Oxidation status of horse feeds in Scandinavia

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Introduction

A well-functioning equine feed should secure the nutritional and energy requirements of the horse, and enhance the performance and health through a well-balanced composition. Horse feeds have traditionally been pelleted. However, the manufacturing of muesli has increased. Mueslis are usually a mixture of heat treated raw materials blended together with oils, aromas and various supplements.

Oxidation is a natural and necessary process. In feed, oxidation can be intiated by temperture, pro-oxidant ions such as iron and copper, light and the supply of oxygen. The oxidation process (Figure 1) forms free radicals such as hydroxyl peroxides which in turn produce secondary oxidation products.

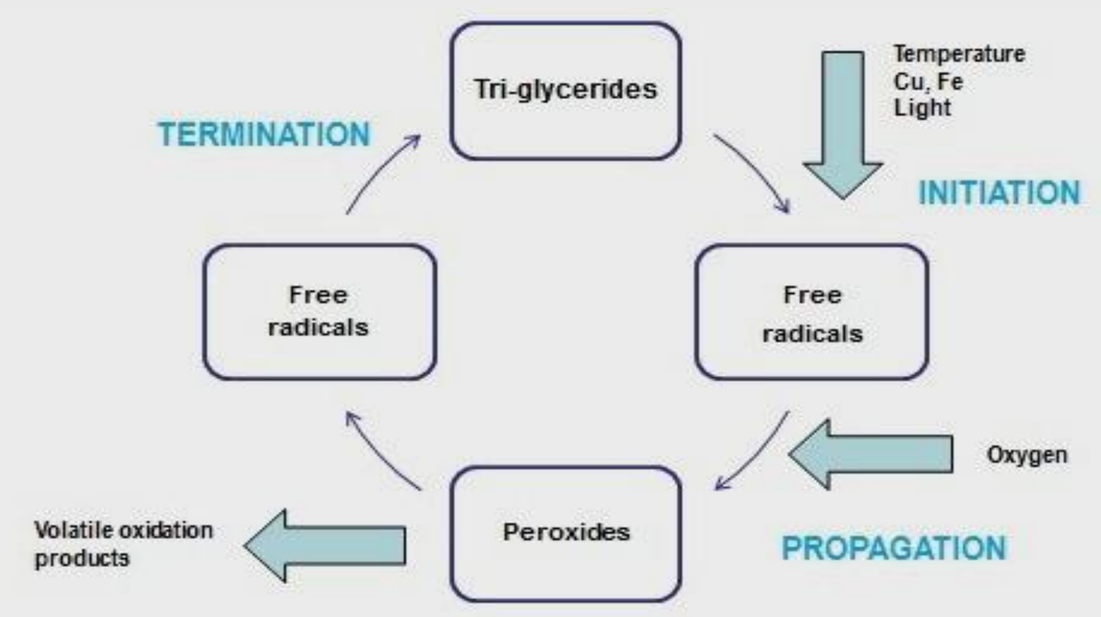

Figure 1. The oxidation process and pro-oxidative influences during storage

There is an increased demand for feeds with low levels of grains, high fiber and low protein content. These customer demands leave fat and oil as a significant energy source compared to the more traditional feeds with large amounts of grain and starch. The aim of the test was to **(1)** investigate the oxidative status of horse feeds used on the Scandinavian market; **(2)** understand the influence of manufacturing method on oxidative status of the feed; and **(3)** determine the need for an antioxidant strategy for equine feed.

Materials and Methods

Samples of feed were collected from typical stables and sent to Kemin's Customer Service Laboratory for oxidation stability analysis. All feeds were collected and analyzed within the shelf life period mentioned on the feed bags. Twenty-eight different feeds from six European countries were collected and analyzed for peroxide value (PV, primary oxidation product) measured in meq/kg and thiobarbituric acid value (TBA, secondary oxidation product) measured as mg/kg malondialdehyde. The feed samples were divided into categories of hobby, performance and special feeds and manufacturing method. Eight feeds were pelleted and twenty were muesli-based feeds.

Results and Discussion

The results (Table 1) from the oxidation analysis showed that 92% (26 of 28 samples) of feeds in the test were high in oxidation products, meaning a strong ongoing oxidation process or what can consider to be "oxidized" samples. Only 8% (2 of 28 samples) of the feeds were considered as stable, or acceptable, with a relatively low oxidative value (TBA value 0.5-1).

Table 1. Interval of TBA values in terms of oxidation status and the respective number of samples in each interval.

	Interval	Number of samples	
TBA value (mg/kg malondialdehyde)			
"Fresh"	< 0.5		
Initiation of oxidation	0.5-1	2	8 %
On-going oxidation	1.0-2.0	13	46 %
Strong oxidation	> 2.0	13	46 %
Peroxide value (meq/kg)			
"Fresh"	< 5		
Initiation of oxidation	5.0-10.0		
On-going oxidation	10.0-20.0	5	18 %
Strong oxidation	> 20	23	82 %

The pelleted feeds were more stable than muesli. In the samples investigated, the muesli ranged from a minimum TBA value of 0.7 and maximum 13.8 mg/kg (table 2), while the pellet's TBA values ranged from 0.6 to 3.7 mg/kg.

Table 2. Overview of mean and min-max values of TBA and PV according to feed category and manufacturing method.

	No. of samples	Peroxide value (meq/kg)		TBA value (mg/kg)	
Feed category		**Mean**	**Min - Max**	**Mean**	**Min - Max**
Pellets					
Hobby	3	101,23	35,6 - 168,6	2,47	1,6 - 3,7
Performance	5	53,27	35,0 - 99,5	1,71	0,6 - 3,2
Muesli					
Hobby	6	70,67	36,0 - 100,5	4,69	1,1 - 13,8
Performance	7	57,39	15,5 - 171,9	2,56	1,3 - 9,6
Special feeds	7	46,74	14,5 - 104,3	0,00	0,7 - 6,3

Initially, there did not seem to be any correlation between TBA value and fat content, as would be expected. A possible explanation might be the oxidative status of the heat treated ingredients in the muesli's and its contribution to the oxidation process. The manufacturing of muesli might also contribute to the higher TBA values. Even though many feeds include dietary antioxidants, these antioxidants usually do not constitute the optimal properties to control oxidation during storage.

Conclusions

More feeds need to be tested in order to do statistical analysis, nevertheless it seems that the oxidative status of the raw material in mueslis play a larger role on the total stability of the feeds. The health impact on the horses fed strongly oxidized feeds and the energy balance available for the performance horse need to be further investigated.