



The effective protection to feed  
and raw materials

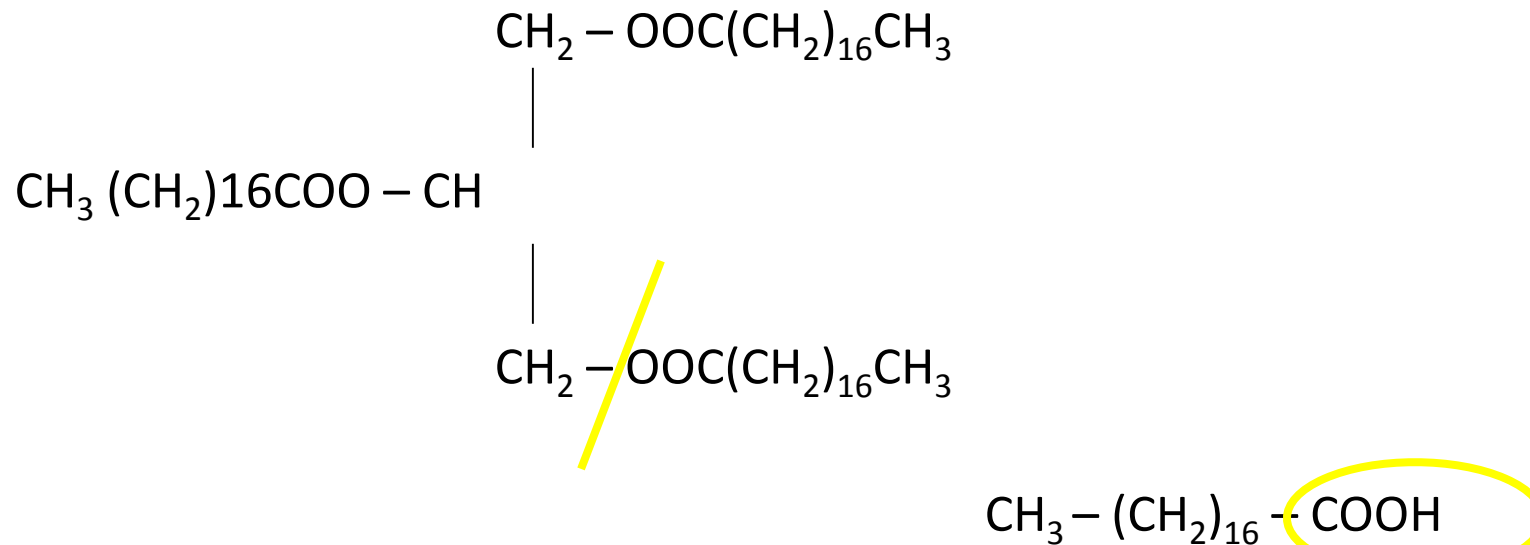
**Oxicap**  
antioxidants

# Main causes of lipid spoilage in Feed

1. LIPOLYSIS: break of the tri-glycerol structure by hydrolysis.
2. OXIDATION: reaction of molecular oxygen with unsaturated fatty acids.

# LIPOLISIS

Lipolysis is the hydrolysis of the ester bounds of lipids (tri-glycerols) caused by enzymatic activity (lipases) or by heating in the presence of water

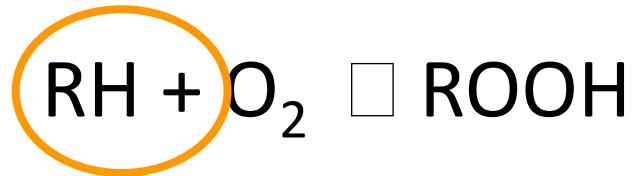


☐ Strange Flavours

Free acids : ☐☐ ACIDITY

# OXIDATION

Oxidation is the direct reaction of molecular oxygen with unsaturated lipids under mild conditions.



RH = Unsaturated Lipids:

- Fatty Acids
- Essential Fatty Acids
- Liposoluble Vitamines
- Carotenoids

LOST !

