcus*, *Clostridium*), gram negative bacteria (including *E. coli*, *Salomonella*, *Pasteurella*) and fungi (including *Aspergillus*). A full list of pathogens which ***Virukill***® has been tested against is available.

MAIN ADVANTAGES OF VIRUKILL®

- ***Virukill***® is highly effective against all forms of microorganisms including viruses, bacteria, Mycoplasma, fungi and yeast.
- ***Virukill***® is safe to use at the recommended doses.
- ***Virukill***® is highly stable including the diluted product prepared for use. Stability tests of diluted product were stopped after 6 months as there was no decrease in efficacy over this period.
- ***Virukill***® is considered non-corrosive on all surfaces including various metals, plastics and rubber.
- ***Virukill***® is not pH dependent. Works in a wide range of pH's, so no need to first adjust the pH of the water before adding ***Virukill***®.
- All efficacy testing against all forms of pathogens have been done under conditions of high organic load and hard water condition. ***Virukill***® has passed all of these efficacy tests, even under these very harsh experimental condition.
- ***Virukill***® works in a wide range of temperature. It has even been tested at boiling point and it remains effective.

DISINFECTION AGAINST IMPORTANT PIG PATHOGENS WITH VIRUKILL®

PED, (Porcine epidemic diarrhea virus) is a coronavirus. This is an enveloped virus, thus generally quite easy to inactivate with disinfectants. ***Virukill®*** has been tested and found to be effective against coronaviruses. This virus is mainly spread through feces and infected surfaces such as boots and vehicles. As there is currently no vaccine available your only option is good Biosecurity. ***Virukill® is your best option***.

PRRS (Porcine reproductive and respiratory syndrome virus) is an Arterivirus. This is also an enveloped virus. ***Virukill®*** has not been specifically tested against an Arterivirus, but has been tested and found to be highly effective against all enveloped viruses which were tested. This virus is most frequently spread by close contact between pigs and through feces and urine. Good biosecurity is your best option for the management of this disease.

Influenza virus. ***Virukill®*** has been tested and was found to be highly effective against influenza virus. Influenza virus is also an enveloped virus and is thus not difficult to inactivate outside of the body. There are vaccines available, but this virus has a tendency to change often. The main route of transmission of this virus is airborne, but close contact has also been suggested as a methods to transmit the virus. Good biosecurity will be a great help in the control of swine flu. ***Virukill® is your best option***.

Porcine circovirus (PCV) is a naked virus. This means that the virus is very difficult to inactivate outside of the host. Very few disinfectants will be able to effectively inactivate PCV. ***Virukill®*** has been tested against cirocviruses and it has been found to be effective. Good Biosecurity and an all in all out system of farming with good pre-placement disinfection appears to be the best control option. ***Virukill® is your best option***.

Porcine Parvovirus (PPV). PPV is generally widespread in most pig farms and is generally associated with poor fertility. It is believed that the reason for the very wide spread occurrence of this virus is because it is very difficult to remove from infected sites. It is a naked virus and highly resistant. Parvoviruses are regarded as the most difficult of all viruses to inactivate and very few disinfectants can effectively inactivate this family of viruses. ***Virukill® has been specifically tested and has been found to effectively inactivate parvovirus at 2% dilution***.

Bacterial diseases of pigs. There are a number of bacterial diseases of pigs. Most of these are routinely treated with antibiotics. In this era of increased resistance to antibiotics and the ever increasing pressure to reduce the use of antibiotics in animal production, alternatives to antibiotics need to be found. ***Virukill®*** is one such alternative. ***Virukill®*** has been tested against a wide range of bacterial species including gram negative bacteria, Gram positive bacteria and *Mycoplasma* species. ***Virukill®*** has been found to be highly effective against all bacterial strains tested. At the recommended levels of ***Virukill®*** needed to kill the important viruses and particularly the naked viruses, all of the important bacterial pathogens will be inactivated. The MIC levels for bacteria are substantially lower than that of the viruses. ***Virukill® is your best option***.

RECOMMENDED DISINFECTION PROTOCOLS WITH VIRUKILL®

Step 1: Removal of all organic material

This is a very important step. Remove as much of the debris and organic material as possible. All disinfectants are inactivated by organic material. This step is the same as the normal procedures.

Step 2: Dry cleaning of the pens – to remove as much dust as possible

This step involves sweeping the area to be disinfected out to remove as much dust as possible.

Step 3: Wash the pens with a 0.2% *Virukill*® solution (200 ml per 100 L) at a rate of 2 L solution per m^2.

This is where Virukill® is novel and unique. Changing to the Virukill® program will have a dramatic beneficial effect on the disinfection process.

In many **normal disinfection programs**, the areas are washed with large volumes of water and detergent to remove as much of the organic material as possible. However, washing with water does nothing to the bacterial and viral pathogens in the area, apart from moving them to areas where they are difficult to get to, like cracks or corners. The surfactant activity of ***Virukill***® means that no detergents are needed. **For the *Virukill*® application**, replace the water used for washing with a 0.2% ***Virukill***® solution in water.

HOW DOES THIS WORK?

Virukill® is highly effective against bacteria. Very low levels of ***Virukill®*** already kills many of the bacteria found in the pens. This can be seen in Figure 1.

Washing of the pens is an essential step in any effective disinfection program. Washing with a dilute ***Virukill®*** solution will perform the same function as washing with water – i.e. removal of visible dirt. The washing with the 0.2% ***Virukill®*** (200 ml ***Virukill®*** in 100 litres of water) solution can be done making use of the same equipment currently used on the farm – i.e. high pressure sprayers. The surfactant in ***Virukill®*** will do the same function as the detergent in the normal preplacement disinfection program.

If most of the bacteria can be removed during the washing stage – the full force of the final disinfection stage can be focussed on inactivation of viruses especially the very difficult to kill naked viruses and other serious pathogens

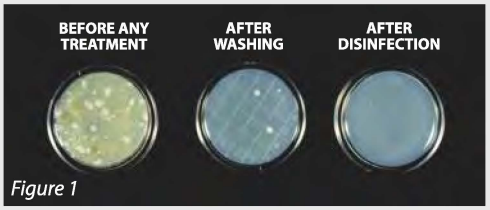


Figure 1

Step 4: Final preplacement disinfection

Disinfect all hard surfaces with a 1% solution of ***Virukill®*** (10 ml ***Virukill®*** per 1 L of water). In cases where parvovirus infection have been found, disinfect with a 2% solution of ***Virukill®*** (20 ml ***Virukill®*** per 1 L of water) ***Virukill®*** has been tested against a wide range of pathogens including naked and enveloped viruses, Gram positive and Gram negative bacteria as well as fungi.

The normal application rate is around 600 ml of the 1% ***Virukill®*** solution per m^2. The area being disinfected should remain wet for at least 20 minutes.

The most important factor influencing the efficacy of a disinfectant is contact time (how long the disinfectant has to work). In order to kill the very difficult to kill naked viruses (the most difficult of the viruses to kill) a contact time of 20 minutes with a 1% solution is needed. If you notice that the disinfectant applied to the pens is drying too quickly, increase the volume which is applied to the pens. Increase the contact time.

Step 5: Monitor disinfestation process

Monitoring of the disinfection process is always a good idea, but you must understand the limitations of these tests. In the monitoring process, you are looking at how effectively you have killed bacteria. In many animal production industries, the killing of viruses is your main concern. It is not possible to effectively and cheaply monitor the efficacy of the disinfection program against viruses.

Step 6: Disinfectant all equipment– including the water system

The drink water system in all pig production facilities should be regularly disinfected with a 1% ***Virukill®*** solution (10 ml ***Virukill®*** in 1 L of water). NB – the pigs must not drink water with 1% ***Virukill®*** in. After disinfection properly rinse drink water system to remove ***Virukill®*** residues.

Step 7: Make use of footbaths

The use of footbaths is essential for good biosecurity, provided they are used correctly. All disinfectants are inactivated by organic material. So when the disinfectant in the footbath looks dirty – it is no longer working. Replace the disinfectant in the footbath regularly. Make use of a 1% ***Virukill®*** solution (10 ml ***Virukill®*** in 1 L of water).

ICA INTERNATIONAL CHEMICALS

Virukill® (Poly Dimethyl Ammonium Chloride 120g/ℓ)
Reg. No: G2838 (Act 36 of 1947)

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DESINFECCIÓN EFECTIVA DE SUPERFICIES EN LA INDUSTRIA PORCINA CON

Virukill®

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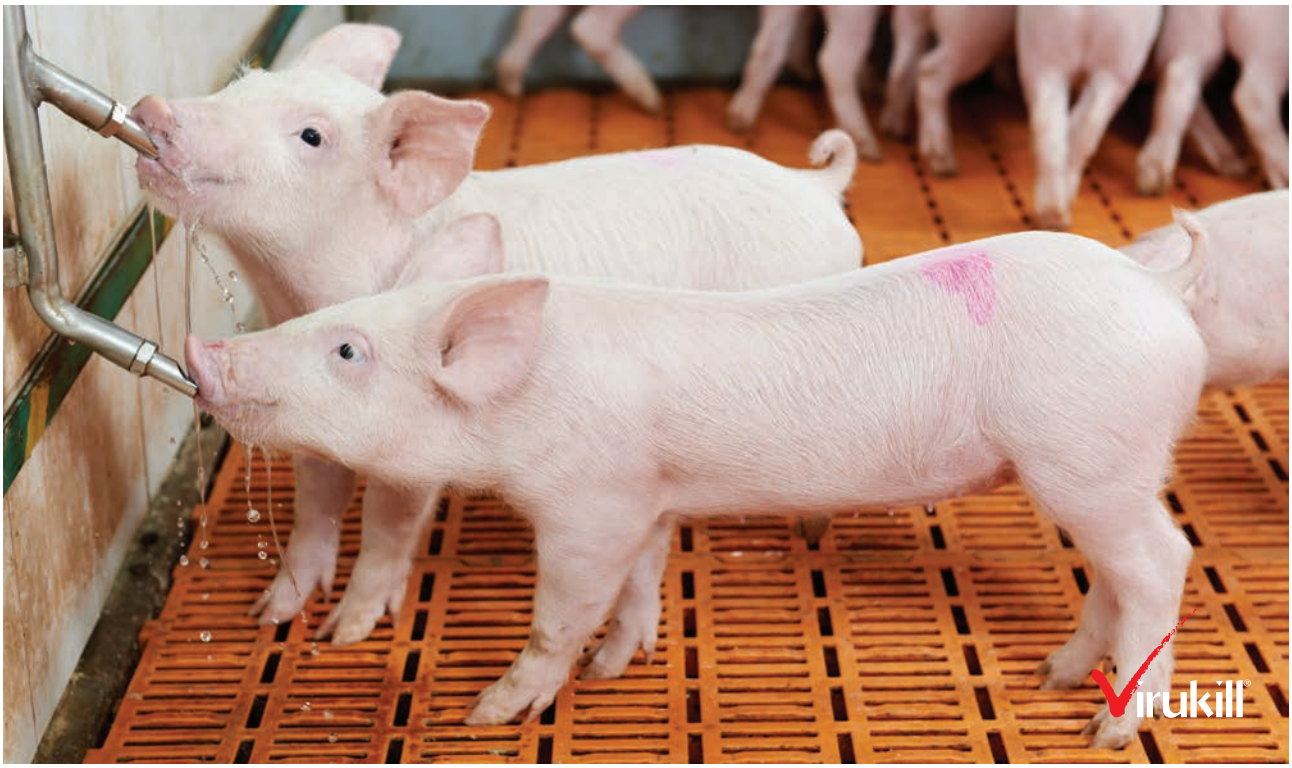
La desinfección es una herramienta crítica en el manejo efectivo de enfermedades, pero que algunas veces es pasada por alto!!



LA IMPORTANCIA DE UNA DESINFECCIÓN EFECTIVA Y BIOSEGURIDAD

Hay problemas cada vez mayores en el control de enfermedades en medicina veterinaria y humana. Esto es debido principalmente al desarrollo de bacterias resistentes a antibióticos. Debe hacerse todo esfuerzo posible para garantizar el uso cuidadoso y prudente de los antibióticos y así evitar que aquellos que aún son efectivos, desarrollen resistencia.

