

It's time to think outside the (feed) tank

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In recent years, there has been a key focus on the use of various fats and oils in poultry diets. This move stems from the increased costs related to raw materials and vegetable oils.

Energy sources provide several advantages to a diet and its benefits to the poultry industry have been well documented. Oxidation of fats/oils is an ongoing process; it is an irreversible process where free radicals are formed when fats/oils remain exposed to certain external factors.

Oxidation can have several unfavourable results, such as lowered nutritional value of the ingredient, feed refusal that leads to lowered feed intake, creation of off-flavoured compounds, rancidity, reduction of shelf life, and oxidative stress. The negative impact on the energy and nutritional values of fats/oils can be costly.

The effects brought about by free radical chain reactions during the oxidation process can, however, be slowed down with the use of a combination of radical scavenger molecules, metal chelators, and an inert carrier.

A selection of antioxidant solutions

Several synthetic antioxidant solutions are utilised in the South African feed industry, such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate, and ethoxyquin. The natural antioxidant solutions available in the global feed industry include α -Tocopherols, oregano, nutmeg, rosemary, thyme, sage, basil, pepper, cinnamon, and cloves.

The combination of one or more of these antioxidants has proven to offer better protection compared to stand-alone ingredients. It is for this reason that scientists worldwide have formulated a range of both dry and liquid

products that can be used in the animal feed production sector.

Oxidation can be measured by primary (peroxides, dienes, and so on), secondary (carbonyls, aldehydes, trienes), and tertiary products. Primary oxidation can be measured by a peroxide value (PV). It is used as an indicator of the primary oxidative state of a product and is defined as the amount of peroxide oxygen in mEq per kilogram of product.

During secondary oxidation, PV levels decrease due to peroxides being utilised in the production of aldehydes and ketones. Thiobarbituric acid/malondialdehyde (TBA) value is measured in milligram per kilogram and is used as an indicator of secondary oxidation.

Tertiary oxidation results in a decline in TBA values as the products are transformed into free fatty acids. A p-anisidine value (AV) is an additional indicator of secondary oxidation. Total antioxidant (Totox) is calculated as $2PV + AV$ and is used as an additional convenient measure of oxidation.

The different phases of oxidation

There are three distinct phases of oxidation, namely initiation, propagation, and termination. Initiation is the step whereby radical species are created from exposure

to oxygen, moisture, light, storage time, temperature, and the presence of metal ion compounds such as copper and zinc.

Propagation is the continuous step during which the free radicals of the initiation phase react to form additional free radicals, resulting in peroxide formation. Termination results in free radicals reacting with one another to form a stable molecule, thus ending the lipid oxidation cycle (Figure 1).

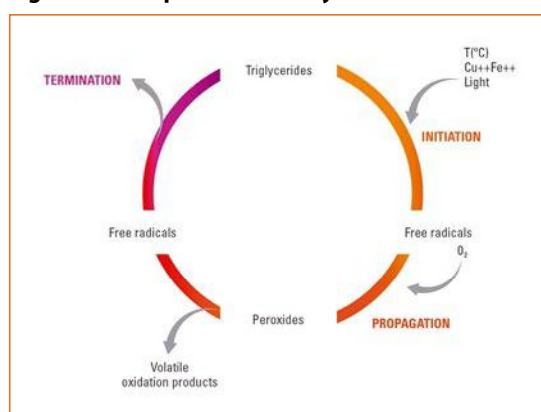
Steps to guarantee a positive outcome

Product storage can result in either a delay or acceleration of the oxidation process. Storage of products in a cool, dry, and dark area is advised. Stock control rules (first in, first out) should always be applied to ensure that stock does not remain on the floor for a long period of time.

Cross-contamination between old and new products should be avoided as far as possible. A combination antioxidant is advised based on the type of operation. The type of oil produced or utilised is an important factor to consider. Some fats/oils are more prone to oxidation than others, by virtue of their content of unsaturated versus saturated fats. The addition of an antioxidant into the production process as soon as possible offers improved protection against the effects of oxidation.

An initial audit of the entire production process is necessary to detect the areas of concern. Thereafter, treatment and continuous monitoring of treated feed ingredients and final feed is paramount to ensure the success of an antioxidant. This should form part of a facility's quality assurance programme and displays commitment to feed safety. 🌱

Figure 1: The lipid oxidation cycle.



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