Nutritional Deficiencies

Turn into Toxics!

Animal Disorders

*Result:* nutritional and sensorial spoilage of the feed as well of risk of burning!!

# Measure of Oxidation

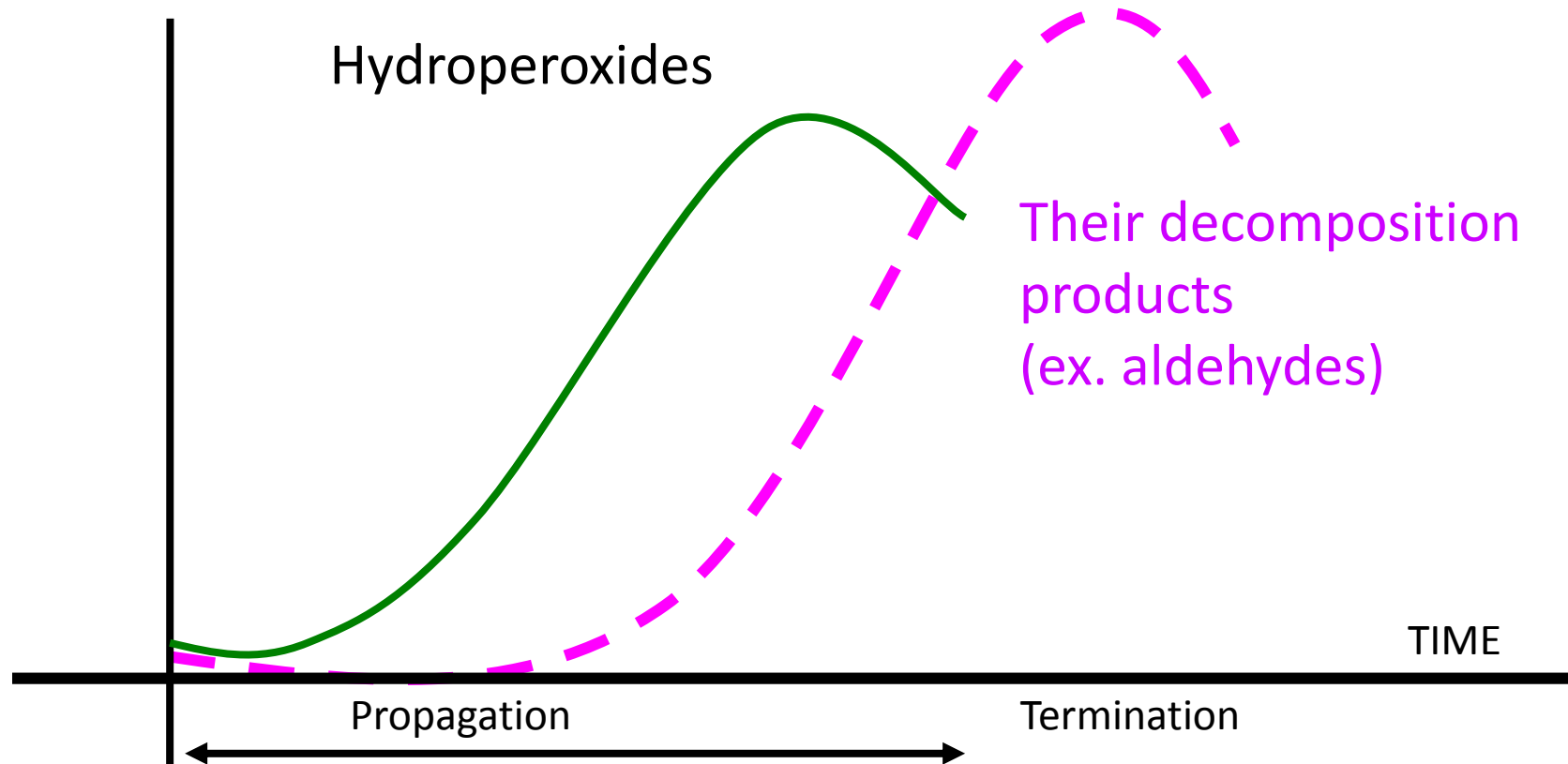
¿ Which is the OXIDATIVE STATE of a lipid?