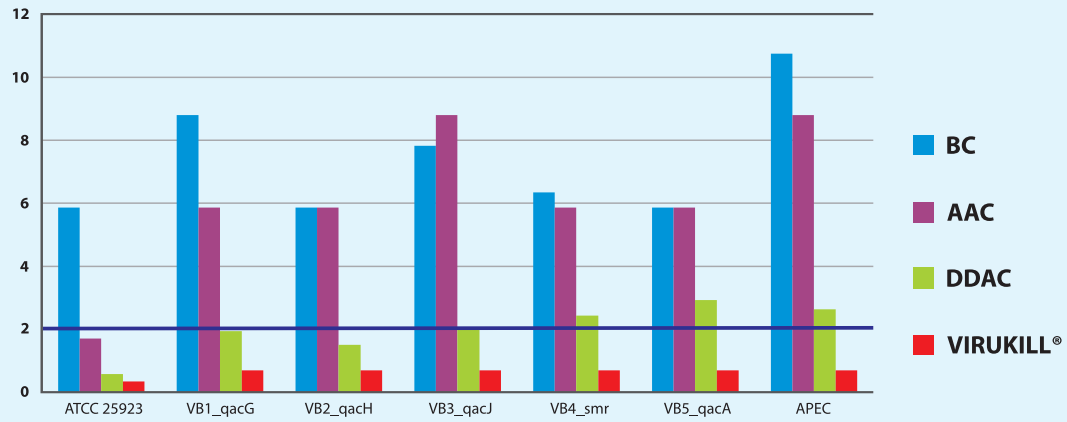
El uso de desinfectantes de buena calidad, como **Virukill®,** puede contribuir de gran manera en la lucha contra enfermedades infecciosas causadas, no solo por bacterias, pero también las causadas por virus y hongos. **Virukill®** es su herramienta mas completa para todas sus necesidades de desinfección y bioseguridad en cualquier instalación de producción animal.

¿QUE ES VIRUKILL®?

VIRUKILL® es un desinfectante único y novedoso cuyo ingrediente activo es cloruro de didecildimetilammonio (DDAC, por sus siglas en inglés), el cual si es usado correctamente, tendrá un impacto significativo en el manejo de enfermedades en la era post-antibiótica.

Hay muchos otros desinfectantes a base de DDAC en el mercado. Entonces, ¿que hace a **VIRUKILL®** diferente? La fórmula patentada de **VIRUKILL®** ha incrementado la eficacia al menos 5 veces más que otros productos basados en DDAC. Esto se puede evidenciar cuando se observan las concentraciones inhibitorias mínimas (MIC por sus siglas en ingles) de diferentes generaciones de desinfectantes basados en amonios cuaternarios (QACs por sus siglas en inglés) mostrados en el siguiente gráfico

Estos desinfectantes cuyo compuesto activo es DDAC, no son lo mismo que Virukill®



Concentracion inhibitors (MIC) para cepas evaluadas contra QAC can un tiempo de contacto de 16hr Benzalkonium chloride (BC), alkylbenzyldimethyl-ammonium chloride (AAC), didecyldimethyl-ammonium chloride (DDAC) and Virukill®.

¿PORQUE VIRUKILL® ES NOVEDOSO?

Virukill® es una nueva formulación patentada de los mejores desinfectantes basados en DDAC. LA modificación ha tomado el punto fuerte de los desinfectantes basados en amonios cuaternarios (QACs por sus siglas en inglés) (La seguridad), y ha hecho a **Virukill®** substancialmente menos tóxico que cualquier otro producto con el mismo nivel de eficacia.

LA modificación de **Virukill®** ha tomado el punto débil de los desinfectantes basados en amonios cuaternarios (QACs por sus siglas en inglés) (Pobre eficacia contra virus), y ha hecho a **Virukill®** altamente eficaz contra los virus. (Razón por la cual el nombre de **Virukill®**). **Virukill®** ha sido probado extensamente y ha demostrado su eficacia contra los patógenos mas importantes incluyendo los virus desnudos (incluyendo *Parvovirus* y *Reovirus*), virus envueltos (incluyendo el virus de la *Influenza*), bacterias Gram positivas (incluyendo *Staphilococcus, Streptococcus, Clostridium*), bacterias Gram negativas (incluyendo *E. coli, Salmonella, Pasteurella*) y hongos (incluyendo *Aspergillus*). Está disponible una lista completa de patógenos, contra los cuales se ha probado el **Virukill®**.

PRINCIPALES VENTAJAS DE VIRUKILL®

- **Virukill®** es altamente efectivo contra todo tipo de microorganismos incluyendo virus, bacterias, Micoplasma, hongos y levaduras
- **Virukill®** es seguro de utilizar en las dosis recomendadas
- **Virukill®** es altamente estable incluyendo el producto diluido y preparado para usar. Evaluaciones de estabilidad del producto diluido se detuvieron pasados 6 meses, ya que no disminuía su eficacia pasado este tiempo.
- **Virukill®** es considerado no corrosivo en todas las superficies incluyendo varios metales, plásticos y cauchos.
- **Virukill®** no es pH dependiente. Trabaja en un amplio rango de pHs, de manera que no hace falta ajustar el pH del agua antes de añadir el **Virukill®**
- Todas las pruebas de eficacia contra todas las formas de patógenos han sido hechas bajo condiciones de altas cargas de materia orgánica y aguas duras. **Virukill®** ha pasado todas estas pruebas de eficacia, inclusive bajo estas duras condiciones experimentales.
- **Virukill®** trabaja en un amplio rango de temperatura. Ha sido evaluado inclusive a punto de ebullición y sigue siendo efectivo.

Virukill®

LA MEJOR OPCIÓN

DESINFECCION CONTRA LOS PATOGENOS PORCINOS MÁS IMPORTANTES

PED, (virus de la Diarrea Epidémica Porcina) es un coronavirus. Este es un virus envuelto, relativamente fácil de inactivar con desinfectantes. **Virukill®** ha sido evaluado y se determinó que es efectivo contra los coronavirus. Este virus es diseminado principalmente a través de las heces e infecta superficies como botas y vehículos. Debido que actualmente no hay una vacuna disponible, su única opción es una buena bioseguridad. **Virukill®** es su mejor opción.

PRRS (virus del Síndrome Respiratorio y Reproductivo Porcino) es un Arterivirus. Este también es un virus envuelto. **Virukill®** no ha sido probado específicamente contra un Arterivirus, pero ha sido evaluado contra virus envueltos y se ha comprobado que es altamente efectivo contra los virus envueltos que han sido testiados. Este virus es diseminado mayormente por contacto cercano entre cerdos y a través de heces y orina. Una buena bioseguridad es su mejor opción para el manejo de esta enfermedad.

Virus de la Influenza. Virukill® ha sido evaluado y se determinó que es altamente efectivo contra el virus de la Influenza. El virus de la Influenza es también un virus envuelto, razón por la cual no es difícil inactivar cuando se encuentra fuera del huésped. Existen vacunas disponibles, pero este virus tiene la tendencia de cambiar frecuentemente. La principal ruta de transmisión de este virus es a través del aire, pero el contacto cercano ha sido también sugerido como método de transmisión del virus. Una buena bioseguridad será de gran ayuda en el control de la gripe porcina, **Virukill®** es su mejor opción.

Circovirus Porcino (PCV) es un virus desnudo. Esto significa que el virus es muy difícil de inactivar fuera del huésped. Muy pocos desinfectantes serán capaces de inactivar efectivamente el PCV**. Virukill®** ha sido probado contra Circovirus y ha demostrado ser efectivo. Una buena bioseguridad y sistemas de "todo dentro - todo fuera" en granjas, con buena desinfección pre-encasetamiento, parecen ser la mejor opción de control. **Virukill®** es su mejor opción.

Parvovirus Porcino (PPV). PPV en general está ampliamente diseminado en la mayoría de las granjas porcinas y esta generalmente asociada a pobre fertilidad. Se cree que la razón de la amplia diseminación del virus es debido a que es muy difícil de remover de los sitios infectados. Es un virus desnudo altamente resistente. Parvovirus es considerado como el virus mas difícil de inactivar y muy pocos desinfectantes son capaces de inactivar efectivamente esta familia de virus. **Virukill®** ha sido probado específicamente y ha demostrado que inactiva efectivamente el parvovirus a una dilución del 2%.

Enfermedades bacterianas en cerdos. Hay una serie de enfermedades bacterianas de los cerdos. La mayoría de estas son tratadas rutinariamente con antibióticos. En esta era de incremento de resistencia a los antibióticos y la presión cada vez mayor para reducir el uso de los mismos en producción animal, es necesario encontrar alternativas a los antibióticos. **Virukill®** es una de esas alternativas. **Virukill®** ha sido probado contra un amplio rango de cepas bacterianas incluyendo bacterias Gram negativas, bacterias Gram positivas y micoplasmas**. Virukill®** ha demostrado ser altamente efectivo contra todas las cepas de bacterias probadas. El nivel recomendado de **Virukill®** necesario para inactivar los virus importantes y particularmente los virus desnudos, todas las bacterias patógenas importantes serán inactivadas. Los niveles de concentración inhibitoria mínima para bacterias son substancialmente más bajas que los de los virus. **Virukill®** es su mejor opción.

PROTOCOLOS DE DESINFECCIÓN RECOMENDADOS CON VIRUKILL®

Paso 1: Remoción de todo el material orgánico

Este es un paso muy importante. Remueva tanto como sea posible el material orgánico. Todos los desinfectantes son inactivados por materia orgánica. Este paso es igual al procedimiento normal.

Paso 2: Limpieza en seco de los corrales para remover tanto polvo y suciedad como sea posible

Este paso involucra el barrido del área a desinfectar para remover la suciedad, tanto como sea posible.

Paso 3: Lave el corral con una solución de Virukill® al 0,2% (200 mL de Virukill® en 100 L de agua) a un rendimiento de 2 L de solución por cada metro cuadrado

Aquí es donde Virukill® es novedoso y único. Cambiando al programa de Virukill® tendrá un efecto beneficioso en el proceso de desinfección

En muchos programas de desinfección normal, las áreas son lavadas con grandes cantidades de agua y detergente para remover tanta materia orgánica como sea posible. Sin embargo, el lavado con agua no le hace nada a las bacterias y virus en el área, más allá de moverlas a áreas donde son difíciles de llegar, como grietas y esquinas. La actividad surfactante de **Virukill®** significa que no se necesitan detergentes. Para la aplicación de **Virukill®**, reemplace el uso de agua por soluciones de **Virukill®** al 0,2%.

COMO TRABAJA ESTO?

VIRUKILL® es altamente efectivo contra las bacterias. Niveles muy bajos de **VIRUKILL®** eliminan bacterias encontradas en el galpón. Esto se puede observar en la figura 1.

Lavar el galpón es un paso esencial en cualquier programa efectivo de desinfección pre-encasetamiento. Lavar con una solución de **VIRUKILL®** diluido hará la misma función que lavar con agua – (remueve la mugre visible). Se puede utilizar la solución de **VIRUKILL®** al 0.2%, (200 mL de VIRUKILL® EN 1 00L de agua), para lavar con el mismo equipo que utilizan en la granja, (rociadores de alta presión). El surfactante en **VIRUKILL®** hará la misma función que el detergente en un programa normal de desinfección pre-encasetamiento.

Si la mayoría de las bacterias son removidas durante la etapa de lavado - toda la fuerza de la desinfección final podría enfocarse en la inactivación de los virus desnudos IBD y CAV, los mas difíciles de eliminar.

