



Pet Food

Safety - Health - Quality





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Pets find their way into the hearts of their owners. You love to give something in return for the company and affection of your dog or cat. The strong human-animal bond between pets and their owners contributes to a more emotional concern. Besides nutritional needs, pet food should be tasty, healthy, safe and adapted to the lifestyle of the pet and its owner. The choice of raw materials, formulation and production technologies should be in line with these requirements in order to provide top quality pet food for the best friend of the family.



Autoxidation

Autoxidation is a typical example of undesired chemical feed degradation. It is a destructive irreversible reaction which occurs in organic materials when exposed to oxygen. It has a major impact on flavour, nutritional quality, and health of the feed product, which are major concerns for pet owners and nutritional feed manufacturers. Because of rancid flavour and change of colour and texture, the process of oxidation leads to a lower palatability and by consequence to a reduced feed acceptance by the pet. Vitamins, fats and proteins lose their important nutritional value and the aggressive molecules formed during the process are detrimental to the intestinal cell lines and beneficial bacteria.

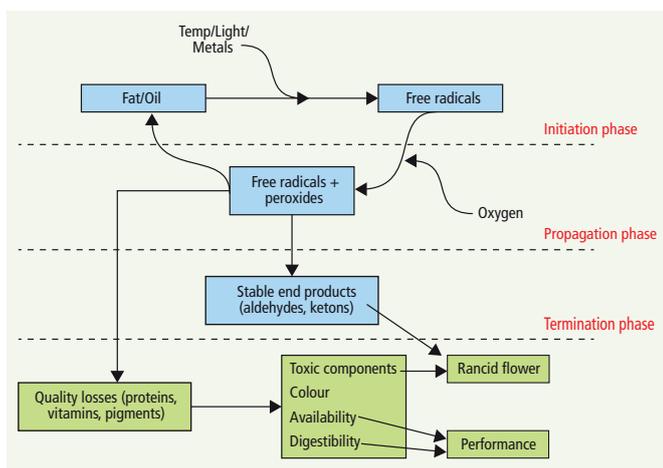


Fig. 1: Different phases of the oxidation cycle.

Autoxidation is a three-phase process (figure 1). Temperature, light and metals initiate the autoxidation process by breaking down an electron bond of an unsaturated fatty acid. In that case a free radical is formed. Free radicals then contain an unpaired electron and have a net positive charge and are therefore highly reactive chemical molecules. They attack nutritional components and animal cells in order to replace the electron and neutralize themselves. Chelating agents, such as citric acid, form a complex to metal ions by which the reactivity of the metal is neutralized and the initiation phase is limited.

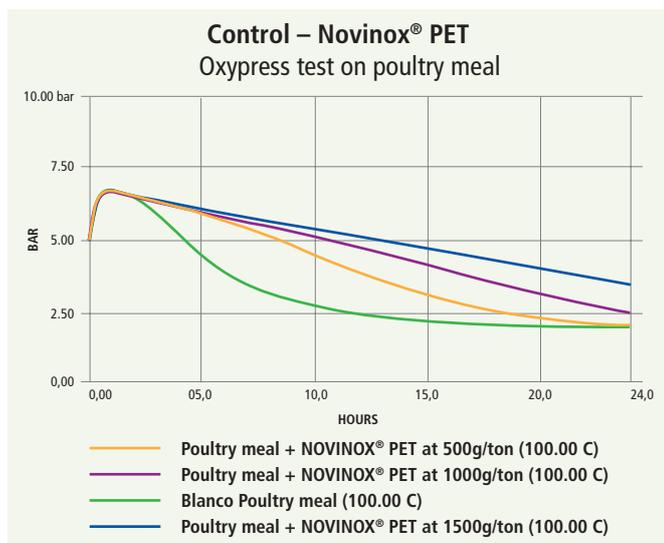
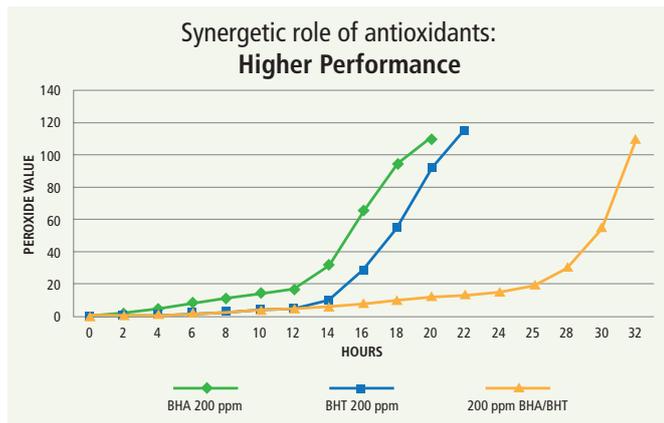
Formed radicals react spontaneously with molecular oxygen to form peroxides, which will interact with other oxidation sensitive molecules to yield hydroperoxides and new free radicals. In this way a chain reaction of radicals is set, disrupting millions of molecules. Two radicals interacting with each other form stable non-radical end products. The peroxides and hydroperoxides degrade to volatile aldehydes and ketones with strong off flavours, causing the oxidative rancidity.

