



Sal CURB® S Antimicrobials

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Sal CURB® S antimicrobials are a blend of aqueous formaldehyde, acetic acid and propionic acid. Sal CURB® S products can be used as part of a feed safety programme and are effective in reducing pathogens present in feed ingredients and feeds and can act as a safe guard for feed.

How does Sal CURB® S work?

The active antimicrobial ingredient in Sal CURB® S is formaldehyde. Formaldehyde is found naturally in the environment. It is a highly volatile gas, which has a high affinity for water (#1) or protein (#2). Formaldehyde will readily attach to proteins through cross-linkages with their primary amine groups (Mannich Reaction). Once the formaldehyde binds to the proteins in the feed, it cannot release and is no longer free to bind to anything else, until pH levels drop to acidic levels, whereby the binding is again released (e.g. in gizzard/ stomach).

Just like all living organisms, every pathogen and microbe has a lipo-protein membrane or cell membrane. When pathogens are in the presence of formaldehyde, the formaldehyde will seek out and attach to the pathogen's lipo-protein membrane. After attaching, the formaldehyde will begin to draw moisture out of the pathogen, leading to desiccation and death. The binding also blocks key transport and cellular activities, preventing normal functioning of pathogenic cells.

Which Sal CURB product is recommended for use in Broilers, Layers and Broiler Breeder feeds where a *Salmonella* positive has been found?

All of our Sal CURB products are effective and broad spectrum antimicrobials which can safely be used in all types of animal feed, however the dosage of the different products may need to be adjusted, to obtain the same efficacy, as the concentration of actives and efficacy of different compounds vary. Generally, the highest efficacy and kill-off of *Salmonella* is achieved with the Sal CURB S products, due to the inclusion of formaldehyde, which is a very potent and effective antimicrobial. For pathogen reduction a minimum dosage of 2 kg/ tonne of Sal CURB® S Liquid is advised. The following table gives guidelines for recommended dosages to reduce Salmonella contamination.

Feed Type	Sal CURB® S Liquid (kg/ t recommendation)	Sal CURB® S Dry (kg/ t recommendation)
Broiler	2	4
Layer	2	4
Breeder (Layer/ Broiler)	3	6

Can the Sal CURB® S products be used in breeder feeds?

Yes, the full range of Sal CURB® products, including the Sal CURB® S range, has specifically been developed for use in all animal feeds and is safe to use in all breeder feeds and during all growth and reproduction phases.

What is the recommended dosage of Sal CURB® in pelleted broiler feeds for *Salmonella* control?

1 kg Sal CURB® S Liquid/ tonne of feed for preventative management, 2 kg/ tonne of feed is recommended for treatment, to ensure Salmonella negative status. A liquid product is generally preferred for its excellent distribution characteristics, high concentration of total actives and cost effectiveness is improved. Liquid products can also be applied via automated equipment, allowing for low handling risks for workers.

What is the anticipated reduction in Salmonella, when the product is correctly applied?

This is dependent upon the microbial load of the feed matrix, however our research indicates an average 2.0 cfu/g log₁₀ reduction of standard Salmonella levels at 2 kg/t of feed dosages, within 24 hours. For a 1 kg/t dosage, an average of around 1.0 log₁₀ cfu/g reduction in Salmonella is anticipated within 24 hours, when applied correctly.

What is the difference between formaldehyde-based products and organic acid based products?

Both formaldehyde and organic acid based products can be effective in managing microbial risks when applied correctly and at the recommended and proven effective levels. Organic acids are excellent anti-microbial compounds, however a higher dose/ concentration is needed and consequently a higher cost impact is seen with these types of products. The time taken for organic acid efficacy is also generally longer than for products containing faster acting ingredients, such as formaldehyde, which is the gold standard in microbial management. Thus, early treatment is often recommended for organic acid based products. Organic acids, such as formic acid, are also quite corrosive if not buffered and protected.

Is the efficacy of the dry product better than the liquid product, when it comes to the hygiene of the feed and animal performance?

Both the liquid and the dry product are highly effective, however the liquid product is more concentrated and thus more cost effective, as a lower dosage is needed for the same effect (around half the dose of the dry product for equal efficacy). Using liquids also allows for automated and safe application of the product within the mixer, without handling of the product (no PPE required as with the dry product). Automated application also allows for excellent distribution and mix of the product within the feed, when using the correct equipment. Our internal testing shows that liquid products tend to have a higher efficacy, due to the liquid products allowing for improved distribution of the product within the feed mix, through smaller droplet size versus a dry product, when applied correctly.