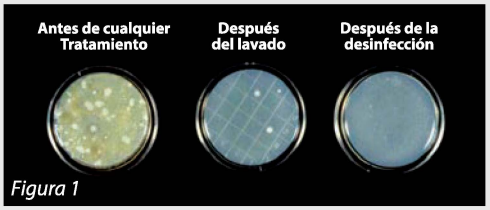


Figura 1

Paso 4: Desinfección final pre-encasetamiento

Desinfecte todas las superficies con una solución de **Virukill®** al 1% (10 mL de **Virukill®** en 1 L de agua). En casos de infecciones de Parvovirus, desinfecte con una solución de **Virukill®** al 2% (20 mL de **Virukill®** en 1 L de agua). **Virukill®** ha sido probado contra un amplio rango de patógenos, incluyendo virus desnudos y envueltos, bacterias Gram positivas y bacterias Gram negativas, al igual que contra hongos.
El rendimiento normal es alrededor de 600 mL de solución de **Virukill®** al 1% por cada metro cuadrado. El área desinfectada debe permanecer mojada por al menos 20 minutos.
El factor mas importante que tiene influencia sobre la eficacia de un desinfectante es el tiempo de contacto (cuánto tiempo el desinfectante tiene que funcionar). Con la finalidad de matar a los virus mas difíciles (virus desnudos) es necesario un tiempo de contacto de la solución de **Virukill®** al 1% durante 20 minutos. Si nota que el desinfectante aplicado a los corrales se esta secando muy pronto, incremente el volumen aplicado e Incremente el tiempo de contacto.

Paso 5: Monitoreo del proceso de desinfección

El monitoreo del proceso de desinfección siempre es buena idea, pero usted debe entender las limitaciones de estas pruebas. En el proceso de monitoreo, usted esta buscando cuan eficientemente usted está matando las bacterias. En muchas industrias de producción animal, el matar los virus debe ser su principal preocupación. No es posible monitorear efectivamente y de manera económica la eficacia de los programas de desinfección contra los virus.

Paso 6: Desinfección de todos los equipos, incluyendo el sistema de tuberías

El sistema de agua de bebida en todas las operaciones de producción porcina deben ser desinfectadas regularmente con una solución de **Virukill®** al 1% (10 mL de **Virukill®** en 1 L de agua). NB – Los cerdos no deben beber el agua con **Virukill®** al 1%. Después de la desinfección, enjuague el sistema de agua de bebida para eliminar los residuos de **Virukill®**

Paso 7: Uso de Lavaderos de botas

El uso de lavaderos de botas es esencial para una buena bioseguridad, siempre que se usen correctamente. Todos los desinfectantes son inactivados por materia orgánica. Cuando el desinfectante en los lavaderos de las botas se vea sucio, ya no está funcionando. Reemplace el desinfectante en los lavaderos de botas regularmente. Usar una solución de **Virukill®** al 1% (10 mL de **Virukill®** en 1 L de agua).

ICA INTERNATIONAL CHEMICALS

Virukill® (Poly Dimethyl Ammonium Chloride 120g/ℓ)
Reg. No: G2838 (Act 36 of 1947)

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CONTINUAL DISINFECTION PROGRAM IN THE FACE OF AVIAN INFLUENZA VIRUS

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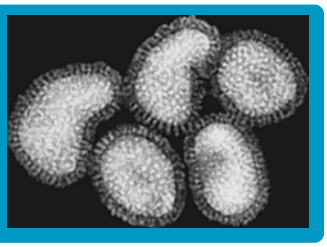
CONTINUAL DISINFECTION PROGRAM IN THE FACE OF AVIAN INFLUENZA VIRUS

Can you really afford NOT to make use of the full *Virukill® Continual Disinfection Program* when there is Avian Influenza around?



The very mention of ***Avian Influenza (AI)*** gets poultry producers and their Veterinary authorities into a state – for very good reasons.

AI is traditionally transmitted by migrating water birds, mostly in North America. By now, the virus has a world-wide distribution with resident virus population in wild birds around the world.

This is by far the most devastating of the poultry pathogens and can easily cause 100% mortality in unvaccinated birds in a very short period of time. Many veterinary authorities around the world do not allow for the vaccination of birds against AI and the control policy is a "stamping out" policy – that is completely destroying the infected flocks. Another major concern with an AI outbreak is that it is a notifiable disease and the OIE must be notified of any outbreak. The news of any AI outbreak normally results in the immediate ban on any poultry products to be imported from the infected country.

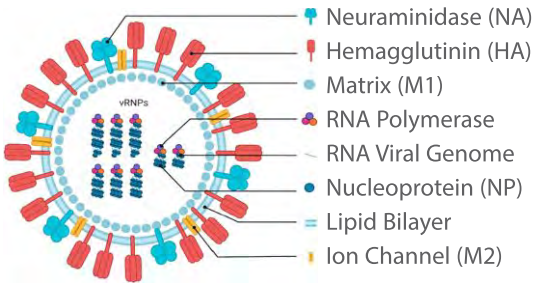
Let us also not forget that the most significant outbreak of influenza virus in humans started in a poultry farm in the USA and moved over to a pig farm and was spread around the world with the movement of American troops in 1918 – resulting in the Spanish flu pandemic which killed between 50 000 000 and 100 000 000 humans!

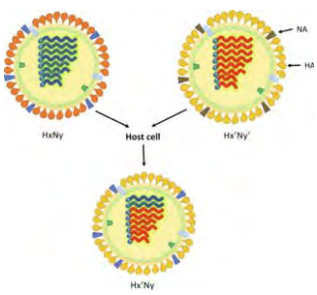
The Virus

AI is a member of the Orthomyxoviridae family of viruses. This is an enveloped virus with two main antigens on the surface of the virus namely neuraminidase (N) and hemagglutinin (H). These antigens give the virus its name. For example, Influenza virus H5N1. These antigens can change by two main methods. The one is called "antigen drift". This is when there are random mutations in the genetic material of the virus (in this case single stranded RNA).

The more significant way the virus can change is called "antigenic shift". This is when different viruses which normally infect different hosts infect the same individual. As the genome of the virus is segmented, when this situation of multiple different viruses in the same host occurs – there can be re-assortment of the genes. In other words, the emerging virus may have some human virus genes, some bird virus genes and some pig virus genes. This make a completely new virus. These antigenic shift events are the cause of many of the human influenza pandemics.

The different antigens on the surface of the virus play a major role in protective immunity. If the birds have been vaccinated against one combination of antigens (such as a vaccine containing H5N1) and the virus in the outbreak differs – the vaccine may not work.





How does *Virukill*® work against Avian Influenza?

Virukill® is a novel, highly effective disinfectant, registered with Act 36/1947 as well as NRCS, which can be used in a full continual disinfection program in commercial poultry. ***Please see different brochures with full details of the Virukill® Continual Disinfection Program.***

Virukill® is an effective disinfectant against enveloped viruses. ***Virukill***® disrupts the envelope of these viruses through the surfactant activity of ***Virukill***®. Once a virus envelope is disrupted, the virus can no longer fuse with the host cell membrane and release the virus genome into the host cell. This means that the virus cannot replicate in the host. Changes to the antigens on the virus can have a major impact on the efficacy of vaccines, but these changes have no effect on the mode of action of ***Virukill***® against the virus.

There are a number of reports on the efficacy on ***Virukill***® against AI. The most significant of these reports was obtained from the OIE reference laboratory for avian Influenza. Ask your distributors for these reports.

The active ingredient of ***Virukill***® is a modified formulation containing DDAC. ***Virukill***® is not the same as the many other DDAC containing disinfectants on the market. ***Virukill***® is different. The main difference can be seen when looking at disinfectant resistance profiles of various bacteria. These bacteria are highly resistant to DDAC, but not ***Virukill***®. This clearly shows that ***Virukill***® is not just another DDAC.

Please see different brochure on resistance to disinfectants.

The *Virukill*® full continual disinfection program is your best answer in the face of Avian Influenza virus

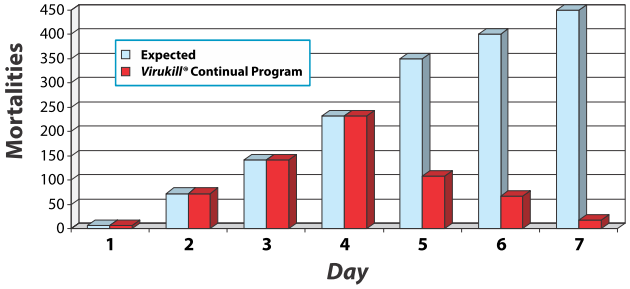


Fig 1: *Expected and Actual mortalities in a case of AI challenge on a commercial broiler breeder farm.*

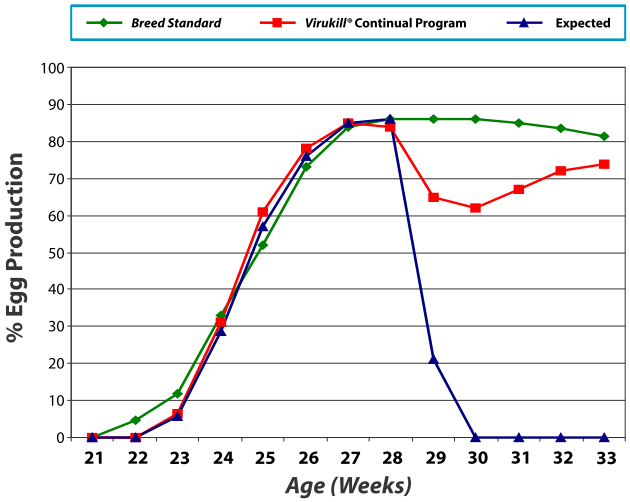


Fig 2: *Weekly egg production data collected from a commercial broiler breeder farm which became infected with Avian Influenza and treated with the full* ***Virukill® Continual Disinfection Program****.*

In a recent disease outbreak, the ***Virukill® Continual Disinfection Program*** was able to reduce the spread of AI on a commercial broiler breeder farm. In Fig 1, the expected mortalities in a poultry house are presented.

The actual daily mortalities obtained in the house infected with AI are shown as the ***Virukill***® treated group. It can be seen that the daily mortalities in this house where reduced to acceptable levels in relation to potential downside of such an outbreak.

On another farm the actual weekly egg production (expressed as a percentage calculated from the total number of eggs over the total number of birds) as recorded on this farm, while experiencing an AI infection and while using the full ***Virukill® Continual Disinfection Program***, is presented in Fig 2. Both the breed standard under normal conditions and the expected egg production in the face of an AI challenge are also presented in the Fig 2.

As an illustration the data from this commercial broiler breeder operation shows that the use of the ***Virukill® Continual Disinfection Program*** can restrict the daily mortalities associated with this infection (Fig 2). Even though the AI infection also caused a drop in egg production in the surviving birds, with the help of the ***Virukill® Continual Disinfection Program***, the egg production started to return to normal within 5 weeks after AI outbreak were recorded.

Methods and dilutions for the use of *Virukill*® in the full *Continual Disinfection Program*

Pre-placement disinfection

1) Dry clean the house and get rid of as much dust and dirt as possible.
2) Wash with a 0.02% dilution of ***Virukill***® in water (20ml ***Virukill***® per 100L water) and apply like you would apply the water for washing – at least 2 litres per m^2. This can be sprayed making use of the high pressure washing system.
3) Allow to dry
4) Disinfect house with a 1% solution of ***Virukill***® (1L ***Virukill***® per 100L water) at around 600 ml per m^2. The volume is dependent on how long the floor takes to dry. The floor must preferably remain wet for 30 minutes. If the floor starts drying before this time, add more of the 1% ***Virukill***® solution.
5) Disinfect cooling pads with a 0,2% ***Virukill***® (200ml per 100L water) solution. If ***Virukill***® is used in cooling pads for the first time it is recommended to pre-disinfect the cooling pad with 1% ***Virukill***® solution.
6) Disinfectant all equipment – including the drinking water system from the header tank through all of the drinkers with a 1% ***Virukill***® solution.
7) Add bedding and all other items.
8) Replace all disinfected equipment.
9) Do a final fogging if desired at the following application rates:

   ULV:

   - 500ml ***Virukill***®, 5000ml Propylene glycol, 14500ml water.

   Fogging Solution (Cold or Thermal):

   - 500ml ***Virukill***®, 17000ml Propylene glycol, 2500ml water.

   The rate for both fogging and misting is 550ml per 1000m Cube.

Footbaths

Use a 1% ***Virukill***® solution and change once dirty.

Drinking water application

Add 100 ppm ***Virukill***® (10ml per 100L water) to the drinking water of the birds on a continual basis. The drinking system must first be flushed clear with a 1% ***Virukill***® solution which the birds should not drink.

Disinfection of the air in the presence of birds

Spray the air around the birds with a 1% solution of ***Virukill***® at application rate of approximately 4ml per bird as often as required. The process has been safely tested up to three sprays per day.