It is assessed through the analysis of oxidation products:

- ***Hydroperoxides*** (Peroxide Value)
- ***Aldehydes*** (Anisidine Value)

# Oxidation Products

The nature/amount of oxidation products varies along the oxidative process



# Peroxide Value (PV)

Measures the Hydroperoxides (ROOH)

It is a titration assay

*Iodine measurement:*  $\text{ROOH} + 2 \text{KI} \rightarrow \text{ROH} + \text{I}_2 + \text{K}_2\text{O}$

As hydroperoxides do, PV reaches a maximum value and decreases afterwards. A very oxidised fat will exhibit a PV  $\square\square$

Without oxidation  $\text{PV} < 3$  miliequivalents  $\text{O}_2$  / kg of fat

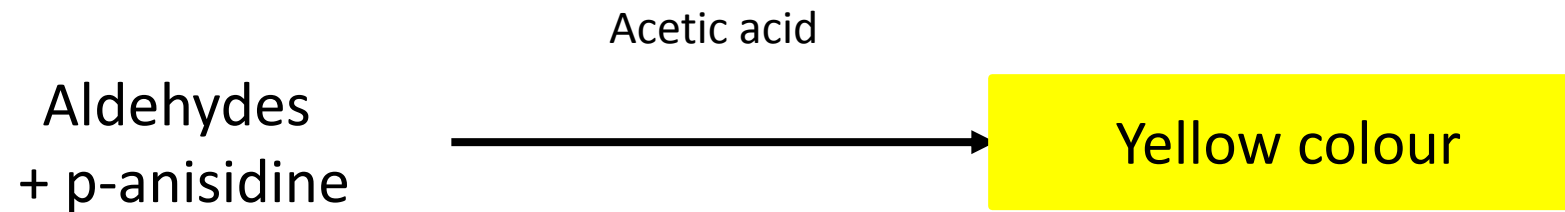
Max. Acceptable limit  $\text{PV} < 10$  meq  $\text{O}_2$  / kg

Max. Observable level  $< 25$  meq/kg



# Anisidine Value (AV)

Measures the Aldehydes (ROOH decomposition)