Novinox® – The perfect antioxidant:

- Fat soluble
- Effective in low concentrations (high contact surface)
- Active ingredients relevant to the substrate
- Ethoxyquin free
- No objectionable smell
- Limits the initiation phase
- Stops the propagation phase
- Synergy between active molecules

NOVINOX[®], the complete antioxidant program

NOVINOX[®] PET contains a well-balanced synergetic synthetic antioxidant system of BHT and BHA, enforced with chelating agents such as citric acid. An ethoxyquin-free antioxidant specifically designed for dry pet food, snacks and raw materials.



NOVINOX[®] NAT, a natural antioxidant based on tocopherols and rosemary extracts.

Rosemary extract, derived from *Rosmarinus officinalis L.*, is standardized for its specific compounds carnosic acid and carnosol, which exert antioxidative functions.

Natural tocopherol exists as a mixture of 4 homologues, Alpha, Beta, Gamma and Delta. They occur naturally in vegetable oils. These mixed tocopherol concentrates are proving to be valuable ingredients when regulations do not permit the use of more effective synthetic antioxidants or where natural source antioxidants are simply preferred.

Bacteria in pet food



INNOVAD[®] puts special focus on bacterial contamination and feed hygiene. The whole production chain, from raw material producer to pet food manufacturer has to be involved in this process. Any risk of contamination of pet food with potentially pathogenic bacteria should be monitored and corrective actions should be taken. Besides *Salmonella* and *E. coli*, bacteria such as *Listeria* and *Campylobacter* are of growing concern due to their influence with respect to antibiotic resistance.

A feed hygiene program should take into account the following control points:

- Types of raw materials: fish meal, animal protein meals and vegetable protein meals have a much higher risk of contamination.
- A risk assessment of the installation with special attention to elevators, transport systems and cleaning procedures.
- Production processes including pelleting, extrusion and heating can reduce the bacterial count in pet food, but condensation of the warm air in the cooling phase can easily lead to quick and significant recontamination.
- Pest control (mice, birds, rats).

NOVIBAC[®] product range

The NOVIBAC[®] product range offers carefully designed preservative concepts that can be selected based on active components, buffered or non-buffered mixes, liquid or dry application, corrosiveness, etc. Based on know-how and experience, INNOVAD[®] can define with the customer the most appropriate product and application.



Gut health and integrity



In the small intestine a major part of digestion and almost all absorption of nutrients take place, while feed passage time is relatively short. A healthy intestinal tract is required for optimal and undisturbed nutrient utilization. Age and stress can lead to loss of gut barrier integrity, increasing the need for specific energy to maintain and guarantee proper cell proliferation.

NOVYRATE® EB

NOVYRATE® EB is a synergistic combination of esterified butyrins, with immediate activity in the early part of the intestinal tract, and a prolonged effect towards the hindgut.

Key benefits of using butyric acid source:

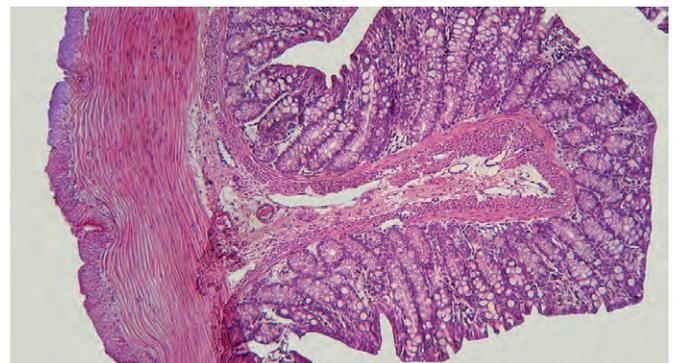
- Helps support the development of epithelial cells by providing a readily available source of energy
- Enhances enterocytes and intestinal velocity development by stimulating villi growth
- Controls the microbial balance and helps to overcome bacterial infections
- Neutralizes oxidative stress and inflammatory compounds at intestinal level.
- Maintains perfect barrier function by increasing tight junction functionality.