Virukill®

Always refer and adhere to the label

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REMOVING NAKED VIRUSES FROM BROILER PRODUCTION

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The importance of removing naked (non-enveloped) viruses at pre-placement disinfection and the continual disinfection program in broiler production.

Preplacement disinfection of poultry houses (or sheds) is very important and an essential part of poultry production. The importance of this process is becoming even more critical in the light of the growing pressure to reduce the amount of antibiotics used in animal production.

Biosecurity is our last line of defense.

Virukill® is the very best product for all your biosecurity needs!

Monitoring of the efficacy of pre-placement disinfection is a very important part of a good biosecurity program. Traditionally, swabs or contact plates are collected from areas pre- and post-disinfection and the reduction in bacterial numbers is used to evaluate the efficacy of pre-placement disinfection.

There are, however, some problems with this system. The main concern is that there is no, or very little relationship between the ability of a disinfectant to inactivate bacteria and viruses – particularly the very difficult to kill naked viruses.

Also – bacteria are free living organisms and they can grow independently even when there is no poultry in the shed. If you wait too long after pre-placement disinfection to collect samples, bacterial numbers may have drastically increased again as bacteria multiply exponentially. For viruses this is different since they need their host to multiply.

It is very difficult to evaluate the effective removal of viruses from a poultry house. Removal of bacteria is used as an indication – but is this good enough?

THE BIG QUESTION

IS IT IMPORTANT TO REMOVE THE VIRUSES FROM THE HOUSE BEFORE PLACING NEW BIRDS?

There are two different major types of viruses. The enveloped viruses which include viruses like Infectious bronchitis virus (IB), Newcastle Disease virus (NDV) and Avian Influenza (AI) and the naked (non-enveloped) viruses that include viruses like Infectious bursal disease virus (Gumboro) (IBD), Chicken aneamia virus (CAV), Reovirus, Adenovius and Astrovirus. The ability of a disinfectant to inactivate enveloped viruses is more closely related to the ability to inactivate bacteria. However, naked viruses on the other hand, are very difficult to inactivate and very few products can effectively inactivate naked viruses.

Virukill® has been extensively tested and found to be effective against all known poultry naked viruses

IBD and CAV are both immunocompromising viruses. If these viruses are not removed, they will damage the immune system of the birds – which is the basis of the defense system stimulated by the use of vaccines.

Reovirus, Adenoviruses and enteroviruses attack the digestive track of the day old chicks and if not removed – will have a major negative impact on production parameters.

Large-scale commercial project with Virukill®

A large- scale production experiment was launched to determine the ability to remove viruses by pre-placement disinfection in relation to overall production parameters in commercial poultry houses. Efficacy evaluation of disinfection for the removal of naked viruses was performed by making use of a commercial test system developed for the evaluation of five naked enteric viruses. Young birds are exposed to treated houses and used as "baits" to collect viruses. The numbers of viruses in the exposed birds are determined after a week of exposure. The system makes use of quantitative real time PCR to determine the number of viruses in the sample and provides a virus score.

The following result sheet is from the commercial test system performed in a test house treated with **Virukill®** at the preplacement disinfection stage. This house was washed with a 0.5% **Virukill®** solution at 2 litres per meter^2 and then disinfected with a 1% **Virukill®** dilution at 600 ml per m^2.

NO	IDENTIFICATION	TEST/METHOD	RESULTS	AMOUNT (LOG 10 TITRE)
006	F: KB2 - 1 Days	Chicken astrovirus	Not detected	
006	F: KB2 - 1 Days	Avian nephritis virus-3	Detected	1,24
006	F: KB2 - 1 Days	Reovirus	Not detected	
006	F: KB2 - 1 Days	Rotavirus A	Not detected	
006	F: KB2 - 1 Days	Rotavirus D	Not detected	

VIR- CHECK SCORE : 4

RELATIVE SCORE : Green

CONCLUSION : The VIR-check score indicates that the cleaning and disinfection of the sampled house was thorough and successful. On average, broiler flocks with a green VIR-check score show the highest daily growth.

The following result sheet is from a commercial test system performed on in a control house disinfected with an Aldehyde based product at a 1% concentration at preplacement. The house was washed with water and disinfected with a 1% dilution of the Aldehyde product at a rate of 1 liter per m^2 (as stipulated in the instructions)

NO	IDENTIFICATION	TEST/METHOD	RESULTS	AMOUNT (LOG 10 TITRE)
002	B: KBS - 2	Chicken astrovirus	Detected	3,25
002	B: KBS - 2	Avian nephritis virus-3	Detected	3,33
002	B: KBS - 2	Reovirus	Detected	1,43
002	B: KBS - 2	Rotavirus A	Not detected	
002	B: KBS - 2	Rotavirus D	Not detected	

VIR- CHECK SCORE : 51

RELATIVE SCORE : Yellow

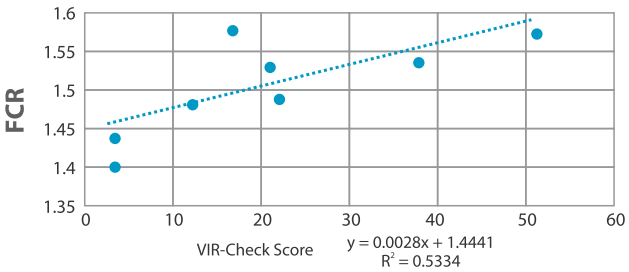
CONCLUSION : The VIR-check score is around the average score of farms, On average, broiler flocks in houses with a yellow VIR-check score grow 0.8 grams per day less that flocks with a green score.

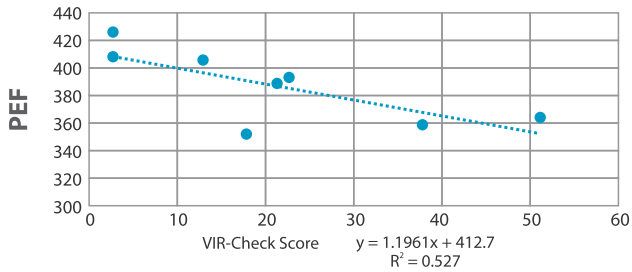
Comparison of the Commercial Test Score for removal of viruses in relation to important production parameters.

The main poultry production parameters which influence the profitability of poultry production is the Feed Conversion Ratio (FCR) (the amount of feed to poultry mass conversion ratio) and the performance efficiency factor which includes the FCR, mortality rate, number of birds, final mass of birds and the duration of the production cycle.

	MEAN VIRUS SCORE	STD DEV.	MEAN FCR	STD DEV	MEAN PEF	STD DEV
Virukill®	19.25	12.55	1.48	0.05	396.82	24.30
Aldehyde	23.00	17.30	1.53	0.05	378.05	22.22

The study results showed that the lowest virus load was recorded in the houses where **Virukill®** was used for preplacement disinfection. The mean Feed Conversion Ratio or FCR, which is a very important measure of production, was lower in the **Virukill®** treated houses than the Aldehyde houses. This means that less feed was needed during the production cycle. The Performance Efficacy Factor (PEF) includes the number of mortalities, FCR, weight of birds and the duration of the production cycle. The higher the PEF, the better the production cycle was. A higher PEF is an indication of a more profitable cycle, as less feed is used and less mortalities experienced.





Relationship between the viral evaluation of cleaning and performance of eight trial houses

There is a direct correlation to a lower commercial test score on the removal of viruses and lower FCR. There is also a direct correlation between a lower commercial test score and a higher PEF score. This clearly shows the relationship between the removal of naked viruses at preplacement to improved performance.

Conclusions

Systems for the evaluation of pre-placement disinfection efficacy against the difficult to inactivate naked viruses have shown that disinfection with **Virukill®** results in lower numbers of naked viruses remaining after disinfection. It was also found that there is a direct relationship between lower virus levels and improved Feed Conversion Ratios and improved overall performance index.

Virukill® has clearly been shown to be the most effective at removing naked viruses from the house during pre-placement disinfection.

The link between reduced levels of naked viruses and better performance after pre-placement disinfection was clearly demonstrated.

Virukill®

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COMMERCIAL CONTINUAL DISINFECTION PROGRAM

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CONTINUAL DISINFECTION PROGRAM ON A LARGE COMMERCIAL SCALE

Total saving - based on experimental data on a farm with 10 houses per site with 42 000 birds per house and 7 cycles per year could be as high as US$ 180 600 per year!

Virukill® is a novel, highly effective disinfectant which can be used in a full continual disinfection program in commercial poultry. Please see different brochures with full details of the **Virukill®** continual disinfection program.

The active ingredient of **Virukill®** is a modified formulation containing DDAC, a quaternary ammonium compound. **Virukill®** is not the same as the many other DDAC containing disinfectants on the market. **Virukill®** is different. The main difference can be seen when looking at disinfectant resistance profiles of various bacteria. These bacteria are highly resistant to DDAC, but not **Virukill®**. This clearly shows that **Virukill®** is not just another DDAC. Please see different brochure on resistance to disinfectants.

There is growing pressure world-wide to reduce the use of antibiotics in animal production. This is leading to concerns that disease control in animal production will be increasingly difficult.

The Virukill® full continual disinfection program is the best answer to disease control in situations where antibiotics can no longer be use

Experimental data collected some time ago (and published – Bragg & Plumbstead 1999) showed that there was a substantial reduction in mortalities using the continual disinfection program under the experimental conditions used.

This experiment has now been repeated on a very large commercial scale. Part of the focus of this experiment was also to attempt to correlate the removal of viruses at preplacement to overall production efficacy. Accurately determining the successful removal of viruses (particularly naked viruses) during pre-placement is very difficult. (see the brochure on the removal of viruses).

Effects of the full Virukill® continual disinfection program

In this large experiment, a total of 8 broiler production houses on a commercial poultry farm were selected. Each house held 42 000 birds. Four houses were used as a control continuing with current disinfection procedures, and 4 houses were used for the continual **Virukill®** disinfection program. Each pair of houses (one control and one experiment) were stocked with the same supply of birds and received the same batch of feed. These houses were in the same production site to ensure that all factors were kept as close as possible to each house. Parameters which were measured included daily mortality, feed conversion ratio (FCR) and weight of the birds. These were used to then determine the production efficacy factor (PEF) for the different houses.

FCR was calculated by using the formula:

$$FCR = \frac{\textit{Mass of Feed (kg)}}{\textit{Live Mass of Birds at end of Cycle (kg)}}$$

PEF was calculated using the formula:

$$PEF = \frac{\textit{\% Liveability x Ave Body Weight (kg) x 100}}{\textit{FCR x trial duration (days)}}$$

Table 1 (below) depicts the overall feed conversion ratio, overall production efficacy, and weight gain during the study, together with the mortality rates shown in **figure 1** as well. An estimation of the cost savings using **Virukill®** in a full continual disinfection program (the bottom line in any poultry production business) can be seen in Table 2 and Table 3.

EXPERIMENT 1	*Trial House 1*	*Standard House 1**	*Trial House 2*	*Standard House 2*
Mortality (%) (at end)	3.48%	3.19%	6.12%	9.10%
FCR	1.48	1.44	1.54	1.58
PEF	406.97	408.75	359.41	352.21

* Standard disinfection program on the farm was with a glutaraldehyde based product. This was the normal SOP that was in use on the commercial farm.

EXPERIMENT 2	*Trial House 1*	*Standard House 1*	*Trial House 2*	*Standard House 2*
Mortality (%) (at end)	3.69%	6.45%	8.40%**	5.86%
FCR	1.40	1.57	1.49	1.53
PEF	426.08	362.35	394.81	388.89

** Showed high first week mortalities which influenced the overall mortality rate. First week mortalities are normally associated with hatchery issues.

