Oxidation processes under control – MIAVIT´s approach for modern livestock

Speakers: Juan Cañete & Corinna Ingmanns

Moderator: Andreas zur Wickern

Third-generation family-owned company

Mi-A-Vit originally began as a veterinary practice more than
55 years ago

Still owner-managed today

Founder Dr Hans W. Niemeyer created the guiding principle "*Prevention instead of medication*"

From Germany to all over the world

From Germany to all over the world

- Sales in over 80 countries
- Export share of 50%

From Germany to all over the world

MIAVIT Headquater
Essen, Germany

MIAVIT Nutricion Animal S.L.
Tarragona, Spain

MIAVIT Vietnam Co. Ltd.
Ho-Chi-Minh City, Vietnam

MIAVIT branch
Nairobi, Kenia

MIAVIT branch
Izmir, Turkey

Team of Experts

465 Employees worldwide

Know-How of

veterinarians, farmer,

Chemicals, agricultural scientist, …

Nearly 20 languages

russian, spanish, arab,
english, french, swabian, chinese,…

One team worldwide

Ho Chi Minh, Izmir,

Nairobi, Tarragona, …

Successful business segments…. many opportunities

Animal nutrition

Premixes, mineral feed and supplements

Pet food

Premixes and speciality products for pets

Biogas

Additive concepts to increase biogas yield

Food

Premix concepts for the food industry

For industry and trade

Customised premixes
MIAVIT raw materials
Antioxidants
Mycotoxin binders
Effective special solubles

Customised private label products

Dosage forms

Powder
Liquid
Paste
Tablets

Speakers

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Swine Nutritionist & Product Manager Antioxidants

Speakers

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UNIVERSITY OF APPLIED SCIENCES

Agricultural Engineer, University of Applied Sciences Osnabrück (Germany)

Ruminant Nutritionist

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- Oxidation process
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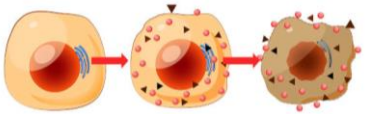
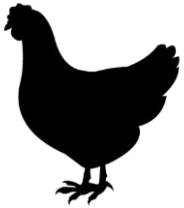
  - Antioxidants and cell protection

Introduction

Oxidation process ≠ Oxidative stress





BHA, BHT, Ethoxyquin … ≠ Vitamin E, C, Polyphenols …

Closely related

Oxidation process

- **Oxidation process** is an undesirable and irreversible series of chemical reactions involving oxygen that **degrades the quality** of raw materials, feedstuffs and vitamins.

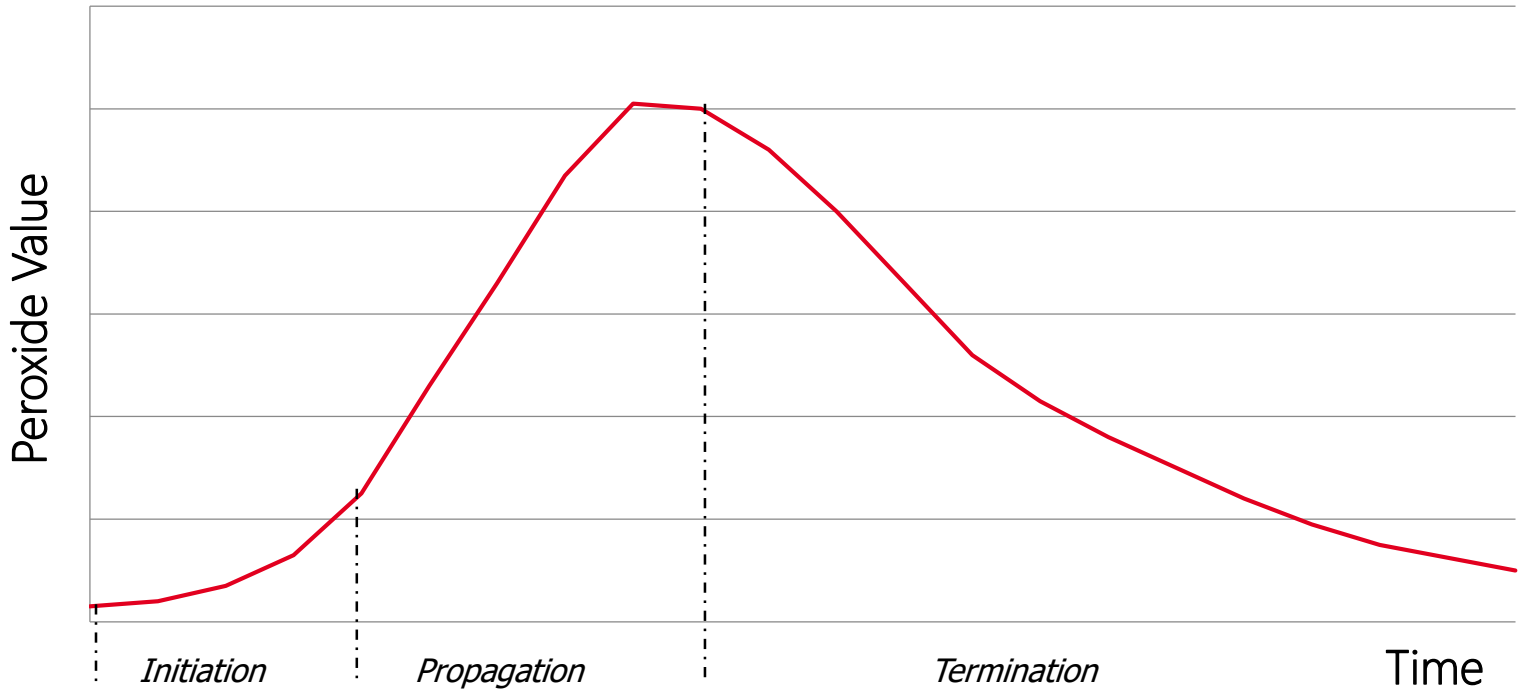
Feed material	Result of oxidation
Vitamins	Loss of active levels (IU)
Pigments	Loss of active levels (ppm)
	Reduction in energy value (MJ/kg)
	Rancidity
Fats and Oils	Palatability problems
	Digestive disturbances
	Tails in meat, milk, egg cellular dysfunction

- Direct **impact** on:
  1. *Animal health*
  2. *Animal performance*
  3. *Product shelf life*