Esterified butyrins are combined molecules composed of a glycerol structure and butyrate molecules. The final result of the esterification is a combination of mono-, di- and tri-butyryns which provide a source of butyrate molecules in the intestinal tract. The triglyceride-like structure of esters can only be digested in the presence of the digestive enzyme lipase, which is hardly present and active in the stomach. By definition, this guarantees full stomach bypass properties, while being activated after pancreatic lipase has been added once the feed moves towards the small intestine.



During the esterification process, it is of utmost importance that the reaction is controlled carefully in order to guarantee the desired stability of the product. A correct catalyst, the right esterification speed and the final purification step need expertise and profound chemical knowledge, resulting in a highly concentrated, pure and colourless product with a high stability in time and during the pelleting process, guaranteed without the typical smell of butyric acid.

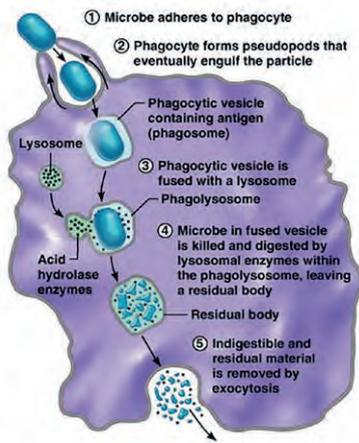
Due to the balanced ester combination, **NOVYRATE® EB** combines butyrate supply (quantity) and strong antibacterial activities (quality).



Immunity

The immune system is an incredible defense mechanism which protects the body from many kind of disease-causing agents including bacteria, viruses, toxins, and parasites. The adaptive portion of the immune system is very specific, reacts to unique molecules called antigens, and uses antibodies and cell-mediated immunity to rid the body of foreign substances. Non-specific immunity provides protection for the animal from many foreign invaders through cells like macrophages. As the intestine is in continuous contact with the outside environment, the intestinal immune function plays a very important part. Especially the non-specific immunity of pets can be reinforced and optimized by the use of quality sources of Beta-Glucans and Mannan-oligosaccharides.

First line defense: Focus on blocking pathogen attachment and phagocytose capacity.



Phagocytosis by the macrophage.

Before entering the body, pathogens will adhere to the gut wall, which will give them time to prepare invasion and cause structural damage to the defense system (natural barrier function) which is present.

Once invaded, the non-specific immunity becomes active by means of phagocytosis, a mechanism by which bacteria are destroyed by different types of cells such as macrophages, white blood cells that engulf and digest foreign agents that have entered the body.

Vesicles in the cytoplasm of the macrophage, release enzymes such as lysozyme, protease, super peroxides, etc., resulting in the total destruction of the invader. Finally the digested content is eliminated of the phagocyte and presented to the specific immune system in order to enlarge its database and prepare for immediate action in case of repetition.

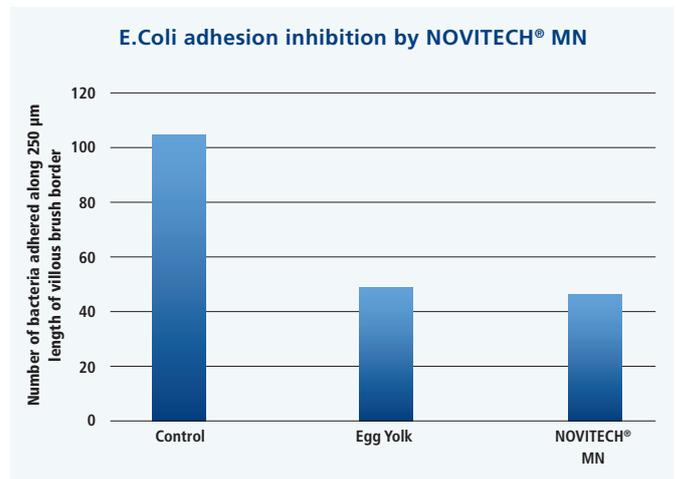
NOVITECH® MN

NOVITECH® MN is a biological defense modifier. It provides yeast mannan-oligosaccharides (MOS) and beta-glucans for gut immunity.