Table 1: *Performance parameters of poultry houses undergoing standard and continuous disinfection programs.*

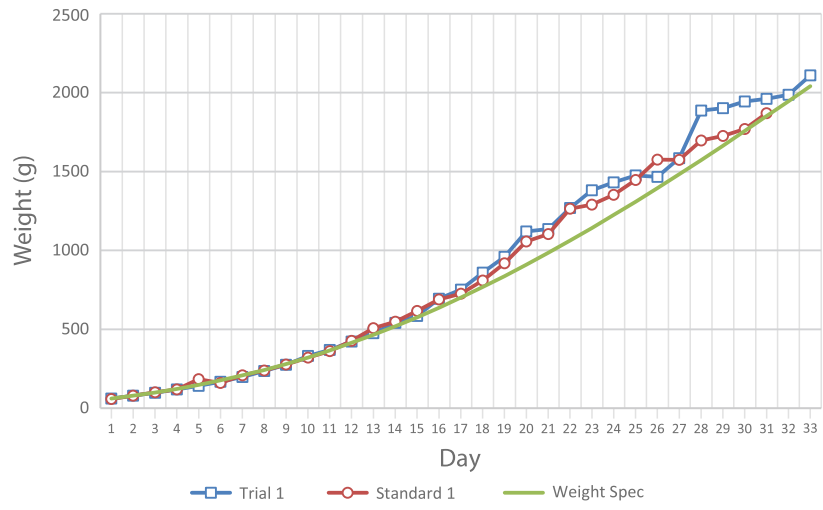

Fig 1: *Growth curves seen in the experiment when compared to the breed standard. This confirms the safety aspects of making use of the full **Virukill®** continual disinfection program. Trail 1 (blue) is the data from the house on **Virukill®**.*

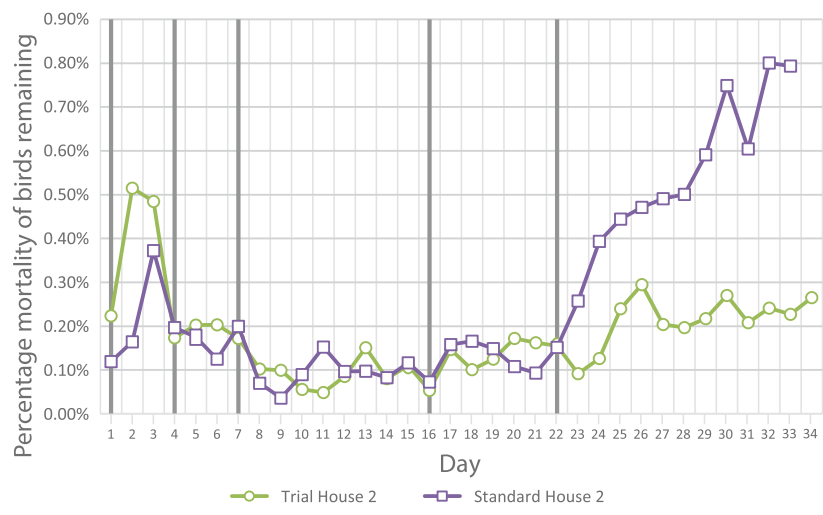

Fig 2: *Typical daily mortalities recorded in two houses. Note on Day 21, the increase in mortalities in the control house. This is typical on many poultry farms around the world – increased mortalities around day 21. This was not seen in the **Virukill®** house (Trail house 2). Vertical lines indicate the days on which the birds were sprayed with 1% **Virukill®**.*

Cost benefits of the full Virukill® continual disinfection program

	Virukill®	Control	Total number of birds/ house	More birds in Virukill® group	Value (@ 2 US$ per bird)
Mortalities	4.43%**	6.25%	42 000		
Total mortality	1860	2625		765	1 530
On 10 houses/sites				7 650	15 300
Based on 7 cycles per year				53 550	107 100

** Average without the house with high first week mortalities.

Table 2: *Cost benefits of the full* ***Virukill®*** *continual disinfection program based on mortalities.*

	Virukill®	Control	Total number of birds/ house	Less feed in Virukill® group	Value (@ 5 US$ per bird)
Mean FCR	1.48*	1.53	42 000		
Mass of feed	62 160 kg	64 260 kg		2100	1 050
On 10 houses/sites				21 000	10 500
Based on 7 cycles per year				147 000	73 500

Table 3: *Cost benefits of the full* ***Virukill®*** *continual disinfection program based on Feed conversion ratio.*

Saving in terms of reduced mortality based on 10 houses per site with 42 000 birds per house and 7 cycles per year
= US$ 107 100

+

Saving in terms of reduced FCR based on 10 houses per site with 42 000 birds per house and 7 cycles per year
= US$ 73 500

=

Total saving based on 10 houses per site with 42 000 birds per house and 7 cycles per year
= US$ 180 600

Methods and dilutions for the use of Virukill® in the full continual disinfection program

Full details with dilutions can be found on other brochures

The full continual disinfection program consists of the following:

1) Effective preplacement disinfection
2) Effective biosecurity
3) Continual drinking water treatment
4) Regular disinfection of the air around the birds.

DISCLAIMER

- The figures shown in this document are calculated and based on data collected from real world experiments performed on a large scale production facility.
- Good farm management remains essential to gain the most benefits from the use of the full continual disinfection program.
- These production figures cannot be guaranteed in all situations.

Virukill®

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MICROBIAL RESISTANCE TO DISINFECTANTS

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RESISTANCE TO DISINFECTANTS

THE NIGHTMARE TO COME!

Disease control options are becoming increasingly difficult as effective antimicrobials are limited. In the era of antibiotic resistance, the only reliable and effective disease control option will be improved biosecurity and the use of good quality disinfectants. The major problem however, is the growing concerns of microbial resistance to disinfectants. In the BC (before Covid) era, there were very few scientific publications on resistance to disinfectants. During the Covid 19 pandemic – some 700 000 tons of disinfectants were released into the environment, many of these taking up to a year to break down. This results in a disinfectant gradient in the environment which can rapidly result in the development of resistance to disinfectants. In the post Covid era there are growing numbers of research articles related to the resistance to disinfectants.

***Fig 1**. Massive use of disinfectants during the Covid-19 pandemic. We are now reaping the consequences!*

Resistance has been reported in all the major groups of chemicals used for disinfection. For example, there is evidence that *Enterococcus* species, *Bacillus* species and *Clostridium* species are resistant to 70% ethanol. *Mycobacterium* species and *E.coli* are showing resistance to glutaraldehyde. Reports of QAC resistance are increasing in number and the bacteria showing resistance include *Acintobacter baumannii*, *Serratia* species and *Pseudomonas aeruginosa*. Chlorine is frequently used for the disinfection of drinking water. Apart from the fact that chlorine is highly water pH dependent, resistance has also been recorded with *Salmonella* species, *Micrococcus* species and *Actinomycete* species.

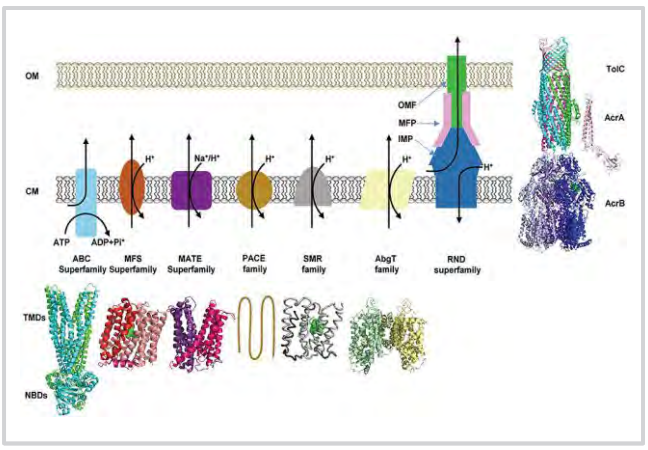

***Fig 2**. Examples of efflux pumps which play a role in both antibiotic resistance & disinfectant resistance.*

Research is also clearly showing that there is a connection between resistance to antibiotics and disinfectants mainly through common mechanisms. The most common of these mechanisms are the efflux pumps of which there are many different types which can be found in the bacterial cell wall (See Fig 2). These efflux pumps are protein systems in the cell wall of the bacteria which can pump antimicrobial chemical out of the cell.

The novel patented formulation of Virukill®

is preventing the development of resistance to disinfectants.

Researchers working to understand the mechanisms of resistance to disinfectants have found that even when bacterial strains are showing high levels of resistance to other Quaternary Ammonium based disinfectants, the bacterium is still fully susceptible to **Virukill®**.

Virukill® is a novel formulation with DDAC being the active ingredient. **Virukill®** is not just another DDAC based product. It is unique and in the era of resistance to disinfectants, **Virukill®** stands out as a major product where there is no evidence of development of resistance.

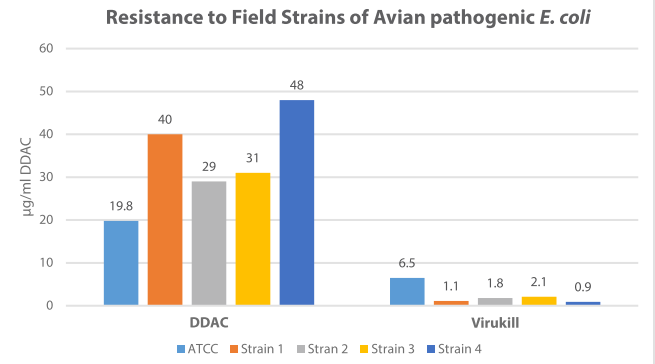

***Fig 3**. Minimum inhibitory concentration (MIC) values of reference strain and field isolates of avian pathogenic E. coli when exposed to DDAC and the same strains exposed to **Virukill®**. It can be seen that there is resistance to DDAC in the field strains but no resistance to **Virukill®**.*

In an effort to understand the development of resistance to disinfectants in bacteria, various research projects at the University of the Free State, South Africa, are being undertaken.

One such project was to investigate the induction of resistance in bacteria. In these experiments, bacteria were grown repeatedly in levels of disinfectants which were low enough not to kill the bacteria. The bacteria are therefore being exposed to the disinfectant at levels which are too low to kill them immediately. A substantial increase in resistance to DDAC was seen with the APEC strains (See Fig 4). When the same experimental conditions were used with the same strains, except **Virukill®** was used – no development of resistance was recorded (Fig 5).

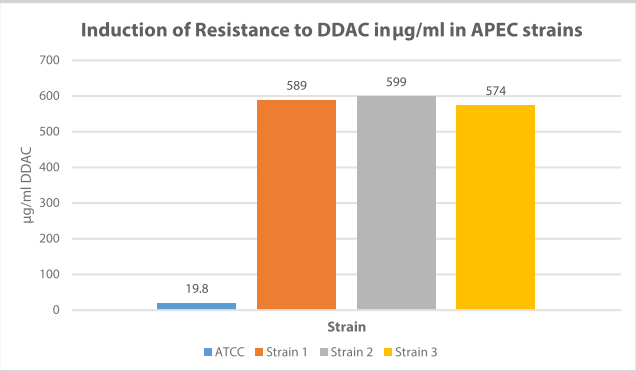

Fig 4. *Results of induction experiments undertaken where the MIC for the APEC strains (Avian pathogenic E. coli) at the start of the experiment was 19.8 µg/ml DDAC (working with a 80% DDAC solution). In just 10 passages – the MIC was found to increase to around 600 µg/ml. This is a 30 fold increase in the MIC in just 10 days when the bacterium is exposed to sub-lethal levels of a disinfectant.*

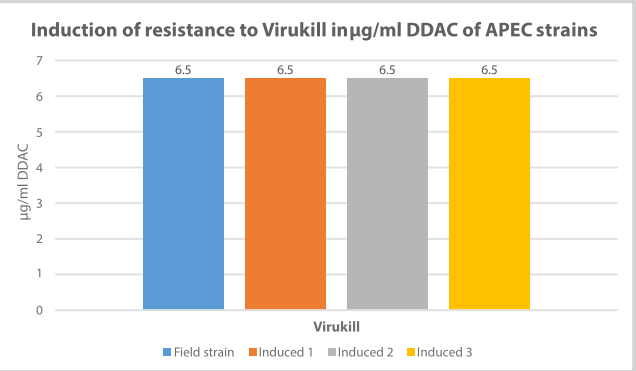

Fig 5. *Induction experiment performed with* ***Virukill®****. There was no change in the MIC in the induced APEC strains after 10 passages. The MIC remained at 6,5 µg/ml DDAC (based on the fact that* ***Virukill®*** *contains 12% DDAC). NB. Note the scale on the y-axis.*

In another experiment (which is still ongoing) where transcriptomics (this is the sequencing of all of the RNA in a bacterium exposed to certain conditions in order to understand how the bacterium reacts to certain conditions) analysis of the RNA of bacteria grown in different products are being analysed, it was discovered that when the bacterium (in the case a highly resistant strain of *Serratia* species) is grown in DDAC, there is a massive upregulation of bacterial stress response genes (which would trigger various resistance mechanisms). When the same bacterium was grown in the presence of **Virukill®**, no up-regulation of the stress response genes was noted, therefore no up-regulation of various resistance mechanisms occurred. **Virukill®** is the only disinfectant which is not showing the development of bacterial resistance to disinfectants.