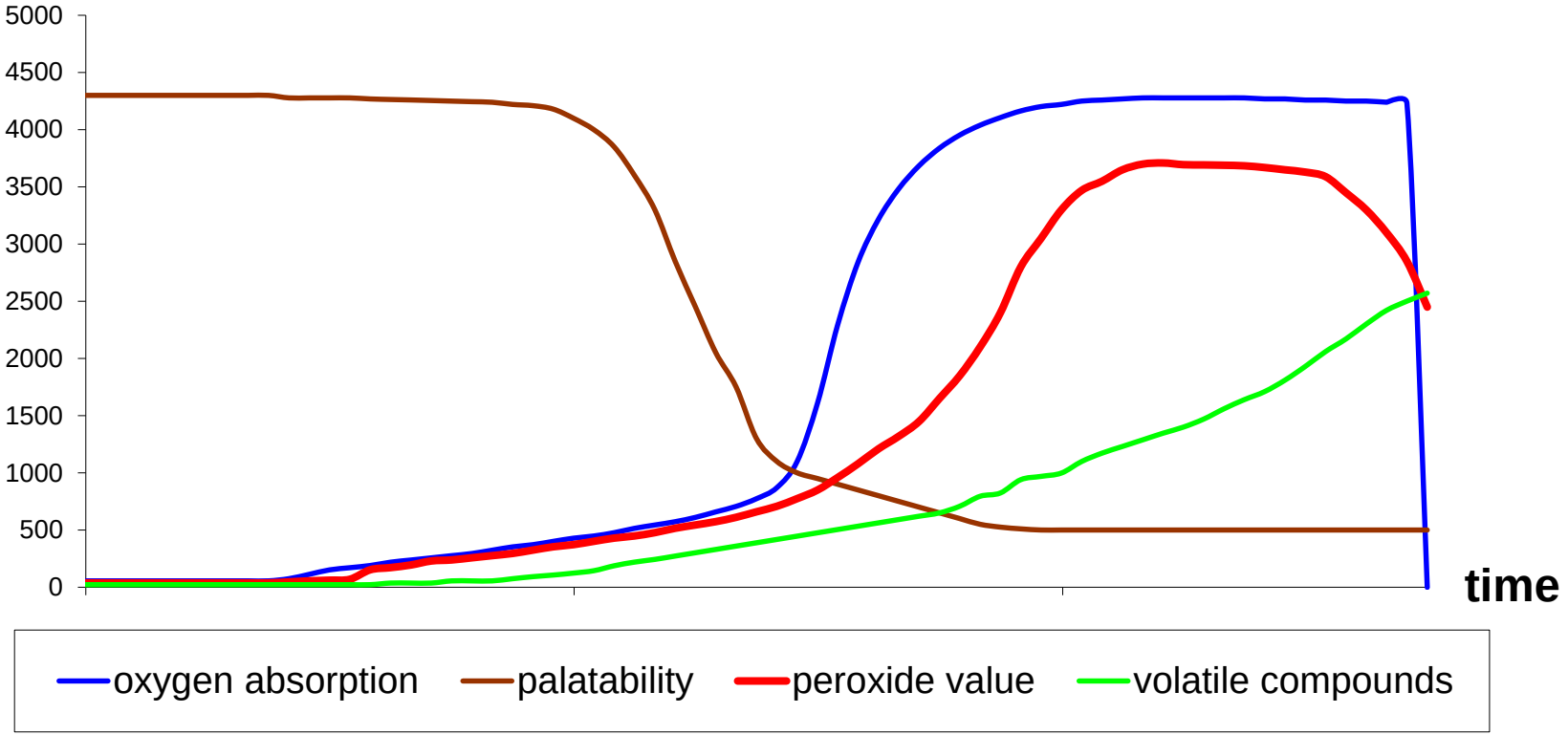
⬇

Economical results

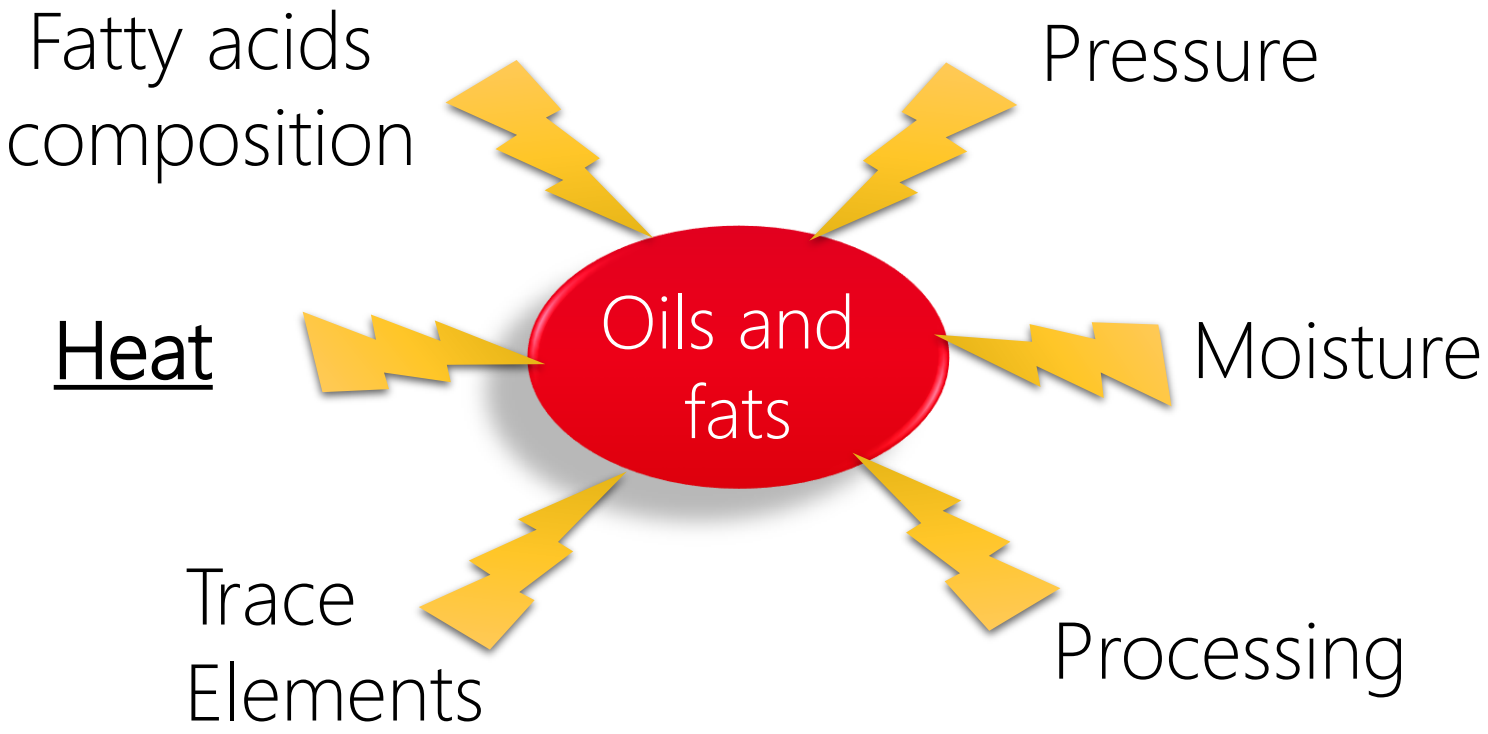
Three phases of autoxidation



Autoxidation components of fatty acids



Lipid oxidation factors



Oxidative susceptibility

Animal origin	Vegetable origin
fish oil	linseed oil
poultry fat lard cattle fat	soybean oil rapeseed oil palm oil coconut oil

- **More sensitive** to oxidation when:
  - the number of double bonds increases
  - the length of the chain increases

Oil/Fat oxidation impact

- Meta-analysis: 29 publications (42 poultry and 23 swine observations)
- Groups differ in oxidized or not oxidized oil/fat source

When oxidized source feeding:

