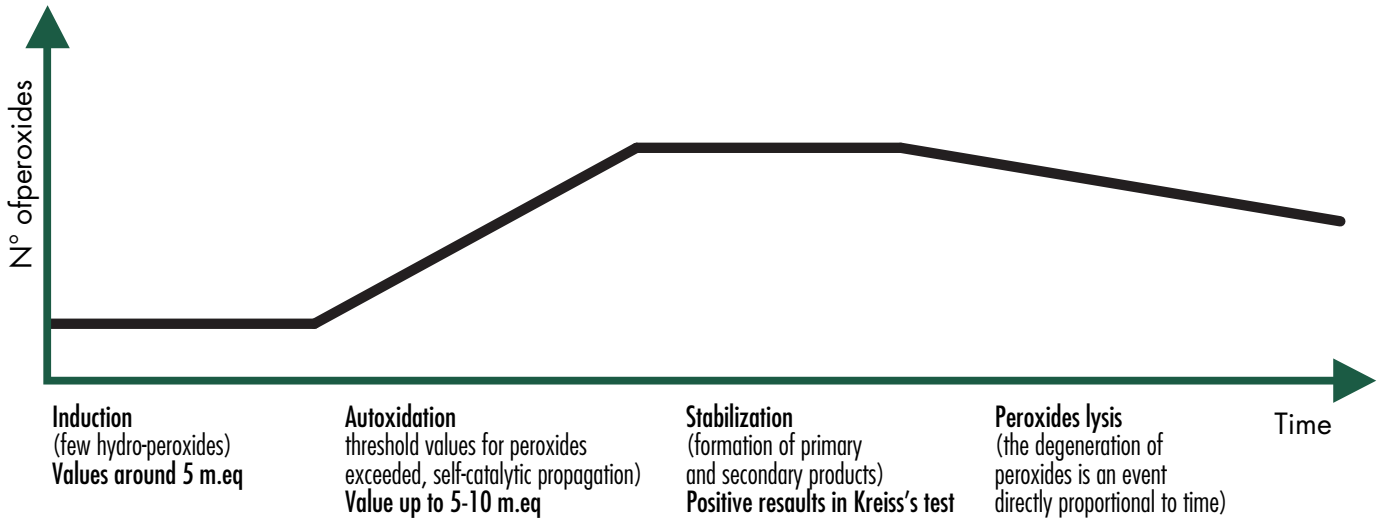
Fats alteration

Randicity represents the entire degenerative process of fats, from the formation of hydroperoxides and the breakdown of triglycerides to the formation of secondary products of the process. Rancidity processes are of various types:

1. Hydrolytic rancidity: breakdown of triglycerides by H2O and lipase to form mono- and di-glycerides, glycerine and free fatty acids
2. Bioxidation by molds (for example, in oilseeds) causing ketone rancidity (ketoacids)
3. Oxidative rancidity: combination of O2 with free or esterified fatty acids to give rise to hydroperoxides
4. Secondary rancidity which, from the degradation of fatty acids, gives rise to secondary oxidation products such as alcohols, epoxides, aldehydes, esters and more.

NUMBER OF PEROXIDES



During the autoxidation phase, the formation of primary and secondary products, that represent real toxic metabolites, is still limited but the fats quality is poor and involves a progressive risk of intoxication. The products that are formed in the following phases are certainly the cause of significant health problems.

The factors of rancidity affect in a variable way and are often combined:
Presence of oxygen - High degree of unsaturation - Presence of heavy metals (Fe, Cu, etc.) - Light irradiation, especially UV - Reduced presence or absence of antioxidants.

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Analytical parameters and their meaning:

1. **Number of peroxides** is directly proportional to the presence of peroxides in the fat; it is especially significant in the initial autocatalytic phase of oxidation. The unit of measurement is the milliequivalents of active oxygen per kilograms of fat (extracted).
2. **Oleic acidity** indicates the percentage of free (non-esterified) fatty acids in the fat (hydrolytic rancidity). The unit of measurement is represented by the percentage of free fatty acids expressed as oleic acid (or other acid). (Is the parameter applicable only to oils?).
3. **Kreiss's test** Qualitative indicator of the presence of aldehydes (secondary product of oxidation). It's important to underline that it may take chromatic interferences (for example, in cotton oil and
4. olive oil). The assay is positive if the lower layer of the fat/acid/phloroglucine solution shows colors ranging from net pink to red.
5. **Numbers of p-anisidine** correlated with the presence of ketones (secondary product of dioxidation). The unit of measure is expressed as Extinction at 350nm of a 1 g/dl solution of fat.