Virukill® is a critical product to use on your farms to prevent the build-up of resistant bacteria. See the brochure on the use of **Virukill®** in a product rotation program on your farm.

There is also growing evidence that there is a link between disinfectant resistance and antibiotic resistance. **Virukill®** is an essential tool to use to combat diseases in poultry production.

Please see other brochures for detailed instructions on the use of Virukill® on your farm if you are currently not using Virukill®.

Virukill®

ICA INTERNATIONAL CHEMICALS

Virukill® (Poly Dimethyl Ammonium Chloride 120g/ℓ)
Reg. No: G2838 (Act 36 of 1947) Caution.

ICA International Chemicals (Pty) Ltd. | Reg. No: 2001/013319/07
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Plankenbrug Industrial, Stellenbosch, 7600, South Africa.

ROTATION OF DISINFECTANTS

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Why is the rotation of antibiotics and anticoccidial agents recommended?

The answer to this is to prevent the build-up of resistance to these products. At this stage, we are all well aware of the concerns around antibiotic and anticoccidial resistance. There is growing pressure to reduce the use of antibiotics in animal production. In some countries the use of anticoccidials are being limited as well. This will leave the poultry producer in a very difficult position. The only viable option left for effective disease control in this situation will be improved biosecurity and disinfection.

For many years, the thinking, among both scientists and producers, was that there is no resistance to disinfectants, and many producers have been making use of the same disinfectants on their farms for many years. The main criteria on selection of the product has normally been "cost". Very little attention has been given to efficacy of products.

Biosecurity has, in the past, been the most overlooked method for disease control, but this has to change and much more attention needs to be paid to biosecurity and pre-placement disinfection, as this is now our last line of defense.

Resistance to disinfectants – the coming storm!

Scientists now know that there is resistance to disinfectants and this is of increasing concern. Generally, disinfectants work by damaging the bacterial cell wall which destroys the bacterium.

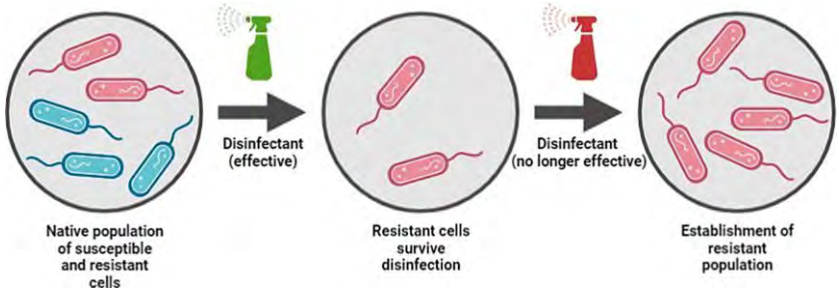

Fig 1. *How a bacterial population becomes resistant to a disinfectant.*

It only takes one bacterium to survive and in a short space of time, the entire population is resistant.

Scientists now understand that bacteria make use of at least some of the same mechanisms they use to become resistant to antibiotics to also become resistant to disinfectants, such as efflux pumps. In other words – it is becoming clear that there is a link between antibiotic resistance and disinfectant resistance. By using poor quality disinfectants on your farm, you can be promoting antibiotic resistance, even if you are not using antibiotics in the production cycle.

There is a growing concern that the bacterial populations are showing increased resistance to the commonly used disinfectants.

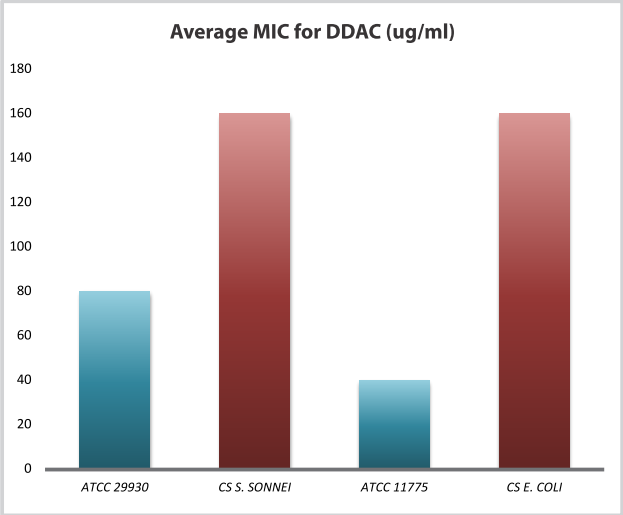

Fig 2. *The difference in MIC values against DDAC (not* ***Virukill®****) between reference strains (ATCC) and field strains (CS) of bacteria, highlighting the development of resistance to disinfectants.*

Resistance to disinfectants can develop quickly, when exposed to sub-MIC levels of disinfectants. In experiments where disinfectant resistant was induced, it was shown that in only 10 passages (days), there was a significant increase in resistance to DDAC (as can be seen in Fig 3).

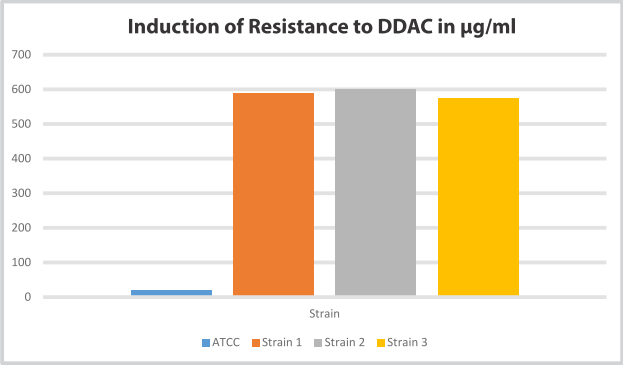

Fig 3. *Induction of resistance to DDAC in only 10 passages (days) when grown in sub-MIC levels of DDAC. The MIC against DDAC went from 19,8 µg/ml for the reference strain to around 600 µg/ml for the same strain after just 10 passages in sub-MIC levels of DDAC.*

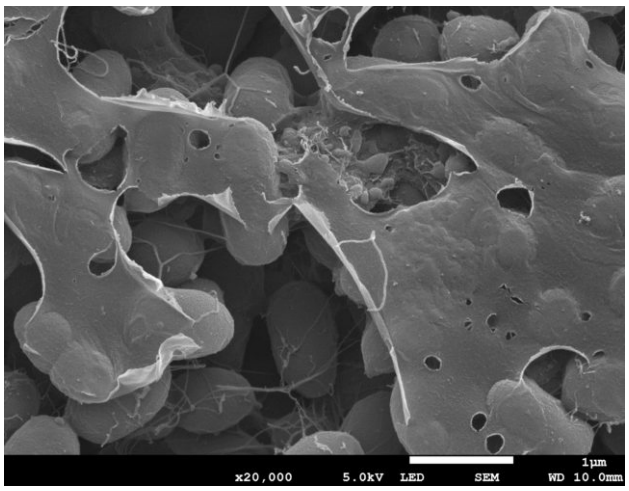

Fig 4. *Development of resistance also resulted in the development of biofilms – which adds to the bacterial resistance. Scanning electron microscope (SEM) image of the development of biofilm in the induction experiments.*

Virukill® is a modified formulation of a DDAC based disinfectant. **Virukill®** is not the same as DDAC. Please see the brochure entitle "**Virukill®**: A novel disinfectant", where these differences are explained.

Development of resistance to disinfectants can also result in the development of resistance to antibiotics, even if the bacteria are not exposed to antibiotics.

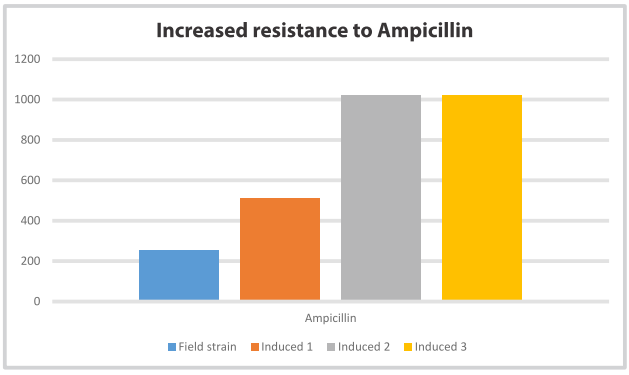

Fig 5. *Graph showing an increase in antibiotic resistance (Ampicillin in this case) when there is an increase in resistance to DDAC in an induction experiment.*

PRODUCT ROTATION PROGRAM

If you are not currently making use of **Virukill®** for pre-placement disinfection in poultry production, then it is essential that you start a disinfection rotation program on your farm and include **Virukill®** as one of your products in this rotation programme.

Because there is no evidence of a build-up of resistance in bacteria to **Virukill®**, all of the bacteria which are developing resistance on the farm to other disinfectants (and antibiotics) will be killed off, or at least substantially reduced, during the **Virukill®** disinfection cycles. If you are planning to continue with lower quality products for your pre-placement disinfection, you need to do product rotation at least every six months, with every alternative product cycle making use of **Virukill®** for all of your disinfection needs.

If you are currently making use of *Virukill®* for your pre-placement disinfection there is no need for product rotation.

Researchers are closely monitoring the situation regarding the development of resistance to **Virukill®** in various bacterial pathogens and if there is any indication of the development of resistance, your **Virukill®** distributor will inform you to start a product rotation program.

Methods and dilutions for the use of *Virukill®* in the full continual disinfection program.

PRE-PLACEMENT DISINFECTION

1) Dry clear the house and get rid of as much dust and dirt as possible.
2) Wash with a 0.02% dilution of **Virukill®** in water (20 ml **Virukill®** per 100L water) and apply like you would apply the water for washing – at least 2 litres per m^2. This can be sprayed making use of the high pressure washing system .
3) Allow to dry
4) Disinfect house with a 1% solution of **Virukill®** (1L **Virukill®** per 100L water) at around 600 ml per m^2. The volume is dependent on how long the floor takes to dry. The floor must preferably remain wet for 20 mins. If the floor starts drying before this time, add more of the 1% **Virukill®** solution.
5) Disinfect cooling pads with a 0,2% **Virukill®** (200 ml per 100L water) solution. If **Virukill®** is used in cooling pads for the first time it is recommended to pre-disinfect the cooling pad with 1% **Virukill®** solution.
6) Disinfectant all Equipment – including the drinking water system from the header tank through all of the drinkers with a 1% **Virukill®** solution. Drinking water system should be completely rinsed after this treatment. Birds must not drink the 1% **Virukill®** solution
7) Add bedding and all other items.
8) Replace all disinfected equipment.
9) Do a final fogging if desired at the following application rates:

   ULV:

   500 ml **Virukill®,** + 5000 ml Propylene glycol, + 14500 ml Water

   Fogging Solution (Cold or Thermal)

   500 ml **Virukill®**, + 17000 ml Propylene glycol, + 2500 ml Water

   The rate for both fogging and misting is 550ml per 1000 m^3.

FOOTBATHS

Use a 1% **Virukill®** solution and change once dirty.

DRINKING WATER APPLICATION

Add 100 ppm **Virukill®** (10 ml per 100L water) to the drinking water of the birds on a continual basis. The drinking system must first be flushed clear with a 1% **Virukill®** solution which the birds should not drink.

DISINFECTION OF THE AIR IN THE PRESENCE OF BIRDS

Spray the air around the birds with a 1% solution of **Virukill®** at application rate of approximately 4 ml per adult bird as often as required. Safety has been tested up to three sprays per day.