Performance

↓ 5% ADG

↓ 3% ADFI

↓ 2% G:F

Health

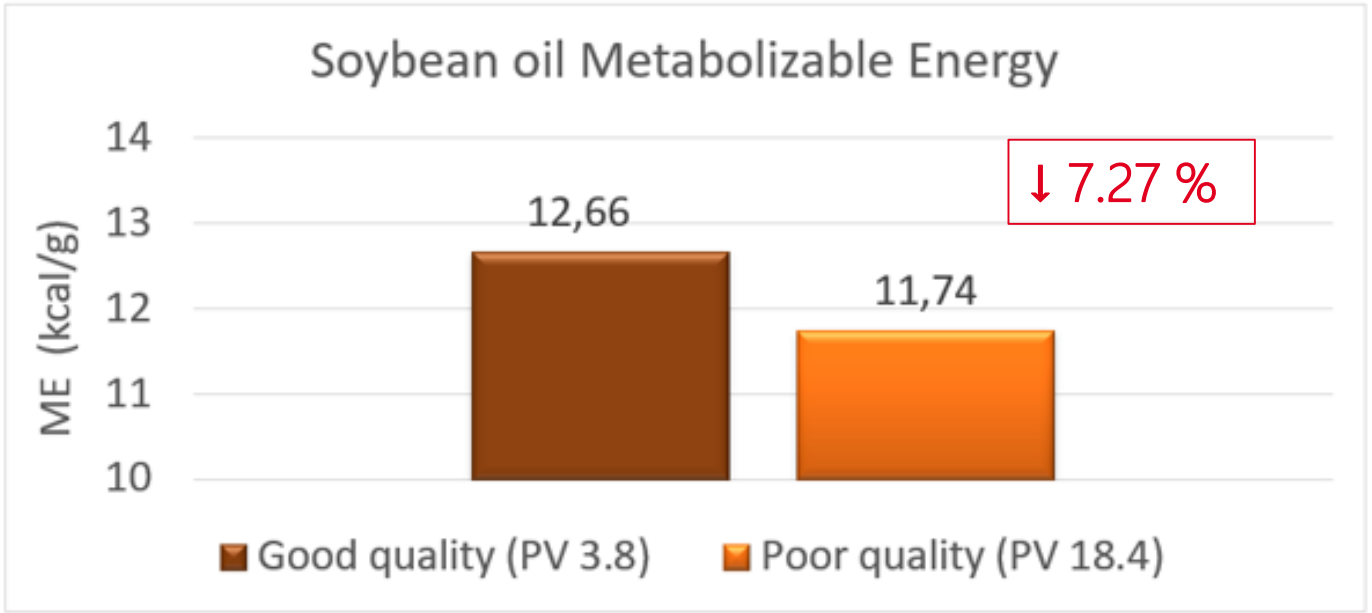
↑ 120% TBARS in plasma

↓ 52% Vit E in plasma

Source: Hung et al., 2017

Oil/Fat oxidation impact

- **Energy** is the most **expensive** nutrient



- Soybean oil:
  - 9,000 kcal ME
  - 950 €/t
  - 0,1056 €/kcal
- 4% in feed:
  - 38 €/t
  - 360 kcal
- ↓ 7.27 % ME (oxidation)
  - ↓ 26.17 kcal/t feed
  - - 2.76 €/t feed

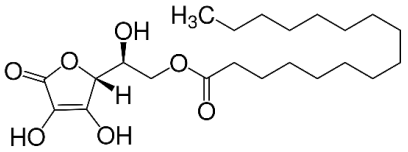
Source: Pesti et al., 2002

Technological antioxidants

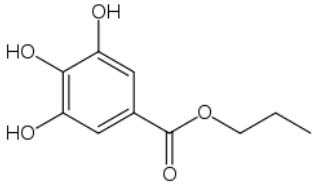
- **Antioxidants** are substances that **delay or inhibit oxidative degradation** processes **to protect** raw materials and feedstuffs and **increase** their shelf life.
- The principle products used in this way are **BHA**, **BHT** and **propyl gallate** regarding synthetic solutions and **tocopherols** regarding natural ones.
- An **effective antioxidant** must be correctly formulated and applied early enough to afford the best protection.

Types of antioxidants

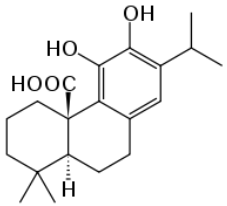
Ascorbyl palmitate



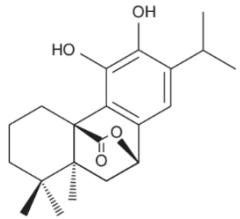
Propyl gallate



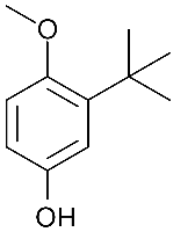
Carnosic acid



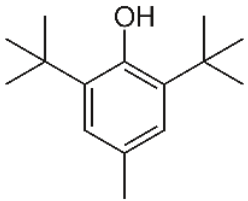
Carnosol



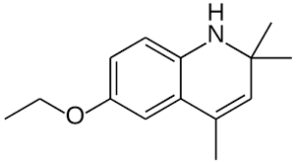
BHA

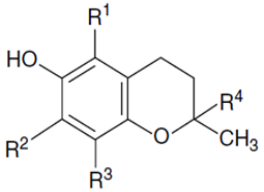


BHT



Ethoxyquin





R^1	R^2	R^3	
CH_3	CH_3	CH_3	α-Tocopherol
CH_3	H	CH_3	β-Tocopherol
H	CH_3	CH_3	γ-Tocopherol
H	H	CH_3	δ-Tocopherol

Synthetic antioxidants

Natural antioxidants

Antioxidants - EU regulations

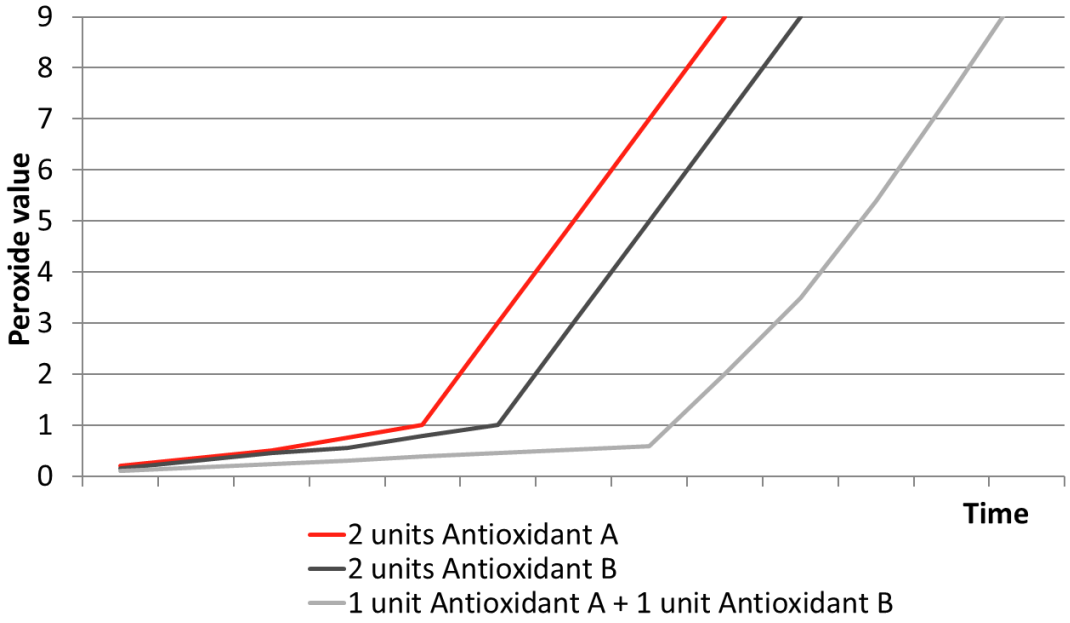
Antioxidant	Max. allowed concentration (mg/kg) complete feed	Remarks
BHA	150*	Alone or together with BHT
BHT	150	Alone or together with BHA
Propyl Gallate	100	
Tocopherols	No limit	