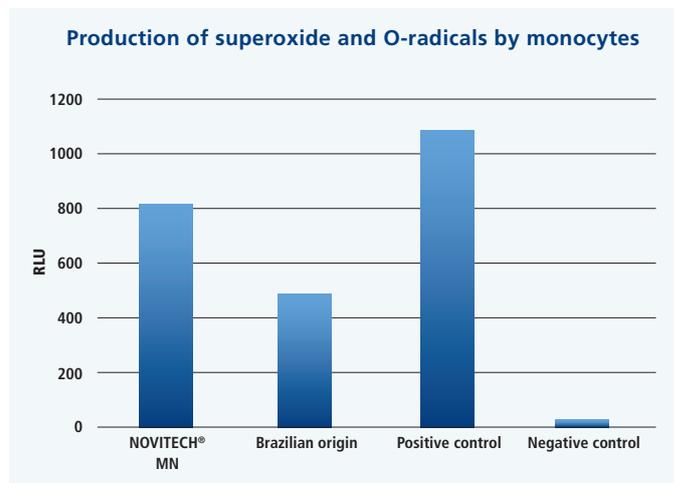
Beta-glucans elevate immune signaling and the recruitment of macrophages to the intestine in order to counter anticipated pathogenic challenges, while MOS limit pathogenic bacterial development by the inhibition of bacterial binding to intestinal villi without affecting the binding site for beneficial bacteria as they are able to colonize the environment. The intestinal structure is maintained and the pet shows better growth, overall health, well-being and longevity.

Although the level of MOS and Beta-glucans are guaranteed, it does not guarantee successful immune support. The correlation between immune supportive properties and the concentration of MOS and Beta-glucans was subjected to research and was found to be very low. Other parameters like yeast strain, fermentation process, hydrolysis and purification could influence the immune supporting activity.

More appropriate and correlated in vitro and ex-vivo testing procedures have been developed in order to make proper differentiation possible and to ensure qualitative and uniform properties of **NOVITECH® MN**.



Reference: INNOVAD® (University of Bologna).



Reference: INNOVAD® (University of Ghent).



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Oxidative stress

Oxidative stress results from an imbalance between levels of antioxidants and reactive oxygen species (ROS).



Factors that can cause oxidative stress – such as reproduction, whelping, growth, competition, other stress situations, etc. – occur in the pet's whole lifecycle, from kittens and puppies to adult cats and dogs.

ROS are formed by cellular respiratory activity. As a result of incomplete reduction of oxygen to water, ROS – very aggressive molecules – are ready to damage the important metabolic process. Especially tissue organs with a high metabolic rate are susceptible to significant levels of ROS. Ideally these free radicals are neutralized by the body's own anti-oxidant systems.

Research for new bio-efficient antioxidants has particularly focused on natural antioxidants in order to respect the consumer concerns over safety and toxicity. Grape seeds and green tea extracts provide an abundant source of flavonoids and polyphenols. It has been reported that the antioxidant potential of grape seed extract is 20 and 50 fold greater than vitamins E and C respectively, arising from increased levels of polyphenols.



AFSORIN® BF antioxidant by nature

AFSORIN® BF is a unique formulation of polyphenols and powerful chelators, which represent an efficient source of antioxidants, reinforcing the natural antioxidant defense system through grape seed oil and green tea extracts.

Urinary tract

Reaching the highest possible animal health status has become a key element for pet owners. Pet food can be an ideal vector to interfere in this health subject, where the focus has clearly changed from treatment to prevention.

Lower urinary tract disorders commonly occur in cats and dogs. It is a broad term that is used to cover a number of conditions associated with the lower urinary tract, including the bladder and urethra. It presents a variety of problems such as inflammation of the bladder (cystitis) or urethra, formation of urinary crystals and stones in the bladder (*crystalluria/uroolithiasis*), and partial or total obstruction of the urethra.

Lower urinary tract disorders are a risk factor for all pets: male cats have a longer and narrower urethra, which makes them more susceptible to blockage. Female dogs more frequently encounter infections of the urinary tract due to a shorter urethra through which bacteria reach the bladder rather quickly. Neutered male cats are more likely to become overweight, which increases the risk of developing urinary problems.