Virukill®

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APPLICATION RATES

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APPLICATION RATES FOR Virukill®

In all cases involving animal production & food processing where the exact cause or potential cause of problems are not clear, the following application rates should be applied:

PRE-PLACEMENT DISINFECTION

- **Wash:** 0.2% Virukill® solution at 0.5 - 1 litres per m^2
- **Disinfection:** 1% Virukill® at 300 - 400 mℓ/m^2

POULTRY DRINKING WATER APPLICATION

- Rinse water lines with 1% Virukill®. Birds should not drink this concentration. This is for a flush to remove biofilms.
- 0.01% (1 mℓ Virukill® in 10 litres water) added continually to the drinking water.

REGULAR SPRAYING AND DISINFECTING OF THE AIR IN THE PRESENCE OF BIRDS

- 1% Virukill® solution every 3 days at about 4 mℓ per adult bird– or spraying as required depending on disease challenge on the farm.

The following tables are compiled from a vast number of scientific tests that have been performed by various laboratories around the world.

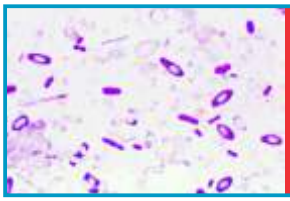
Individual reports can be requested from your Virukill® representative or from the product registration holder.

APPLICATION RATES AND CONTACT TIME FOR SPECIFIC PATHOGENS

The standard recommended contact time is 20 minutes and many of the tests have been performed with a 20 minute contact time. This long contact time is mainly to inactivate the very difficult to kill naked viruses. Various tests have been performed on much shorter contact times, particularly for bacterial pathogens, where the shortest contact time tested and found to be effective was only 10 seconds.

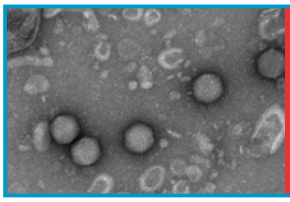
FUNGI AND YEASTS

COMMON DISEASES/PATHOGEN	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN	RECOMMENDED APPLICATION RATE
POULTRY		**OTHERS**	
Aspergillus niger	0.5%	*Candida albicans*	0.5%
		Penicillium brevicompactum	0.5%
		Saccharomyces carlbergensis	0.5%
		Trichophyton mentogrophytes	0.5%



BACTERIAL ENDOSPORES

COMMON DISEASES/PATHOGEN POULTRY	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN SWINE	RECOMMENDED APPLICATION RATE
Bacillus subtilis spores	0.5%	*Bacillus anthracis* endospores	1%
Clostridium sporogenes endospores	0.5%		



NAKED VIRUSES

COMMON DISEASES/PATHOGEN POULTRY	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN SWINE	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN OTHERS	RECOMMENDED APPLICATION RATE
Infectious bursal disease virus (Gumboro) (IBD)	1%	Porcine Circovirus (PCV2)	1%	Feline Calicivirus	0.5%
Chicken Anaemia virus (CAV)	1%	Swine Adenovirus	1%		
Adenovirus	1%			Canine Parvovirus	2%
Reovirus	1%				
Enteroviruses	1%	Swine Parvovirus	2%		
Egg drop syndrome virus (EDS) - Adenovirus	1%				

ENVELOPED VIRUSES

COMMON DISEASES/PATHOGEN POULTRY	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN SWINE	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN OTHERS	RECOMMENDED APPLICATION RATE
Infectious bronchitis virus (IB) (Coronavirus)	0.5% to 1%	Porcine Epidemic Diarrhea virus (PED) (coronavirus)	0.5% to 1%	**Covid -19 SARS-CoV- 2** (Specific tests have been done against this virus)	0.5% to 1%
Infectious laryngotracheitis virus (ITL)	0.5%	Swine Influenza virus	0.5%		
Newcastle disease virus (paramyxovirus) (NCD)	0.5%	Swine Pseudorabies virus (Herpesvirus)	0.5%		
Avian Influenza virus	0.5%				
Orthomyxovirus	0.5%			Feline Herpesvirus	0.5%
Marek's Disease virus (Herpesvirus)	0.5%	Africa Swine Fever (Asfarviridae)	0.5%		

GRAM POSITIVE BACTERIA

COMMON DISEASES/PATHOGEN **POULTRY**	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN **SWINE**	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN **OTHERS**	RECOMMENDED APPLICATION RATE
Staphylococcus aureus and other *Staphylococcus* species	0.2%	*Staphylococcus* species	0.2%	*Listeria monocytogenes*	0.5%
Streptococcus species	0.2%	*Mycoplasma* species	0.2%	*Acinetobacter antiratus*	0.5%
Mycoplasma gallisepticum	0.2%	*Bacillus* species (vegetative cells)	0.2%	*Lactobacillus fermentum*	0.5%
Mycoplasma synoviae	0.2%	*Clostridium* species (vegetative cells)	0.2%	*Micrococcus luteus*	0.5%
Bacillus species (vegetative cells)	0.2%			*Bacillus* species (vegetative cells)	0.2%
Clostridium species (vegetative cells)	0.2%			*Clostridium* species (vegetative cells)	0.2%

GRAM NEGATIVE BACTERIA

COMMON DISEASES/PATHOGEN **POULTRY**	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN **SWINE**	RECOMMENDED APPLICATION RATE	COMMON DISEASES/PATHOGEN **OTHERS**	RECOMMENDED APPLICATION RATE
Avian pathogen *Escherichia coli*	0.2%	*Escherichia coli*	0.2%	*E. coli* 0157	0.2%
Avibacterium paragallinarum	0.1%	*Salmonella* species	0.2%	*Klebseilla pneumoniae*	0.5%
Salmonella Typhimurium	0.2%	*Pseudomonas* species	0.5%	*Proteus vulgaris*	0.5%
Pseudomonas aeruginosa	0.5%	*Pasteurella multocida*	0.1%	*Shigella sonnei*	0.5%
Ornithobacterium rhinotracheale	0.1%			*Vibrio alginolyticus*	0.5%
Pasteurella (Avibacterium) gallinarum	0.1%			Highly resistant *Serratia marcescens* (this strain is resistant to 20% DDAC)	2%
Pasteurella (Avibacterium) volantium	0.1%				

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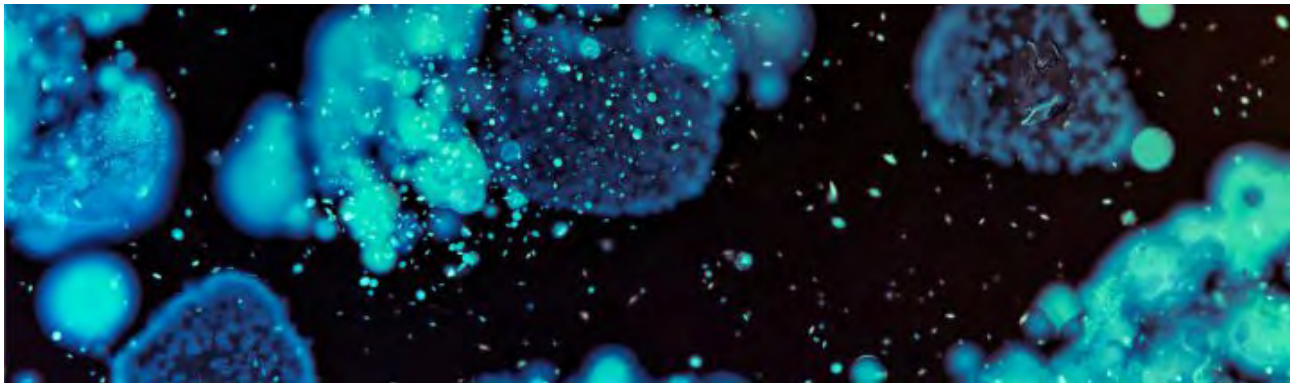
Virukill®

DISINFECTANT AEROSOL FOGGER

Reg. No: GNR529/243642/040/1200 (Act5)

ICA International Chemicals contact details: +27-21-886-9812 | www.icaonline.co.za

A BREAKTHROUGH IN THE CONTROL OF HARMFUL AND UNWANTED MICROORGANISMS



Building on the tried and tested efficacy of ***Virukill®*** (Reg. no. G2838 of Act 36 of 1947) for the control of all pathogenic micro-organisms, this new ***Virukill® Disinfectant Aerosol Fogger*** will greatly assist in the control of harmful micro-organisms, wherever they occur, even in difficult to reach areas. Highly effective against a wide range of bacterial pathogens such as *Listeria monocytogenes*, various *Vibrio* species, *Camphylobacter* species, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, various species of *Bacillus* and *Clostridium* (both vegetative cells as well as endospores), various species of *Salmonella* and many others.

WHAT IS THE VIRUKILL® DISINFECTANT AEROSOL FOGGER?

The ***Virukill® Disinfectant Aerosol Fogger*** is a ready-to-use dilution of the highly effective disinfectant, ***Virukill®***, in a pressurised can, which, once triggered will completely empty, resulting in a very fine aerosol mist which can be used to disinfect any closed area of approximately 35 m^3 per aerosol can. Examples of such closed areas include (but not limited to) the inside of empty trucks transporting food stuff or animals and birds such as day-old chicks, closed rooms in hatcheries, food processing areas, laboratories, incubators, setters, walk-in cool rooms, animal rearing facilities (in combination with a full ***Virukill®*** continual disinfection program) abattoirs, veterinary consulting rooms, veterinary kennels, operating theaters and many more.

Virukill®

ADVANTAGES OF VIRUKILL® – THE ACTIVE IN THE VIRUKILL® DISINFECTANT AEROSOL FOGGER

Virukill® has been tested against a wide range of microbial pathogens and found to be highly effective even against very difficult to kill pathogens such as fungal spores, bacterial endospores and even naked viruses such as *Caine Parvovirus* and *Infectious Bursal disease virus*. ***Virukill®*** has been found to be highly effective against all bacterial pathogens including *Listeria monocytogenes*, various *Vibrio* species, *Camphylobacter* species, *Escherichia coli*, *Staphylococcus aureus, Pseudomonas aeruginosa*, various species of *Bacillus* and *Clostridium* (both vegetative cells as well as endospores) various species of *Salmonella* and many others (a full list of micro-organism against which ***Virukill®*** has been tested is available on request).

Virukill® has been tested and found to be very effective against various fungal species including *Aspergillus niger* and *Aspergillus fumigates*, both of which are problematic in poultry hatchery environments.

Virukill® has been found to be non-corrosive to various metals, plastics, rubber and other surfaces.

Virukill® has been found to be highly stable when diluted.

Virukill® has been proven to be less prone to the development of resistance than other disinfectants.

Virukill® has shown a strong residual effect against bacterial pathogens.

Virukill® has been shown to kill bacteria with only a 10 second contact time.

EFFICACY TESTS OF VIRUKILL® DISINFECTANT AEROSOL FOGGER

In independent laboratory tests, the efficacy of ***Virukill® Disinfectant Aerosol Fogger*** has been demonstrated at low temperatures (in a walk-in cold room) and at high temperatures (in a walk-in incubator at 37 ºC). High levels of efficacy were seen under both conditions (See Table 1 and Fig 1). Very limited bacterial growth was seen on the disinfected surfaces even after 5 days. ***Virukill® Disinfectant Aerosol Fogger*** is highly effective against various pathogenic micro-organisms (Table 2).

Table 1. Bacterial counts before and after disinfection with the ***Virukill® Disinfectant Aerosol Fogger*** in a walk-in cold room and walk-in incubator are treated.

