

## The importance of Antioxidants in the feed chain

**The application of antioxidants to animal feed and its ingredients is essential and mandatory for safe and adequate animal nutrition.**

Oxidation is one of the major causes for quality loss during processing and storage of feed products. It also generates by-products that can reduce the nutritional content of feed, lack thereof might negatively affect animal health, performance and welfare. The use of antioxidants in different feed ingredients, such as feed additives, premixtures, raw materials and compound feed, is crucial to prevent or delay the oxidative process and secure the quality and nutritional value of feed.

### a. Main factors influencing oxidation of feed:

- Temperature: the speed of oxidation increases with temperature. High temperatures do not only affect the rate of oxidation but also facilitate chemical reactions which would otherwise not occur.
- Light: can initiate lipid oxidation by formation of free radicals in fatty acids chains.
- Oxygen: the presence of oxygen catalyses oxidation processes.
- Transition metals: heavy metal ions are powerful catalysts for the oxidation of lipids.

More specifically, the process of autoxidation is a complex series of sequential and overlapping reactions of free radicals. This chain reaction, which irreversibly alters the qualities of a product, is unavoidable. However, it can be delayed with the help of antioxidants.

### b. Raw materials in feed and premixtures prone to oxidation:

There are several components in feed that are sensitive to oxidative degradation:

- Fats, oils, and fat/oils: fats and oils have become of increasing interest in feed formulations, because they are the greatest source of energy per unit of weight of any feed ingredient. During the oxidation process their nutritional value decreases and the feed develops a rancid smell, which makes it unpalatable for the animals.
- Vitamins: especially the fat-soluble vitamins (A, D, E, and K) are concerned. During the oxidation process the calculated bioavailability decreases and this can affect animal health and growth significantly.
- Carotenoid pigments: as e.g. astaxanthin, lutein or zeaxanthin that are used for colouring fish and poultry feeds. Once they are oxidized, the colour may fade or even disappear.
- Proteins: oxidized oils and fats can interact with the side chain of amino acid, residues or peptides chains, resulting in a decrease of the nutritional value of the protein.

### c. Antioxidants in the EU Feed Market:

Antioxidants are classified as technological feed additives within EU legislation (ref. Regulation (EC) No 1831/2003 on additives for use in animal nutrition). The following antioxidants, listed according to their active ingredient, are authorised in the EU: butylated hydroxytoluene, butylated hydroxyanisole, propyl gallate, ascorbyl palmitate, tocopherols.

#### d. Examples demonstrating the need for antioxidants in feed:

- **Vitamin A** cannot be synthesised by animals themselves, therefore it must be supplied via feed. The active substance of vitamin A is highly sensitive to oxygen, light and elevated temperatures. All these environmental factors contribute to the degradation of the amount of vitamin A that the animal finally ingests. Especially during feed processing the temperature, moisture, pressure and friction (i.e. extrusion, expansion and pelleting) are elements which significantly stress the stability of vitamin A. Additional factors such as humidity and the presence of other additives in vitamin and mineral premixtures can accelerate degradation. It is therefore necessary to stabilize vitamin A with an efficient antioxidant system before placing the product on the market and introducing it in the feed chain. To ensure compliance with the regulatory requirements, the stability of the active substance needs to be secured during manufacturing and storage through the use of antioxidants.
- **Fishmeal** in particular, but also other protein meals like soybean meal, rapeseed meal and meat meal, is very sensitive to oxidation due to its high fat content. Autoxidation will reduce its nutritional value and may cause heating and, sometimes, even spontaneous combustion. Given the characteristics of fishmeal, it must be treated with antioxidants as early as possible in the production process. In fact, adding antioxidants to fishmeal is a legal requirement by the International Maritime Organization.
- **Consumption of oxidized fats by animals** is linked with health problems, reduced growth and discomfort. Lipid oxidation products can be absorbed by the animal's body through the diet and affect cellular integrity. Though animals have a biological protection mechanism to combat free radicals naturally forming as a consequence of different metabolic activities, the additional supplementation of antioxidants in some animal species and under certain circumstances has proven to reduce such "oxidative stress" and strengthen the animals' natural defence system.

**The authorisation of antioxidants according to Reg (EC) No 1831/2003 is therefore essential to ensure a safe and functioning feed chain.**