*except fro cats

Key criteria for antioxidants

- Effective at low concentrations
- Without any unpleasant odour, flavour or colour
- Safe and nontoxic
- No interaction with matrix
- Adequate distribution

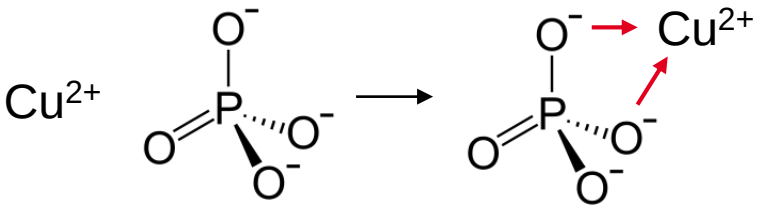
Property 1. Synergistic effect

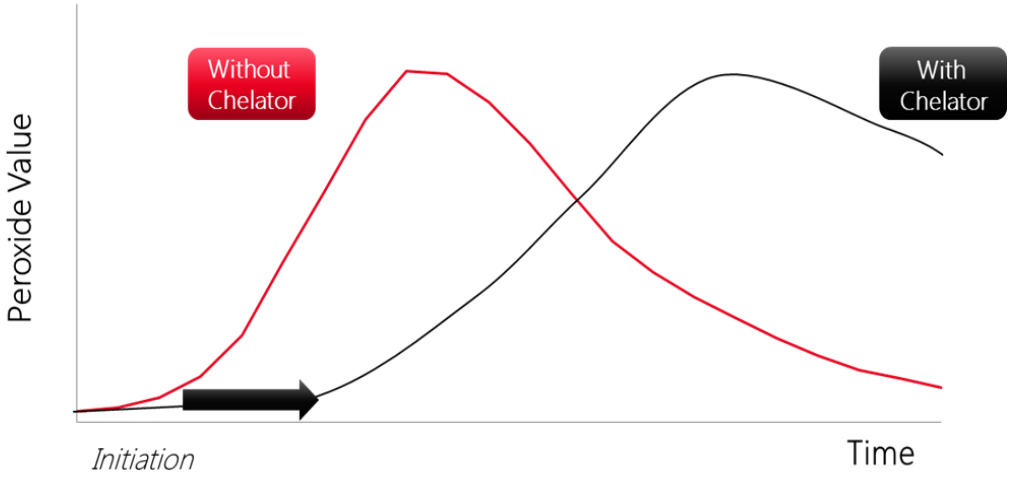


→ 1 + 1 ≠ 2

- Synergistic interactions between certain antioxidants are described for the **optimization of mixtures** of different synthetic and natural antioxidants.

Property 2. Chelation of metal ions





Longer initiation period → Safes AOX usage

- **Chelators** such as phosphoric and citric acid can **nullify the catalytic effect** of trace elements, increasing the ability of antioxidants to delay oxidative degradation processes.

Laboratory service to take decisions

&

Indicative tests

Predictive tests

- Peroxide value (PV)
- Anisidine value (AnV)
- TBARS

- Rancimat
- Oxipres
- Shelf life studies

Miavit´s solution: *MiaRadOx*

Standard Product

MiaRadOx Line

Antioxidants

Liquid antioxidants

to protect substrates from oxidative changes

Synthetic antioxidants
Natural antioxidants
Synthetic and natural antioxidants

MiaRadOx L AP 1010 / MiaRadOx L AP 1212 / MiaRadOx L AP 248
BHA | Propyl gallate | Chelators
Packaging: 25 kg canister *

MiaRadOx L P 24
Propyl gallate | Chelators
Packaging: 25 kg canister *

MiaRadOx L PV 301 / MiaRadOx L PEV 303
Propyl gallate | Natural antioxidants
Packaging: 25 kg canister *

MiaRadOx L NAT
Natural antioxidants | Chelators
Packaging: 25 kg canister *

MiaRadOx L ECOX
Natural antioxidants
Packaging: 25 kg canister *

Powder antioxidants

to protect substrates from oxidative changes

MiaRadOx P2
BHA | BHT | Chelators
Packaging: 20 kg bag *

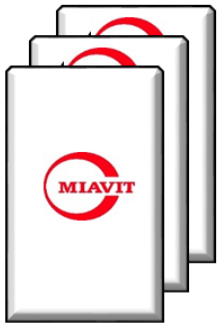
MiaRadOx P AP 0909
BHA | Propyl gallate | Chelators
Packaging: 20 kg bag *

MiaRadOx P TP 177
BHT | Propyl gallate | Chelators
Packaging: 20 kg bag *

MiaRadOx P NAT
Natural antioxidants | Chelators
Packaging: 20 kg bag *

Conclusion I

- ✓ Oxidation process ≠ Oxidative stress
- ✓ Oxidation processes have an impact on economical results.
- ✓ Most sensitive substrates are vitamins, pigments and fats/oils.
- ✓ Antioxidants delay or inhibit oxidative degradation.
- ✓ Certain antioxidant´s properties could increase their efficacy.
- ✓ Laboratory tests help us taking decisions.



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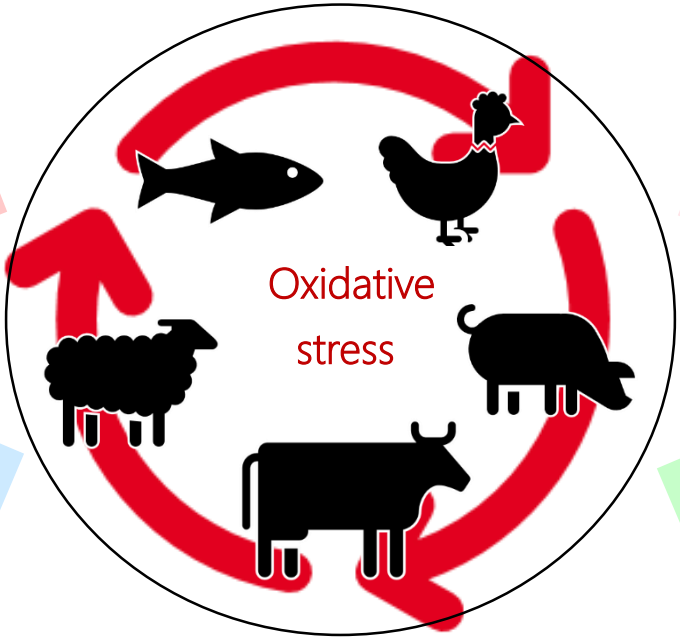
Stress factors for modern livestock