Area Treated	Mean bacterial counts in cfu* per cm^2 (n = 10)			
	Before	3 hours post treatment	24 hours post treatment	5 days post treatment
Walk-in cold room	21.4	0.9	0.6	0.5
Walk-in incubator	31.6	1.4	0.7	0.7

* cfu = colony forming unit

Fig 1. Example of contact plates collected before and after treatment with the ***Virukill® Disinfectant Aerosol Fogger.***

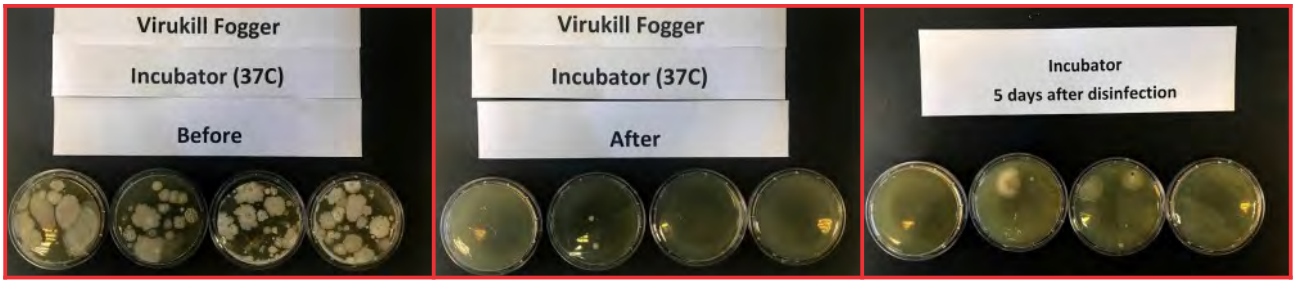


Table 2: Efficacy tests performed on various pathogenic micro-organisms tested with a 5 min contact time collected from a 400 cm^2 surface area. All bacterial counts are in colony forming units (cfu)/cm^2

Organism	Microbial inoculum in cfu/cm^2	Mocrobial count cfu/400cm^2 after inoculation (calculated)	Microbial count on control surface	Microbial count after treatment	Percentage kill rate
Escherichia coli	86.5	34 600	TMTC*	0	99.999%
Pseudomonas aeruginosa	306.25	39 800	TMTC	0	99.999%
Staphylococcus aureus	127.3	50 920	TMTC	0	99.999%
Enterococcus hirae	112.7	45 080	TMTC	0	99.999%
Candida albicans	21.2	8 480	TMTC	0	99.999%
Aspergillus brasilliensis	25.5	10 200	TMTC	0	99.999%

**TMTC = too many to count

PRECAUTIONS

FOR MORE INFORMATION CONSULT SAFETY DATA SHEET

1. Store locked up in a well-ventilated, dry place away from flammable materials, food products, and packaging material.
2. Protect from sunlight and intense light. Do not store at temperatures exceeding 30 °C.
3. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
4. Do not spray on an open flame or other ignition source.
5. Do not pierce or burn, even after use.
6. Do not breathe aerosol spray.
7. Wash hands and face thoroughly after handling.
8. Wear protective gloves, protective clothing, goggles and face protection. Avoid skin and eye contact with product and fumes.
9. Wear respiratory protection when entering treated area before aerosol spray deposit has settled.
10. **Re-entry interval**: Do not enter treated area until aerosol spray deposit has settled down/dried unless wearing the necessary protective clothing.

DIRECTIONS FOR USE

USE ONLY AS DIRECTED

1. Shake container before use.
2. Remove humans/animals/produce/plants/feedstuff and fodder from space to be treated.
3. Highly flammable: Put off all electronics and extinguish all flames before use.
4. Protect food utensils and packaging materials from direct exposure (cover with paper/plastic sheet).
5. Pre-clean dirty surfaces with an appropriate detergent, rinse and dry. Efficacy of disinfectant will be compromised if surfaces are soiled.
6. Place the canister on a solid surface in centre of area to be treated, or evenly distribute canisters if more than one is required, open cupboards, close all windows and doors, seal any openings. ***Virukill® Disinfectant Aerosol Fogger*** can be placed on a raised surface if area is higher than 4 m.
7. Activate the ***Virukill® Disinfectant Aerosol Fogger*** and leave the area immediately.
8. Allow 60 min for the aerosol to disperse and settle before re-entry.
9. Re-introduce animals/produce/plants only after fumes have cleared.
10. Thoroughly rinse or wash treated linen and clothing that will have skin contact during use, to remove disinfectant residues.
11. One canister will disinfect ~35 m^3 from fungi and bacteria, including spores.

ICA INTERNATIONAL CHEMICALS

Virukill® Disinfectant Aerosol Fogger
Reg. No: GNR529/243642/040/1200 (Act5)

ICA International Chemicals (Pty) Ltd. | Reg. No: 2001/013319/07
Tel: +27-21-886-9812 | www.icaonline.co.za | 28 Planken Street,
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ICA
INTERNATIONAL CHEMICALS (PTY) LTD

MANAGING POULTRY DISEASES IN A POST ANTIBIOTIC ERA

Virukill®

ICA International Chemicals contact details: +27-21-886-9812 | www.icaonline.co.za

Virukill®

THE BEST OPTION

POST ANTIBIOTIC ERA

By this stage everyone involved in poultry is aware of the major problems with antibiotic resistance. You should also be aware of the fact that there is increasing pressure to drastically reduce or even totally ban the use of antibiotics in animal production. This will leave poultry producers in a very difficult position.

Alternative control options to the use of antibiotics will be difficult to find. There are no new antibiotics in the development stage. Bacteriophages could be a possibility, but the very high specificity will make their use very difficult. The expression and use of phage enzymes also could have some potential, but there are also challenges with this.

The only really viable option to disease control in a post antibiotic era will be vastly improved biosecurity.

However, biosecurity is the least well understood of the control options and many serious misconceptions about biosecurity and disinfection means that this important stage in disease management is not done optimally.

Many poultry producers are still basing their selection of products to use for biosecurity and disinfectant purely on cost. The most important criteria to use for the selection of the products should be efficacy. The saving of some money at this critical stage will cost you hundreds, if not thousands in lost production, high mortalities and poor performance during the production cycle.

***Virukill*® is the best option for disease management in a post antibiotic era.**

THE ROLE THAT VIRUKILL® CAN PLAY IN DISEASE MANAGEMENT IN A POST ANTIBIOTIC ERA

Virukill®

Virukill® is a novel patented *didecyldimethylammonium chloride* (DDAC) based disinfectant (see information sheet on ***Virukill***® is not just another DDAC) which, if used correctly, will have a significant impact on disease management in a post antibiotic era.

The patented formulation of ***Virukill***® has dramatically increased efficacy of the DDAC and has also greatly decreased toxicity.

Virukill® is a product which has been especially developed for poultry and all tests needed to prove safety and efficacy in poultry have been done and are available from your local representative.

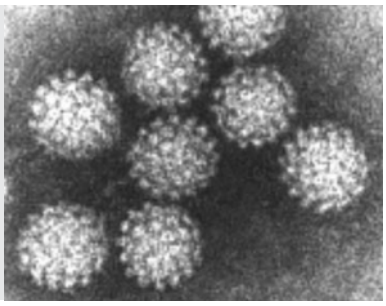
VIRUKILL® CONTINUOUS DISINFECTANT PROGRAM

The full ***Virukill***® continuous disinfection program is your best option for disease management in a post antibiotic era.
This consists of 4 very important steps: -

STEP 1

Effective preplacement disinfection

See information sheet of pre-placement disinfections. Remove all of the pathogens, bacterial and viral, at the pre-placement disinfection stage is critical to disease management and good performance. The effective inactivation of Infectious bursal disease (IBD or gumboro) virus and Chicken anaemia virus (CAV) is critically important at this stage.



STEP 2

Effective biosecurity

Effective biosecurity through the correct use of footbaths and vehicle sprays. Make sure that the disinfectant in the footbath is clean at all times. Change the disinfectant in the footbath regularly. When the footbath is visibly dirty or the disinfectant's efficacy will be compromised.

STEP 3

Continuous treatment of drinking water

Continuous treatment of the drinking water with a 100 ppm solution of ***Virukill***® (10 ml ***Virukill***® per 100 L water). This should be continuous – except when making use of live vaccines or addition of probiotics where a 24 hour withdrawal time is needed. Before the first continuous use of this very low ***Virukill***® concentration in the drinking water, the drinking system must be flushed & cleaned with a 1% ***Virukill***® solution.

NB. The chickens must not drink a 1% solution of ***Virukill***® – this is just to flush the system and remove the biofilms in the drinking systems.

The safety and efficacy of this drinking water application has been tested extensively and if used according to label recommendations it will have no negative effect on any production parameters.

STEP 4

Regular spraying of the air around the birds

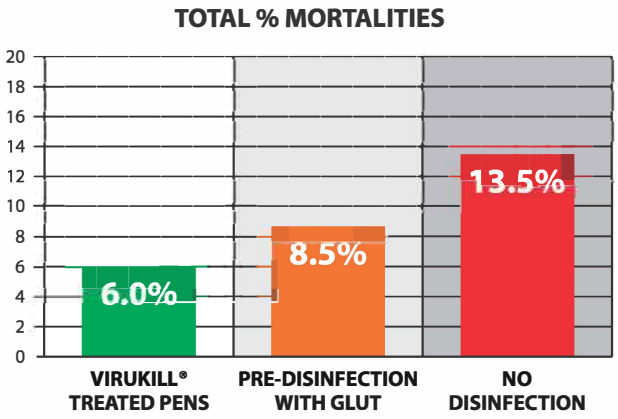
Regular spraying of the air around the birds with a 1% solution of ***Virukill***®**.** The safety of this has been extensively tested and it has been proven to be safe up to three sprays per day. The frequency with which you stray the birds depends on the disease challenge faced. In the face of a serious disease outbreak, you can spray three times a day if needed.

With no major disease challenge you can spray the birds one or twice a week. If you have cooling systems in the houses, you can spray with ***Virukill***® solution as often as you spray the birds to cool them down.

PROOF OF CONCEPT

This system has been used for many years in various parts of the world. Data on this has also been published *(Bragg & Plumbstead, 2003)*.

In that published experiment, birds from the two **non-*Virukill*®** treated groups developed colisepticiameia and had to be treated with antibiotics. The ***Virukill*®** treated group was not treated with antibiotics. Apart from the clear savings in the 2.5% reduction in mortalities in the ***Virukill*®** treated pens which were recorded, no antibiotics were used. This is critically important in the pending post antibiotic era where you will not be able to make use of antibiotics.



METHODS & DILUTIONS FOR THE USE OF VIRUKILL® IN THE FULL CONTINUOUS DISINFECTION PROGRAM

Pre-placement disinfection

1) Dry clear the house and get rid of as much dust and dirt as possible.
2) Wash with a 0.2% dilution of ***Virukill*®** in water (200 ml ***Virukill*®** per 100 L water) and apply like you would apply the water for washing – at least 2 litres per m^2 This can be sprayed making use of the high pressure washing system.
3) Allow to dry.
4) Disinfect house with a 1% solution of ***Virukill*®** (1 L ***Virukill*®** per 100 L water) at around 600 ml per m^2. The volume is dependent on how long the floor takes to dry. The floor must preferably remain wet for 20 minutes. If the floor starts drying before this time, add more of the 1% ***Virukill*®** solution.
5) Disinfect cooling pads with a 0.2% ***Virukill*®** (200 ml per 100 L water) solution. If ***Virukill*®** is used in cooling pads for the first time it is recommended to pre-disinfect the cooling pad with 1% ***Virukill*®** solution.
6) Disinfectant all equipment – including the drinking water system from the header tank through all of the drinkers with a 1% ***Virukill*®** solution.
7) Add bedding and all other items.
8) Replace all equipment which has previously been removed from the house and disinfected with a 1% ***Virukill*®** solution.
9) Do a final fogging if desired at the following application rates:
   ULV Solution:
   500 ml ***Virukill*®**, 5 000 ml Propylene glycol, 14 500 ml Water
   Fogging Solution (Cold or Thermal):
   500 ml ***Virukill*®**, 17 000 ml Propylene glycol, 2 500 ml Water

   The rate for both fogging and misting is 550 ml per 1 000 m^3.

Footbaths

Use a 1% ***Virukill*®** solution and change once dirty.

Drinking water application

Add 100 ppm ***Virukill*®** (10 ml per 100 L water) to the drinking water of the birds on a continuous basis. The drinking system must first be flushed clear with a 1% ***Virukill*®** solution which the birds should not drink.

Please note that there is a 24 hour withdrawal period when vaccinating with live vaccines or treating with probiotics.

Disinfection of the air in the presence of birds

Spray the air around the birds with a 1% solution of ***Virukill*®** at application rate of approximately 4 ml per adult bird as often as required. Safety has been tested up to three sprays per day.

ICA INTERNATIONAL CHEMICALS

Virukill® (Poly Dimethyl Ammonium Chloride 120g/ℓ)
Reg. No: G2838 (Act 36 of 1947)

ICA International Chemicals (Pty) Ltd. | Reg. No: 2001/013319/07
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