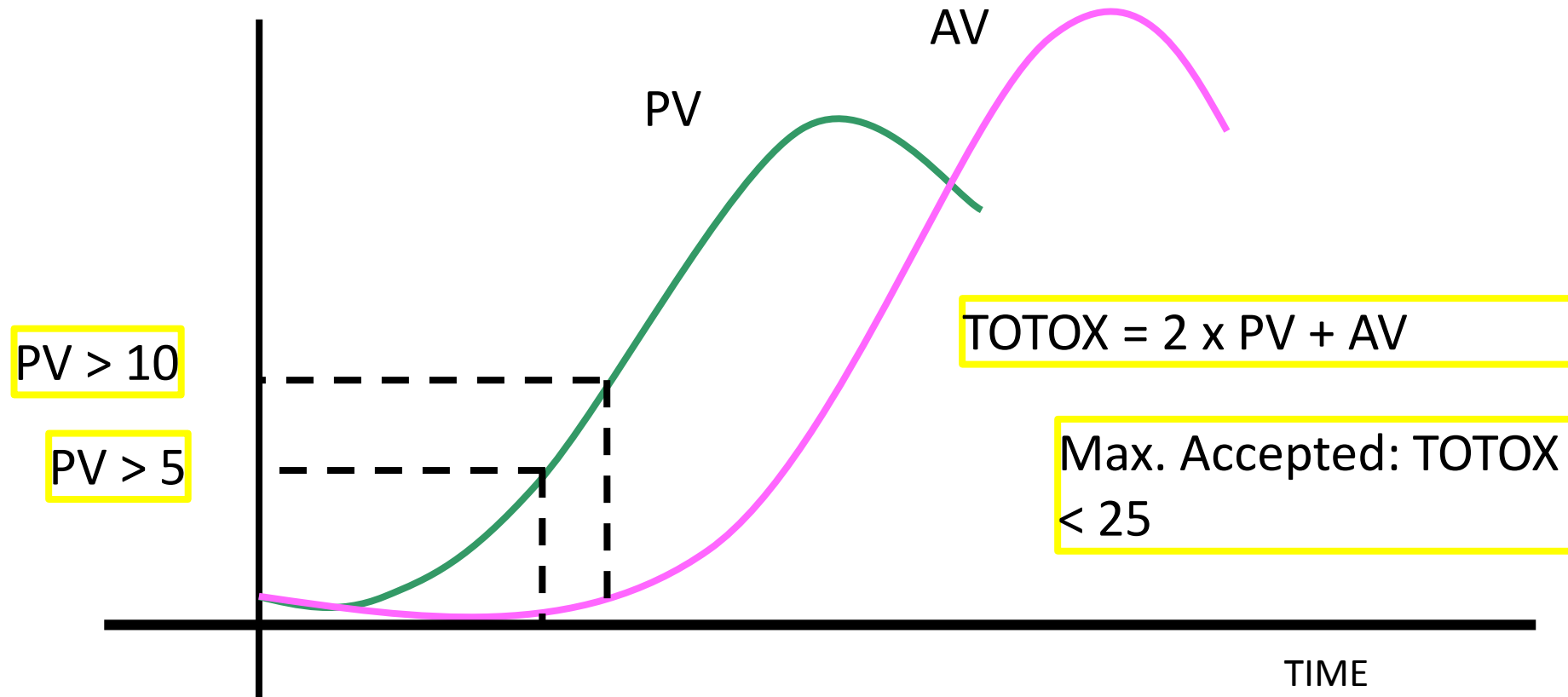


The AV rises later than PV, and therefore, do not bring information about initial stages of oxidation.  
AV ↑ when the propagation has already moved forward.

$AV_{\text{non oxidized fat}} < 5$  in oil extracted from fishmeal  
Max. Observable values <50

# TOTOX Value

The TOTOX value combines the PV and AV, bringing more exact information about the oxidation status.



## ¿RESISTENCE to oxidation of a substrate?

It is measured using assays able to accelerate the normal oxidative process.

The obtained results in this accelerated conditions can be converted into quality parameters for the tested lipid.

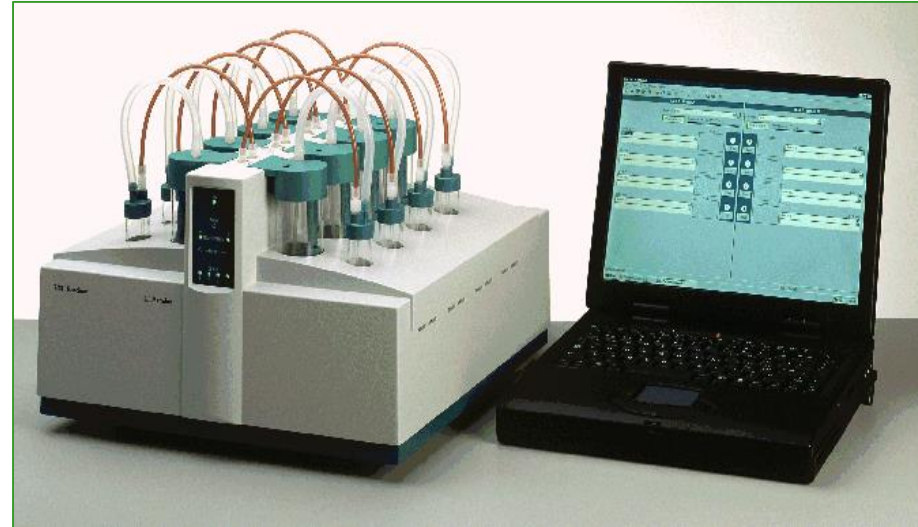
- OSI
- OXYGEN BOMB

# Predictive Methods

Predictive Methods are assays able to *accelerate* the normal oxidative process (applying  $\uparrow T$  or  $\uparrow [O_2]$ ) and *measure* it.