Nutritional stress
- Oxidized fat
- Mycotoxins
- Mould



Environmental stress
- Heat
- Cold
- Humidity
- Air flow

Contaminated water

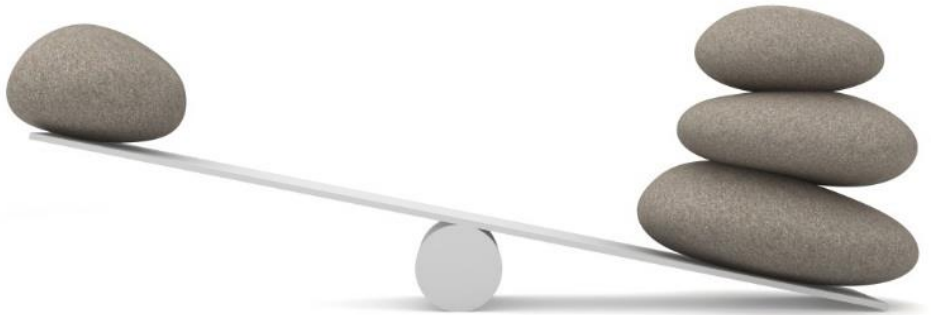
- Nitrite
- Bacteria
- Minerals

Sanitary stress
- at critical phases of the production cycle
- Infectious diseases

Balance - Imbalance

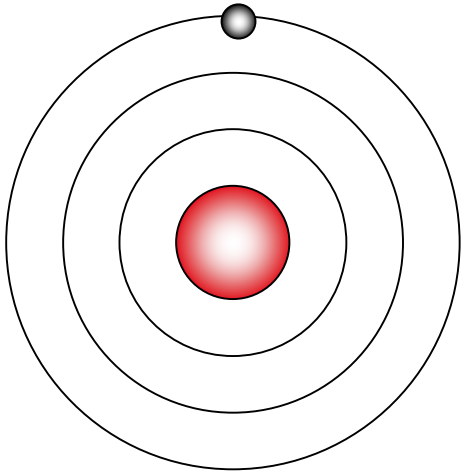
Overconsumption of antioxidants

Overproduction of reactive oxygen species

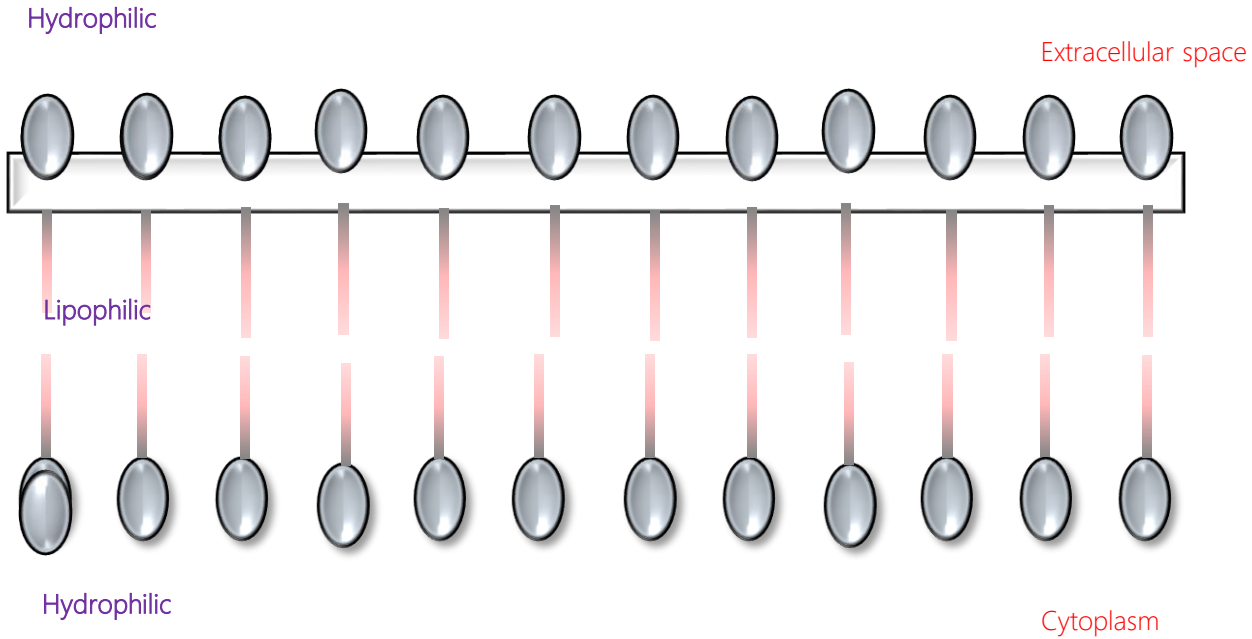


Free radicals

Reactive substances



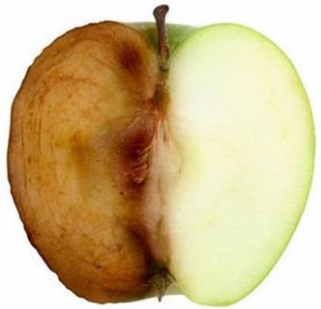
Cellular damage



Oxidation process - Oxidative stress

Consequences for non-living material…

- Loss of palatability
- Loss of energy
- Reduced product shelf life



Consequences for living organisms….

- Cell- and tissue damages
- Aging
- Infertility
- Performance depressions
- Cancer

Antioxidants – Classification

TOOLS

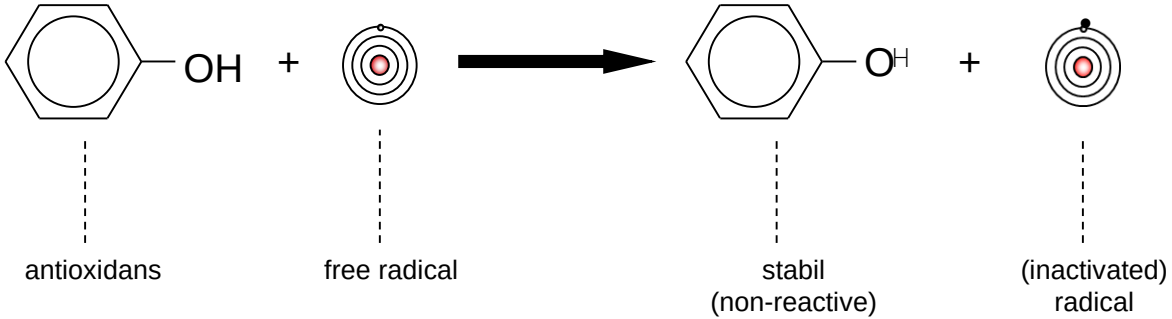
Superoxid dismutase

Glutathion peroxidase

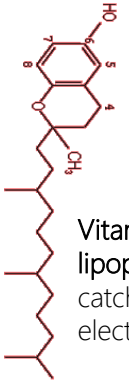
catalase

SPARE PARTS

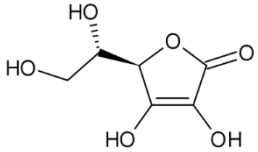
Mode of action – phenolic compounds



Antioxidants and cell protection



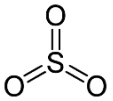
Vitamin E as a lipophilic AOX catches unpaired electrons