What is the guaranteed min formaldehyde in the product?

A minimum of 13% free formaldehyde in the liquid product.

What other organic acids are in the product and what are the minimum guaranteed levels?

Acetic and propionic acid (min 5% combined total) in the liquid product.

Should recontamination take place, how long is the residual effect against Salmonella?

According to our local research, there is still 100% efficacy 7 days after treatment and according to our overseas data, there is still good activity and suppression of Salmonella for up to 15 days post treatment.

What is the residual effect of the organic acids in the product and what is the mode of action for this effect?

The organic acid levels in the product are not sufficient to expect any Salmonella control or additional antimicrobial effects, the function of the organic acids in the product are to help stabilise the product and improve application and penetration efficacy within the feed matrix.

How long does formaldehyde emit from feed?

Internal research conducted by Kemin has shown that with good application and proper mixing, the majority of cross-linking or binding happens within the first 13-15 minutes, leaving little free formaldehyde available to emit from the feed¹. Between 2-24 hours feed stops releasing formaldehyde, as by this time the formaldehyde has completely bound to the proteins in the feed.

Is Sal CURB® treated feed safe to touch?

Feeds which have been treated with Sal CURB® are safe to handle. Formaldehyde is included at less than 0.1% in the feed and is below any levels that would cause harm. Additionally, due to the product being bound to the proteins present in the feed, there is no “residue” on the feed to worry about. However, as common good management practices it is recommended to never touch feed with bare hands, due to general safety and feed biosecurity concerns.

Is the dust from Sal CURB® treated feed dangerous?

Kemin always recommends protecting yourself from dust when working around feed. Similar to when touching feed, the level of formaldehyde and binding characteristics render Sal CURB® treated feed as no more dangerous than dust from non-treated feed. As previously mentioned, feed dust contains many other hazards and breathing in feed dust whether treated with formaldehyde or not, should always be prevented.

Is it safe for the animal to eat Sal CURB® treated feed? What about the safety of the people eating meat from an animal fed Sal CURB® treated feed?

Kemin is dedicated to providing feed biosecurity solutions which are both effective and safe for animals. Formaldehyde is a naturally occurring compound and is found in meat, eggs and milk naturally (with or without supplementation, as it is produced during normal metabolism, as well as in the environment). Formaldehyde is a metabolic intermediate and is present at low levels in most living organisms and is emitted by bacteria, algae, plankton, and vegetation. Formaldehyde is very rapidly metabolised within animals and humans. Formaldehyde is released in the stomach and absorbed into the bloodstream, where it is metabolised to formic acid via the red blood cells. Formic acid is then metabolised into carbon dioxide and water. The metabolic half-life of formaldehyde is 60 - 90 seconds.

With correct application of Sal CURB® in the feed, the formaldehyde is bound to the feed and not free when the feed is consumed by the animal. As an FDA approved feed ingredient, formaldehyde has been tested for animal, feed and food safety when applied in an appropriate manner.

Formaldehyde is listed as a carcinogen¹, why is that?

Research in rats has shown that high levels of exposure to formaldehyde over prolonged periods of time can lead to the development of cancerous cells in the nose of the animal. To protect humans from high level, long-term exposure, the United States Occupational Safety and Health Administration (OSHA) sets standards on the

safe levels of exposure to formaldehyde and has three employee exposure levels. The permissible exposure limit (PEL) is 0.75 ppm over an 8-hour time weighted average; whereas, the action level, the lowest level, is set at 0.5 ppm. The PEL is the level of exposure established as the highest level of exposure an employee may be exposed to, without incurring the risk of adverse health effects².

To ensure worker safety, Kemin works to monitor air quality in mills handling Sal CURB® and follows the USA regulated levels, which are lower and more stringent than the South African limits. Employee exposure levels for customers handling Sal CURB® are shown below in Figure 1, with the OSHA Action level included for reference. The exposure levels indicated on the graph represents the average of each employee exposure at each location. The average exposure for Sal CURB® customers is 0.063 ppm. This level is well below the regulations set forth by OSHA.