**OXYGEN BOMB:** measures drop pressure caused by  $O_2$  *absorption* during lipid oxidation at  $\uparrow T^a$ .



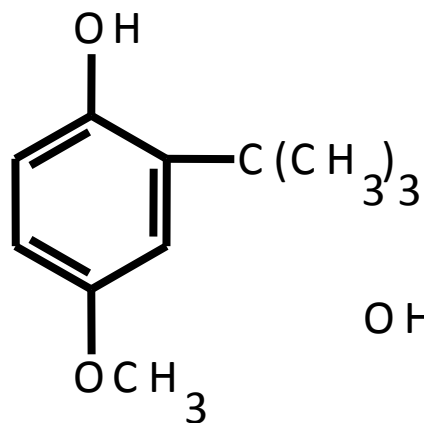
**OSI (Oil Stability Index):** records conductivity caused by *organic acids* produced during fat oxidation at  $\uparrow T^a$ .

# Antioxidants

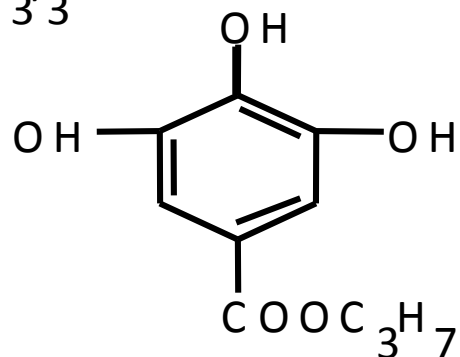
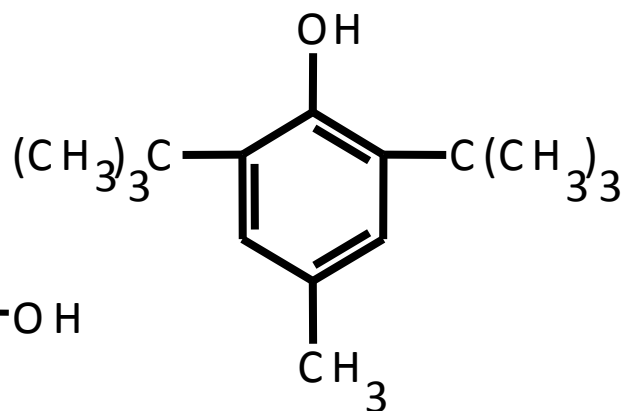
# Fenolic Antioxidant

Fenolic structures have high antioxidant activity due to their ability to give hydrogen atoms and to make resonance structures

Butylatedhydroxyanisole (BHA)