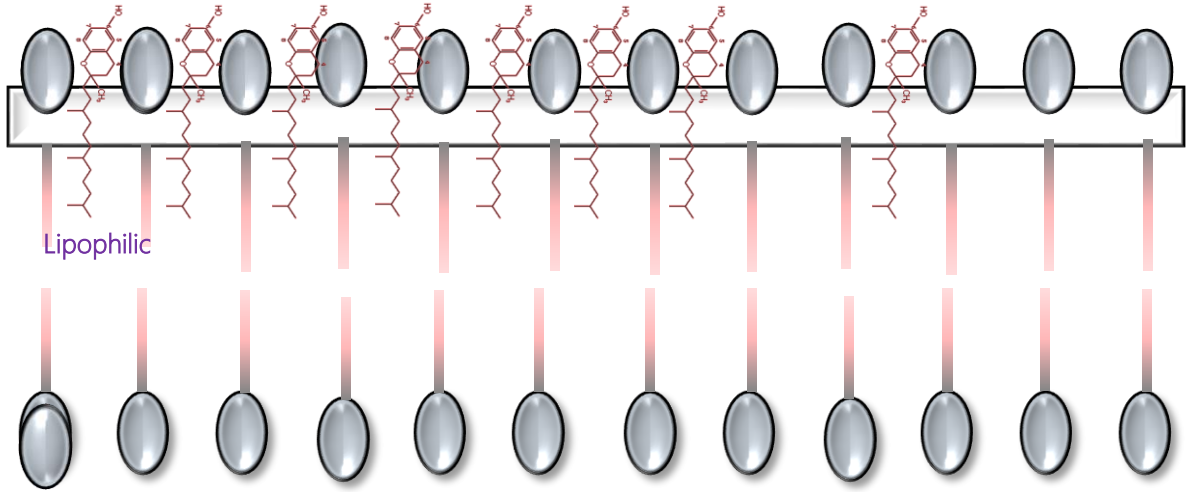


Vitamin C and water soluble polyphenols have a similar function, they transfer unpaired electrons to the enzymatic system for deactivation.

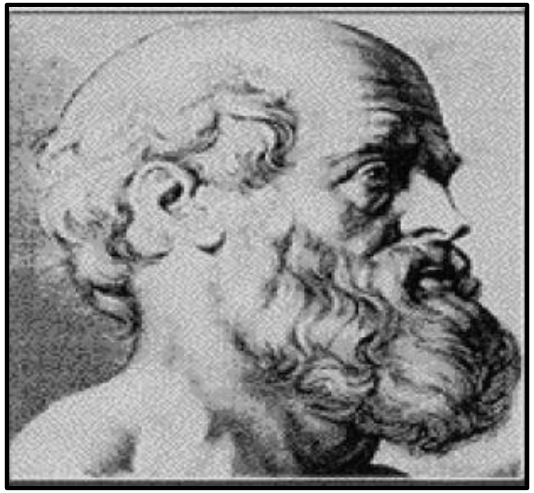
Enzymatic system

Se-dependent enzymatic system deactivates free radicals (SOD, GPx, CuZnSOD, MnSOD)





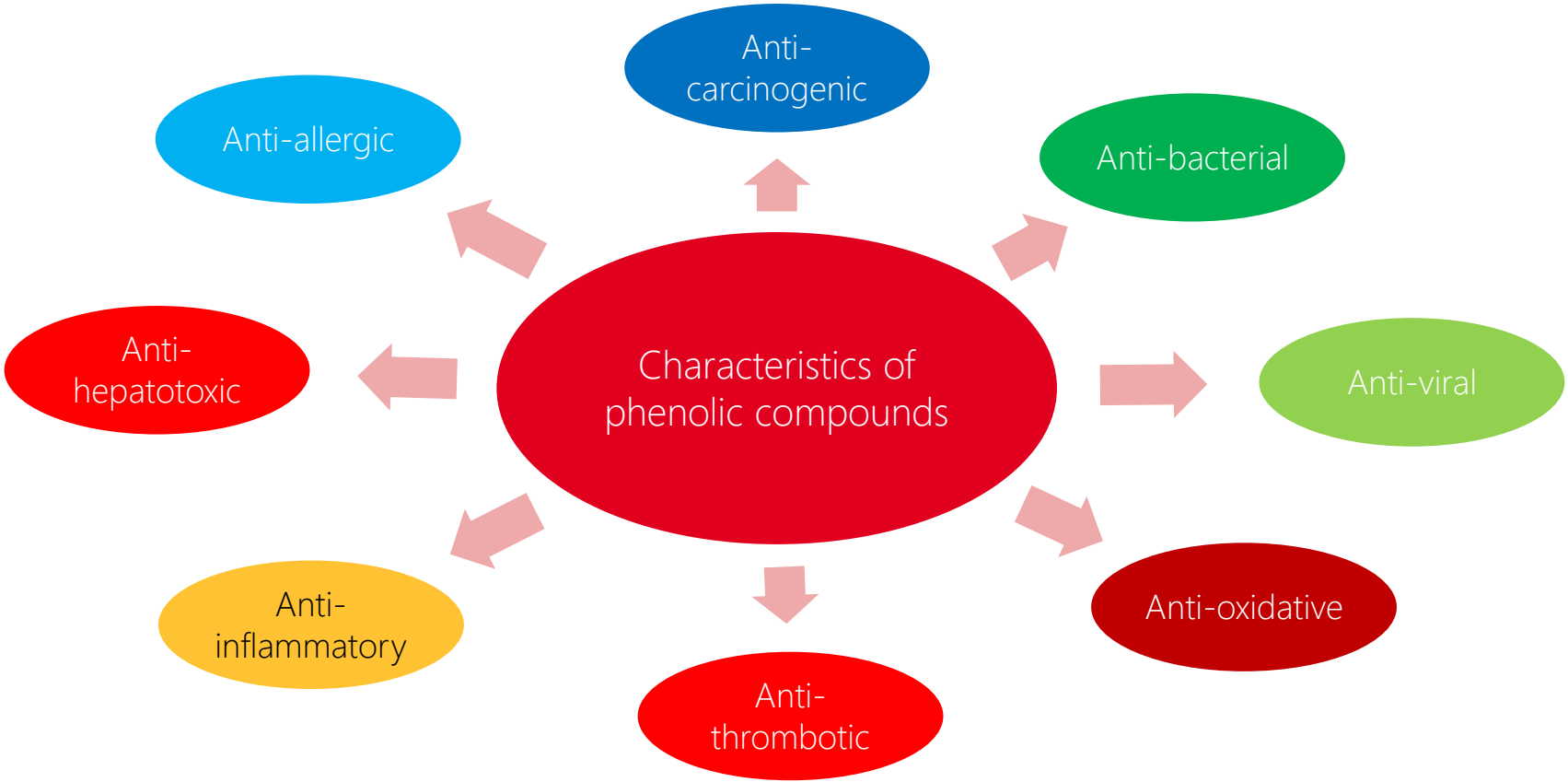
Hippocrates 460 b.c. – 377 b.c.



„Let the food be the medicine
and the medicine be the food“

Adapted from: Peter Surai, PhD, DSc:
Potential of polyphenols in monogastric nutrition

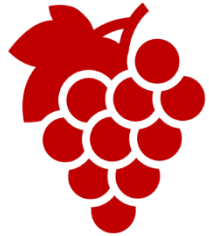
Characteristics of phenolic compounds



The French Paradox

In certain regions of France, the incidence of cardiovascular disease is relatively low, despite a diet high in saturated fats

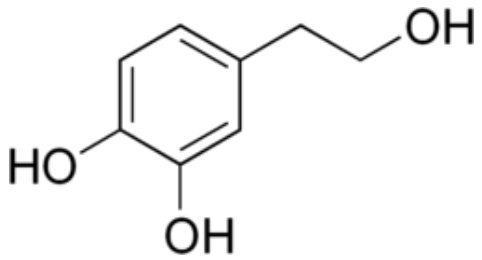
Resveratrol
&
Flavonoids



Adapted from: Peter Surai, PhD, DSc:
Potential of polyphenols in monogastric nutrition

The most powerful AOX from nature: Hydroxytyrosol

- Most powerful **antioxidant** from nature
- **Anti-Inflammatory**
- Decreases LDL oxidation
- Antimicrobial activity
- Neuroprotective
- Regenerates Vitamin E
- ....