Bladder stones and grit are common in pets and cause irritation and inflammation in the urinary tract. The most frequent kind of grit is the struvite, which consists of magnesium ammonium phosphate. Below a certain pH value, the grit can transform itself into bladder stones. For some instances, they can obstruct the urinary tract making it difficult for the pet to urinate and causing the bladder to overflow. The waste materials present in the urine will accumulate in the blood, leading to blood poisoning.

Nutritionally balanced feed containing additives to acidify urinary pH, combined with plenty of fresh and clean water can help in prevention.

NOVICID® KS

NOVICID® KS provides phosphoric acid for urine pH reduction, fumaric acid, calcium citrate and calcium formate. Limiting the amount of magnesium and adding acidifiers in the pet food increases urine acidity. Urine acidification helps to dissolve struvite uroliths and also provides a less favourable environment for its formation.

Botanical extract from Dandelion – *Taraxacum officinale* – is added for optimal kidney support and to promote elimination of waste materials from the body.



Dandelion

Fecal odour

Canine and feline excrements can smell pretty bad and the obligated fecal pickup after the action of the dog or the cleaning of the cat litter box are not exactly appealing tasks. Clearly, decreasing the offensiveness of fecal odour will give an extra zest to pet ownership.



NOVINAT® S

NOVINAT® S contains *Yucca schidigera* extract.

Yucca schidigera is a herbaceous plant of the lily family, native to the deserts of the Southwestern United States and Northern Mexico.

The high saponin content of the extracts binds ammonia, which generally improves the character and intensity of the fecal aroma of pets. The overall decrease in bad odour is about 26%, which varies from individual, composition of the feed, absorption, etc.

This plant extract also has medicinal benefits. Effects in the prevention and treatment of arthritis are well-known. Active components of *Yucca schidigera* include steroidal saponins and polyphenols such as resveratrol and yuccaols. Saponins have an anti-protozoal activity, which suppresses protozoal infection of the intestine and inflammation of the joints. Yucca polyphenols have several roles in the arthritic activity: they inhibit the increase of NFkB, an important protein complex in inflammatory processes and they are also antioxidants that protect the body against the damage of free radicals.

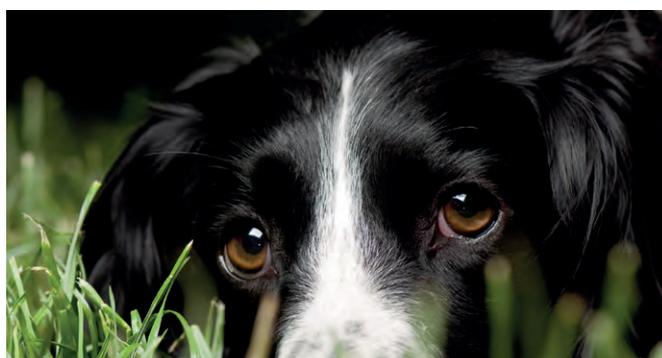


Yucca schidigera plant

Eyes

Macular degeneration is a disease of the macula. The retina is the tissue that lines the inner surface of the eye and is the light sensitive part of the eye. It enables the experience of vision through the rods and cones that are part of its structure.

The macula, or 'yellow dot' is a component of the retina, located at its center. The macula is essential for distinguishing details and colours. Nerve cells and pigment cells are located in the macula and get damaged by macular degeneration. This eliminates the sharp vision and a blurry or black stain remains in the middle of the vision.



Scientific research has shown that the yellow pigment in the macula is formed by the carotenoids lutein and zeaxanthin. These substances help to protect the eye in absorbing blue light and neutralizing free radicals. This pigment protects the central retina against the aging process. Bringing these carotenoids together in a supplement helps to maintain good eye health in later life.

NOVIORO® Y20 NATURAL

NOVIORO® Y20 NATURAL contains extract of marigold flower. Marigold flower is known to derive carotenoids and xanthophylls of natural origin.

Lutein and Zeaxanthin are the two most important factors for eye health. Pets do not produce these antioxidants themselves, so they must be supplied by the pet's diet. It slows down the age related macular degeneration and prevents tear stains on the pet's fur.

NOVIORO® Y20 NATURAL:

The product is standardized on its total xanthophyll content and is free of ethoxyquin.



Marigold flower



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NOVINOX® PET

NOVINOX® NAT

NOVIBAC®

NOVYRATE® EB

NOVITECH® MN

NOVICID® KS

NOVINAT® S

AFLORIN® BF

NOVIORO® Y20 NATURAL

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