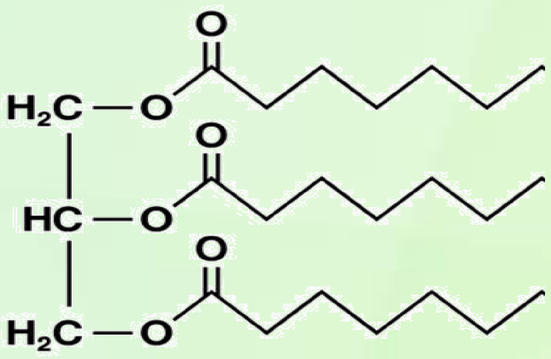
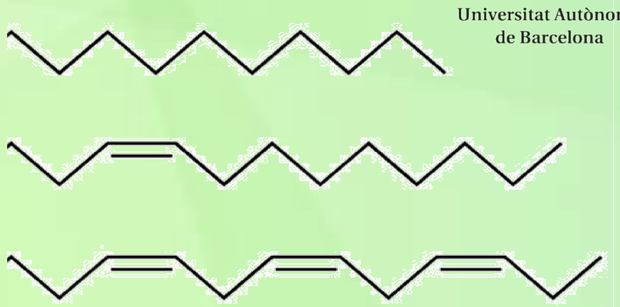


LIPID OXIDATION IN FOOD



Cristina Arroyo Correa

Bachelor's Thesis, Food Science and Technology (June 2018)

OBJECTIVES

1. To compile and synthesize the available literature on the topic.

2. To deepen the phenomenon of lipid oxidation by studying the oxidative mechanisms and the factors that produce it.

3. To investigate the different methods to analyze and control oxidation.

MECHANISMS & PHASES

Initiation:

$LH \rightarrow L^{\cdot} + H^{\cdot}$

Propagation:

$L^{\cdot} + {}^{3}O_2 \rightarrow LOO^{\cdot}$

$LOO^{\cdot} + LH \rightarrow LOOH + L^{\cdot}$

Termination:

$LOO^{\cdot} + L^{\cdot} \rightarrow LOOL$

$L^{\cdot} + L^{\cdot} \rightarrow LL$

Products of lipid oxidation

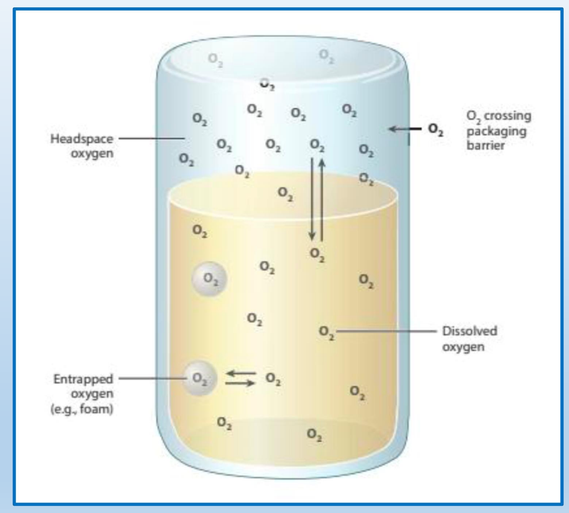
- Decomposition of hydroperoxides in products of secondary oxidation
- Interactions of lipid oxidation products with other food components

THE ROLE OF O_2 AND INFLUENTIAL FACTORS

Oxygen is the main reagent in lipid oxidation reactions that cause rancidity in food.

PROMOTERS
High temperatures
Metals (Cu, Fe)
Peroxides
Lipoxidase
O_2 pressure
Light, UV
Polyunsaturation

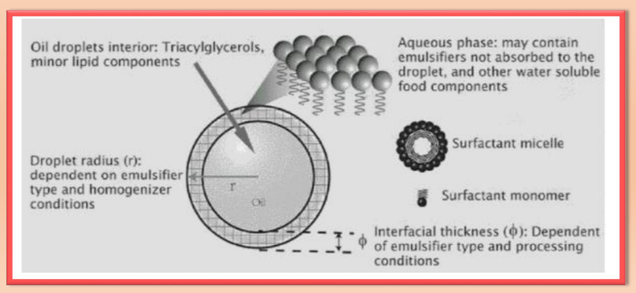
- As **dissolved gas**, the proximity and accessibility of dissolved oxygen to lipids reduces oxidative stability, that is, the system becomes more susceptible to oxidation.
- In the **headspace**, oxygen is in undissolved form and although it has less contact with the surface area with lipids than dissolved oxygen, it still represents a threat to the oxidation of lipids, since that oxygen can be transported from the head space into the matrix and dissolved in the food by diffusion or by mechanical agitation.



OXIDATION IN EMULSIONS O/W

Some components of the continuous phase can inhibit the lipid oxidation reaction:

- **Proteins** can adhere to the surface of the fat droplets.
- **Polysaccharides**, due to their ability to increase the viscosity of the continuous phase.



ANALYSIS AND CONTROL OF LIPID OXIDATION

Methods to analyze lipid oxidation
Chromatographics methods (GC, HPLC)
NMR
FTIR
Peroxide index
P-anisidine index
Thiobarbituric acid test
Hexanal test
Absorbances at 232 and 270 nm

Methods to control lipid oxidation
Antioxidants that react with oxygen (ascorbic acid)
Antioxidants that stop the propagation reaction (BHA, BHT)
Chelators
Packaging in modified atmosphere
Vacuum packaging

CONCLUSIONS

1. Lipid oxidation is a phenomenon of great importance in the food industry, since it is due to the deterioration of foods rich in fatty acids.

2. The health benefits of polyunsaturated fatty acids and the negative effects of trans fatty acids derived from the hydrogenation process have led scientists to look for new ways to protect unsaturated fatty acids in food products, such as packaging under vacuum or in a modified atmosphere, the use of oxygen scavengers and antioxidants, etc.

3. Traditional methods for the analysis of lipid oxidation are being replaced by more modern analytical and instrumental methods.

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