ORAC Values of several wellknown compounds (µmoleTE/g)	
Hydroxytyrosol	27,000
Oleuropein	12,000
Quercetin	10,900
Epicathechin (green tea)	8,100
Resveratrol (grape skin)	7,900

Powerful natural AOX: Polyphenols in olive

Beneficial effects to human health:

- ✓ protection of LDL particles from oxidative damage
- ✓ Maintenance of normal blood HDL-cholesterol concentration
- ✓ Maintenance of normal blood perssure

efsa
European Food Safety Authority
EFSA Journal 2011;9(4):2033

SCIENTIFIC OPINION

Scientific Opinion on the substantiation of health claims related to polyphenols in olive and protection of LDL particles from oxidative damage (ID 1333, 1638, 1639, 1696, 2865), maintenance of normal blood HDL-cholesterol concentrations (ID 1639), maintenance of normal blood pressure (ID 3781), "anti-inflammatory properties" (ID 1882), "contributes to the upper respiratory tract health" (ID 3468), "can help to maintain a normal function of gastrointestinal tract" (3779), and "contributes to body defences against external agents" (ID 3467) pursuant to Article 13(1) of Regulation (EC) No 1924/2006[1]

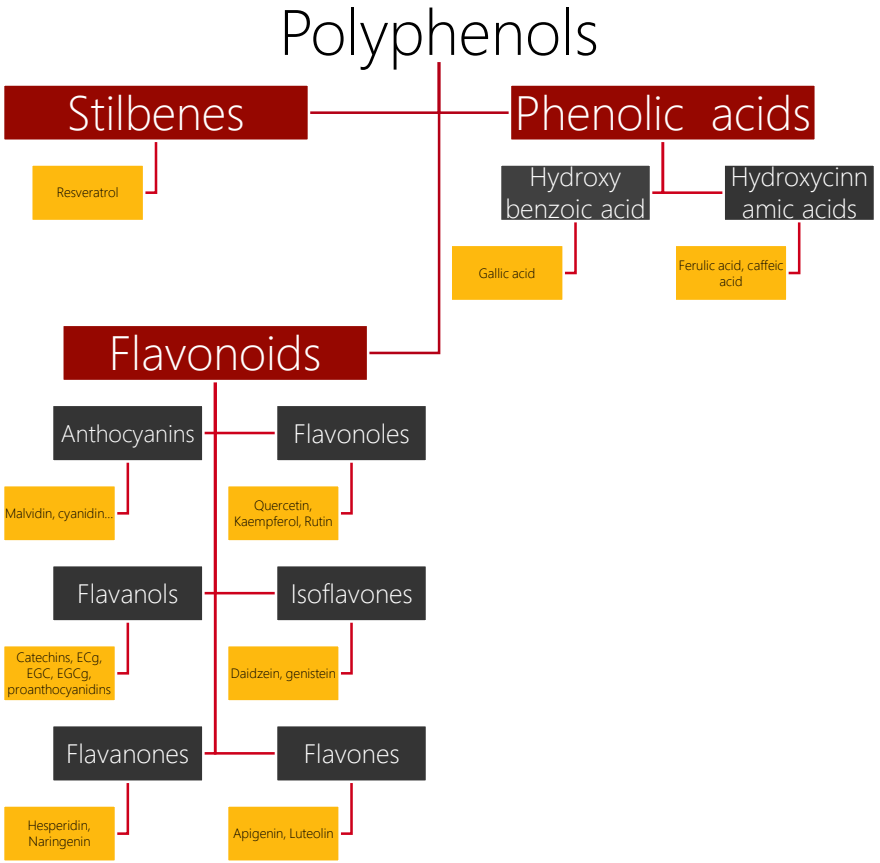
EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA)[2, 3]

European Food Safety Authority (EFSA), Parma, Italy

SUMMARY

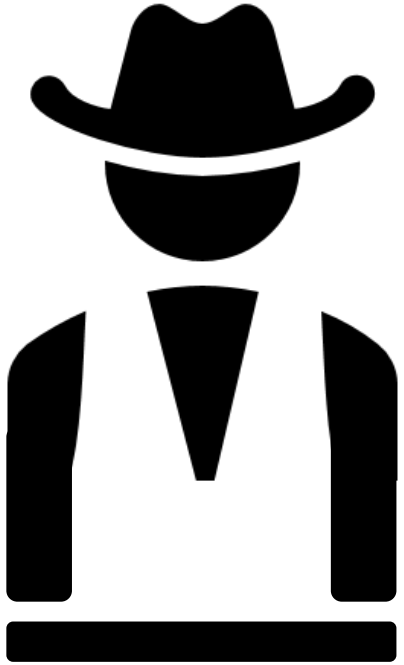
Following a request from the European Commission, the Panel on Dietetic Products, Nutrition and Allergies was asked to provide a scientific opinion on a list of health claims pursuant to Article 13 of Regulation (EC) No 1924/2006. This opinion addresses the scientific substantiation of health claims in relation to polyphenols in olive and protection of LDL particles from oxidative damage, maintenance of normal blood HDL-cholesterol concentrations, maintenance of normal blood pressure, "anti-inflammatory properties", "contributes to the upper respiratory tract health", "can help to maintain a normal function of gastrointestinal tract", and "contributes to body defences against external agents". The scientific substantiation is based on the information provided by the Member States in the consolidated list of Article 13 health claims and references that EFSA has received from Member States or directly from stakeholders.

Biological antioxidants



MOST WANTED

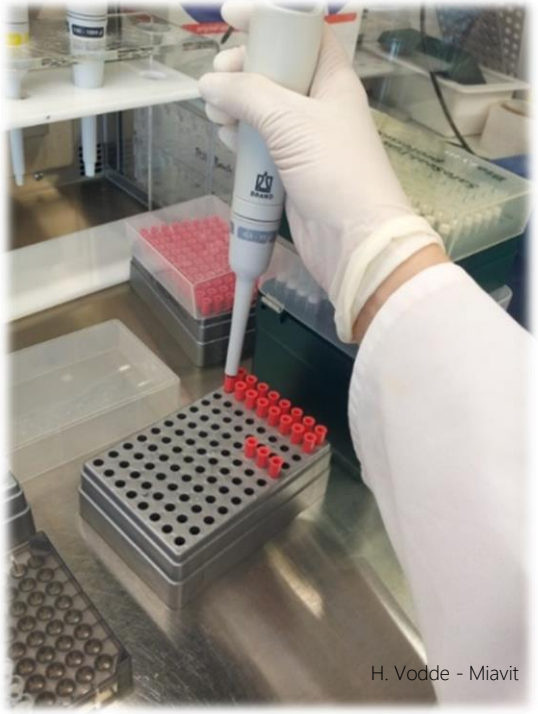
- the right raw material
- effective ingredients
- high & defined concentration
- effective in low dosages
- without unpleasent odor, flavour or color
- stable during processing & storage
- safe and non-toxic