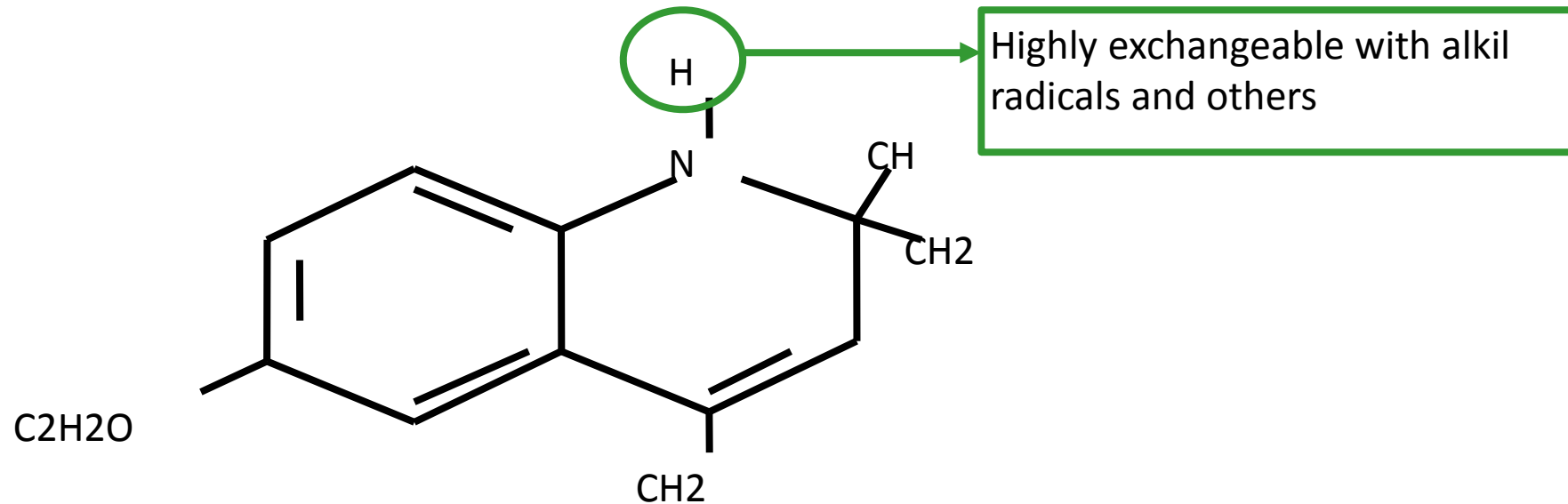
Butylatedhydroxytoluene (BHT)



Propyl gallate

# ETHOXYQUIN

6- Ethoxy-1,2-dihydro-2,2,4-trimethylquinoleine ( $C_{14}H_{19}NO$ ).



Commercial product:

Ⓡ Obtained by reaction between acetone and p-phenitidine

Ⓡ Yellow oily liquid which darkens with age Ⓡ

( $C_{14}H_{19}NO$ ) > 90 %

## Comparing Antioxidants: EFFICACY in Fat

Antioxidant	Days to reach PV = 20 meq/kg
Ethoxyquin (0.015%)	60
BHA (0.02%)	20
BHT (0.02%)	25
Propyl Gallate (0.02%)	40

The protection conferred by Etoxiquin, even at lower doses, overtakes fenolic antioxidants. [Coelho, 1995]

[Coelho, 1995]



# ETHOXYQUIN

- ✓ Described in 1921 by Knoevenagle
- ✓ Patented as antioxidant in 1939 (ICI)
- ✓ Approved for use by:
  - ✓ FDA, Feed and Food, 1959
  - ✓ FAO/WHO & EPA Fruits, 1969
  - ✓ EEC, Canada, Japan. . . . .

# USES OF ETHOXYQUIN

- ✓ Paprika: color preservation
- ✓ Feeds and Forages: nutritive value
- ✓ Fish meal: general quality
- ✓ Rendered products: against rancidity
- ✓ Rubber: anti-degradation agent

# OXICAP<sup>®</sup> E2

**OXICAP E2** is a wide-spectrum formulated antioxidant containing **different types of antioxidants** to be applied directly in **vitamin premixes, feed and raw materials.**

## 14,5% of Active Substances

- BHT = 2,5 %
- Ethoxyquin = 6,5 %.
- Metal chelators = 5,5%.

**Carrier** → high **dispersion capacity** into the substrate.

# OXICAP E2 advantages

- **OXICAP E2** is a powerful stabilizer containing **different effective compounds** conferring an ***enhanced antioxidant action***.
- By combining the benefits of different antioxidants, **OXICAP E2** is able to protect a **broad variety of substrates**.
- **OXICAP E2** is a **cost effective** product due to the high effectiveness of its *active substances*.