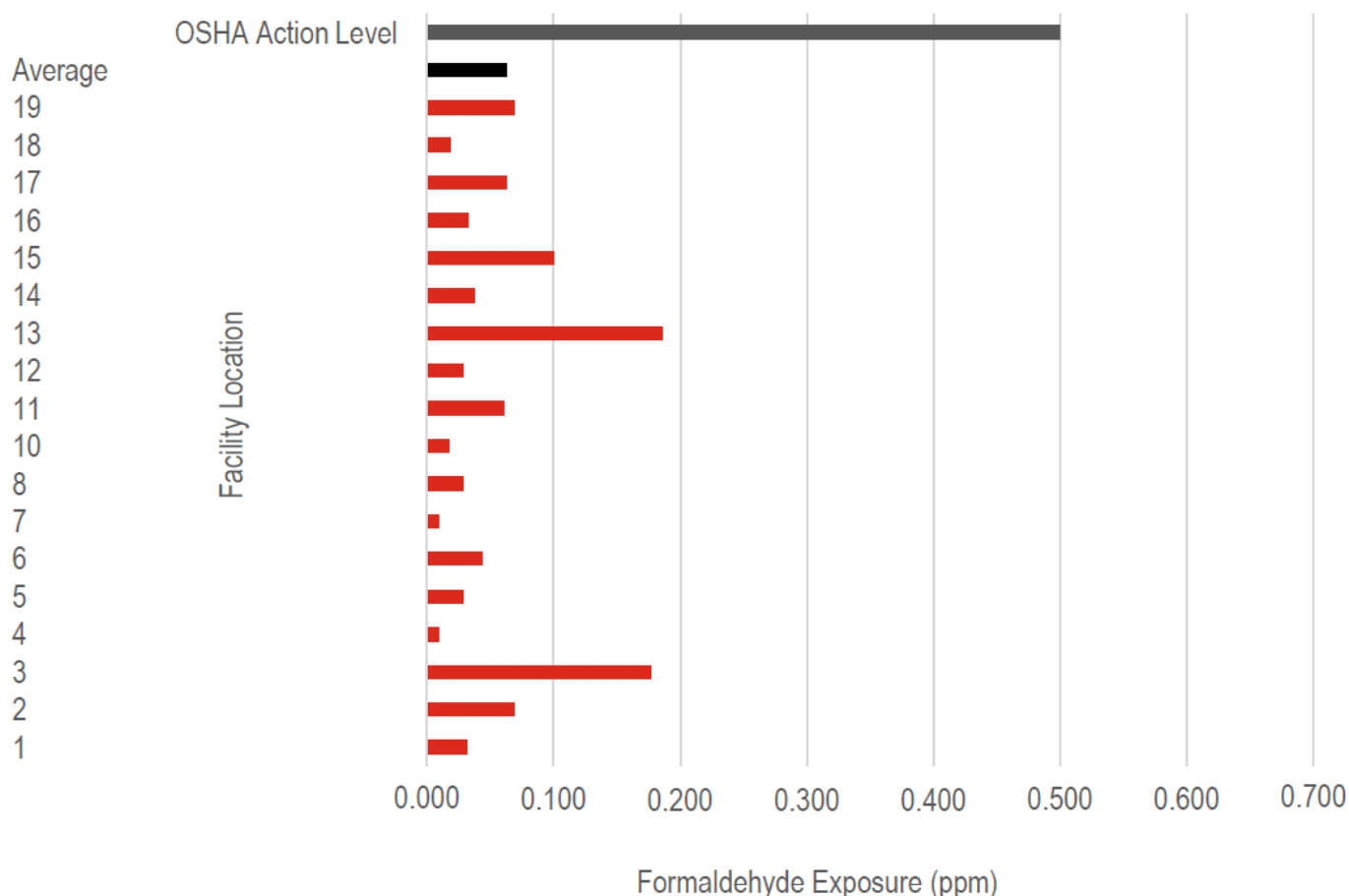


Figure 1. Mean employee exposure to formaldehyde at facilities handling Sal CURB® liquid antimicrobial³.

When using the liquid product, how should any spills be managed and cleaned up?

Kemin supplies a spill kit with all Kemin product application systems, which contain guidelines and equipment to help clean minor spills and contact details for assistance with major spills. Generally, vermiculite or a good adsorbent material is used to absorb the liquid from the area where the spill has occurred, and this is then discarded via the correct disposal channels. Avoid discharge from spills into drains, water and soil. Kemin can

supply instructions for managing spills and documents are available for all customers. The SDS documentation also contains information on management of spillages. Full spill kits and replacement stock can also be purchased from Kemin.

References

1. National Research Council. Review of the Formaldehyde Assessment in the National Toxicology Program 12th Report on Carcinogens. The National Academies Press, Washington, 2014.
2. Occupational Safety and Health Administration, 1995. Standard Interpretations, 1910.1048 Formaldehyde. United States Department of Labor, California, 1995.
3. Kemin Internal Documents: TL-17-KSSA04 and TL-14-00042.