Maximum values (references normated by regulation of fats and derivatives)

Fats	N. of peroxides (m.eq of 02/kg)	OLEIC ACIDITY (!) %	Kreiss's test	N. of anidisines
Peanut	10	0,5		
Safflower	10	0,5		
Coconut	3	4 (Lauric Acid)		2
Rapeseed	10	0,5		
Sunflower	10	0,5		
Corn	10	0,5		
Palm oil	5			6
Palm Kernel Oil	3	5 (Lauric Acid)		3
Soy	10	0,5		
Tallow	2	1,0 (extra) 2,0 (1st) 5,0(2nd) 10,0(3nd)		2,0 (extra) 3,0 (1st) 4,0(2nd)
Lard	2 (extra) 5 (1st)	1,0 (extra) 2,0 (1° q) 8,0(2°q)	Negative	2,0 (extra) 4,0 (1st)
Technical animal fat	Specific table		Negative	

(!)IMPORTANT: We have found that the average values of oleic acidity obtained on fat extracted in Chloroform or in Chloroform/methanol in raw materials or mixtures are on average higher (5-10 times) than the limits shown here, valid for commercial oils. It may be that oleic acidity is not a suitable parameter for assessing the state of conservation of food products and by-products other than oils and fats.

Evaluation of the results of the analysis of Peroxides Number and Kreiss's test.

INDIVIDUAL RAW MATERIALS AND BY-PRODUCTS

The maximum values of di-peroxides in raw materials vary between 5 and 10 m.eq of O2 per kg of fat; it should be noted that, in the tests carried out in the laboratory, the values of fats extracted from the individual raw materials are usually below 5 m.eq.

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Peroxides values between 10 and 15 m.eq could only be tolerated in products that are easily subject for oxidation, such as wheat bran, especially in summer. In the other cases of raw materials, values higher than 5-10 m.eq are a sign that the oxidation of the fats has passed from the induction phase to the autocatalytic propagation and, therefore, has begun the process of qualitative degradation.

COMPOUND FEEDS

As we recalled, the maximum values of the di-peroxides in raw materials vary between 5 and 10 (on average 2-5) m.eq of O2 per kg of fat, therefore the limit values (but still acceptable) of the number of peroxides will fall within this range. In the mixtures, the values obtained represent the average of fats involved, so they must be contained between 5 and 8 m.eq).

In feeds, it is necessary to confirm the results obtained by Kreiss's test, in order that a single component, possibly highly oxidized but included in small quantities in the mixture, is not "hidden" by the "dilution" effect of the components of fats.

Example for TABLE of interpretation of the results of Peroxides and Kreiss's test in COMPOUND FEEDS:

N. of peroxides	Kreiss	Possible interpretation	Results
<5	NEGATIVE	Low fat oxidation	GOOD
Between 5 and 8	NEGATIVE	Acceptable fat oxidation	ACCEPTABLE
Between 10 and 25	NEGATIVE	a) Oxidation (following mixing) due to poor preservation of feed; b) Component of the mixture with oxidized fat, but not compromised	NOT GOOD, possible risk situation.
Between 5 and 15	POSITIVE	Compromise of one of the components of the mixture	POOR, risky situation
Up to 25-30	NEGATIVE	c) Oxidation (following mixing) due to poor preservation of the feed; d) Component of the mixture with oxidized fat, but not compromised	POOR, risky situation
Between 15 to 25	POSITIVE	Compromise of one of the components of the mixture, propagation of oxidation to the other fats.	VERY SUBSTANDARD, subclinical forms of intoxication
Up to 50	POSITIVE	Product compromised	TOXIC, acute intoxication

The evaluation of a feed that has peroxides values exceeding 15 m.eq could be useless, as the administration is not recommended.

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