In vitro measurement of antioxidative potential

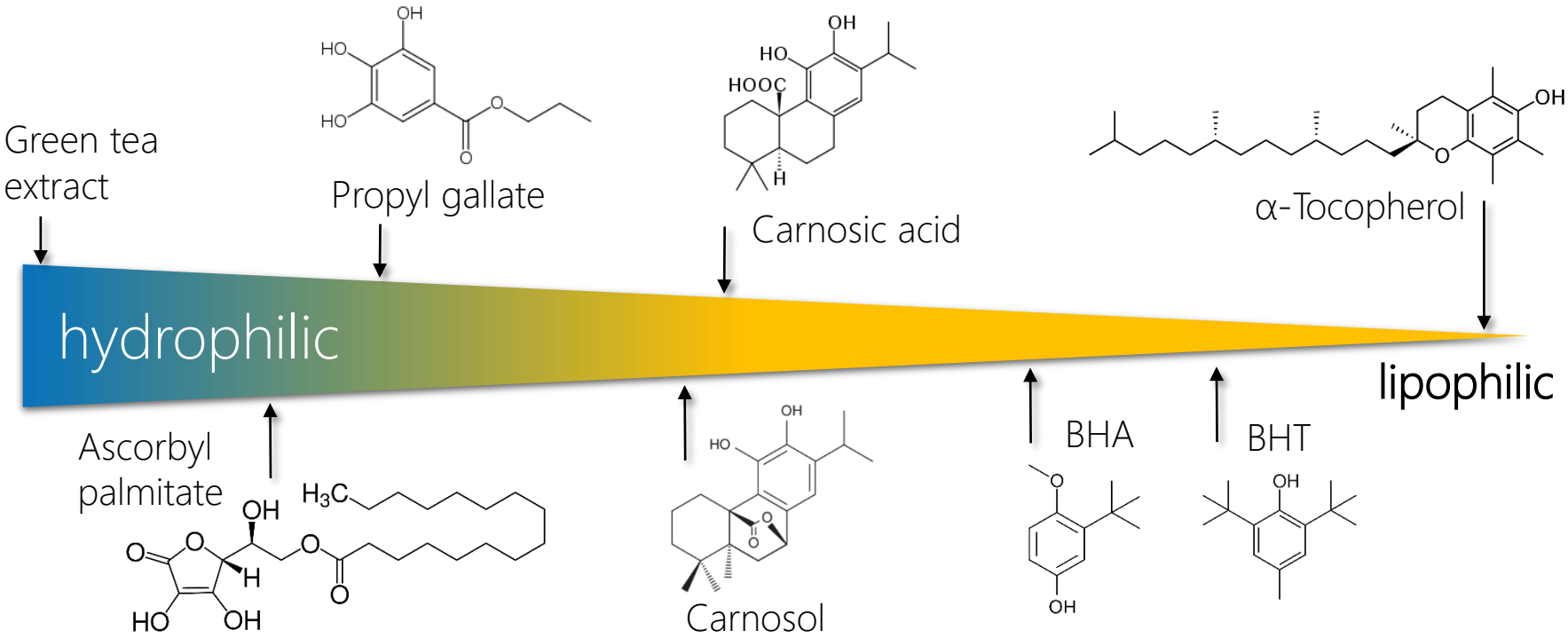
All products standardized: **50% polyphenol-content**

Test material (Polyphenol)	AOX potential
A	54,23
B	54,88
C	51,47
D	48,22
E	4,28
F	> 350



Distribution of AOX

„similis similibus solvuntur“ → Polarity of AOX vs. solvent (oil/water)



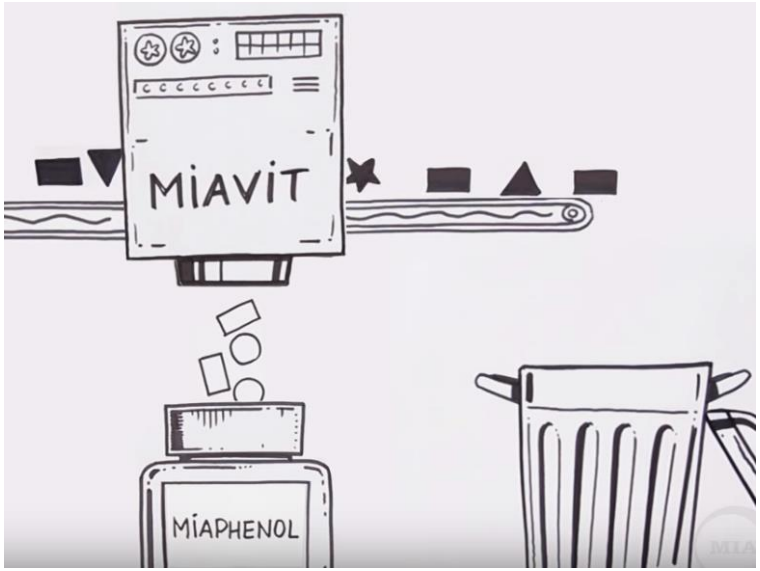
Heatstability of natural polyphenols

	temperature [°C]	time [min]	recovery phenol A [%]	recovery phenol B [%]
Test 1	129	30	89	58
Test 2	110	5	96	96

MIAVIT's solution: *MiaPhenol*

MiaPhenol

- ✓Combination of natural polyphenols
- ✓ Two defined active ingredients chosen for the highest antioxidative capacity
- ✓ Water- and fatsoluble polyphenols
- ✓ Synergistic properties to Vit. E and C
- ✓Heat-resistent
- ✓Defined conc.: 1mg MPH = 2 mg Vit. E (1:2)



Conclusion II

- ✓ Modern livestock is exposed to many challenging situations resulting in oxidative stress
- ✓ Nutrients like Vitamin E, Vitamin C and selenium can help the animal to bind and degrade reactive oxygen species
- ✓ Natural substances like polyphenols bring added value to the animal, but need to be chosen and monitored thoroughly
- ✓ MIAVIT offers solutions for technological and nutritional antioxidants
  - ➢ MiaRadOx product line
  - ➢ MiaPhenol

Thank you for your attention!

If any questions left,
please visit us at our EuroTier Showroom!

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Global Nutrition Series

	Tuesday, 09th Feb.	Wednesday, 10th Feb.	Thursday, 11th Feb.
08:00 am		MIAVIT Interactive - Let`s mix together! – Asia & Russia	
09:00 am	Essential Oils : From traditional wisdom to scientific evidence.	Protect your piglets, let´s talk about Zinc!	Feed Quality - Impact of Mycotoxins
10:00 am			
11:00 am			
12:55 pm		Spotlights on pig nutrition – 2020´s outlook Technical program at the EuroTier Digital	
01:25 pm	Spotlights on poultry nutrition – 2020´s outlook Technical program at the EuroTier Digital		
02:00 pm			MIAVIT Interactive - Let`s mix together! EUROPE-AFRICA
03:00 pm			
04:00 pm	MIAVIT Interactive - Let`s mix together! – LATAM	Oxidation processes under control – MIAVIT´s approach for modern livestock	Aceites esenciales. De la sabiduría tradicional a la evidencia científica.
05:00 pm	Impacto de las micotoxinas en la calidad del alimento