



## KEY CHALLENGES

- Delay Rancidity;
- Prevent Lipid Oxidation;
- No Organoleptic impact;
- Non-GMO source;
- Natural, Customer-friendly label;

## PREVENTING LIPID OXIDATION AND DELAYING RANCIDITY WITH NATURAL ANTIOXIDANTS.

The fats and oils industry plays a significant role in the global food market. Fats and oils are essential ingredients in various food products, providing flavor, texture, and nutritional value. They are widely used in cooking, baking, frying, and as additives in processed foods. The industry encompasses a wide range of products, including vegetable oils, animal fats, margarine, butter, and specialty fats.

Vegetable oils, such as soybean, palm, sunflower, and rapeseed oils, are among the most widely consumed fats and oils globally. These oils are versatile and used in various applications, including cooking, salad dressings, sauces, and margarine production.

Fats and oils are prone to spoilage due to their high fat content, which makes them susceptible to oxidation and rancidity. Spoilage can occur through various mechanisms, including exposure to air, light, heat, and microbial contamination.

These factors can lead to off-flavors, off-odors, and a decrease in product quality, ultimately rendering the fats and oils unsuitable for consumption.

Our natural solutions include, **Guardox™ TG** and **Guardox™ CA**, which are natural antioxidants made from natural extracts used to prevent the lipid oxidation and delay the rancidity in oils and fats applications.

## APPLICATIONS

Vegetable oils



Margarine & Butter



## OUR NATURAL SOLUTIONS

- Guardox™ TG Green Tea Extract
- Guardox™ CA Carnosic Acid Concentrate

## OILS & FAT

### Lipid oxidation and development of rancidity

This are significant challenges for food manufacturers as they reduce the shelf-life and alter the quality and nutritional value of their products. The most common process leading to oxidative deterioration of food lipids is autoxidation, which involves a free radical chain reaction occurring in three distinct stages: initiation, propagation, and termination.

Oxidation initiators, such as light, heat, ionizing radiation, transition metals, metalloproteins, oxidants, homolysis-prone substances, and enzymes, facilitate the generation of primary free radicals. The primary products of autoxidation are lipid hydroperoxides, which are typically tasteless and odorless. However, the decomposition of hydroperoxides produces secondary oxidation products such as aldehydes, ketones, alcohols, hydrocarbons, and acids, which are responsible for off-flavors and off-odors in food.

### Guardox™ TG a Lipid Soluble Green Tea Extract

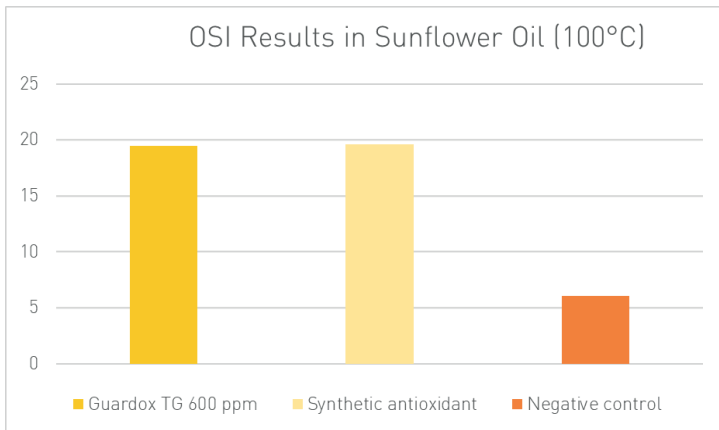
The antioxidant properties of tea polyphenols in **Guardox™ TG**, particularly flavonoids, are widely recognized. The primary source of antioxidant activity in green tea polyphenols can be attributed to their chemical structure, which consists of aromatic rings and hydroxyl groups. These components enable the binding and neutralization of lipid free radicals by the hydroxyl groups present in the polyphenols.

### Fig 1 Guardox™ TG in Sunflower Oil

Sunflower oil is susceptible to rancidity, which can have significant implications for the food industry. It can be attributed to various factors, including exposure to light, heat, air, and moisture.

The study compares the Oxidative Stability Index (OSI) between three samples: Sunflower Oil treated with 600 ppm of **Guardox™ TG**, untreated samples (negative control), and samples treated with a synthetic antioxidant (positive control).

The graph clearly demonstrates the effectiveness of **Guardox™ TG** in Sunflower Oil, as it exhibits comparable results to the synthetic antioxidant in resisting oxidation.

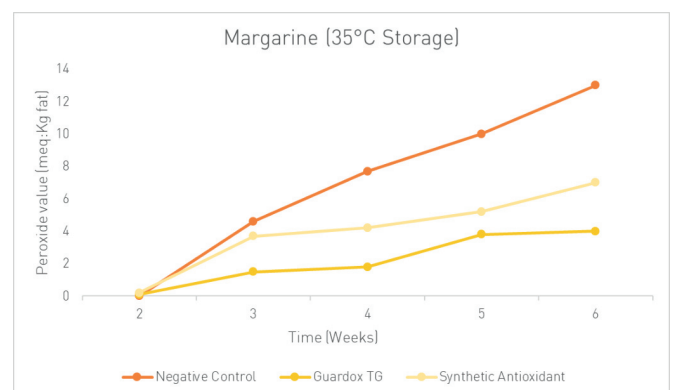


### Fig 2 Guardox™ TG in Margarine

Oxidation in margarine occurs due to the presence of unsaturated fats, such as vegetable oils, which are prone to oxidative degradation when exposed to air, light, and heat. Natural antioxidants such as green tea extract are used as an effective clean label and safer alternatives to synthetic options.

The study compares the results between samples with **Guardox™ TG** Negative control (without any addition), and Positive Control (Synthetic sample).

The graph shows clearly the efficacy of 250 ppm of **Guardox™ TG** in stabilizing margarine for up to 6 weeks, maintaining the peroxide value lower compared with the others Controls.



## OILS & FAT

### Guardox™ CA a Lipid Soluble Rosemary Extract

**Guardox™ CA** a lipid soluble antioxidant extracted from Rosemary, scientifically known as *Salvia rosmarinus*, containing lipid-soluble antioxidants, predominantly carnosic acid. It is an efficient, surpassing the effectiveness of synthetic antioxidants like butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT). Carnosic acid possesses two hydroxy groups located at C11 and C12 in the ortho positions, which enhances its antioxidant capabilities.

These hydroxy groups play a crucial role by donating hydrogen atoms, thereby interrupting the oxidation chain reaction. Additionally, when carnosic acid is consumed and acts as a protective agent against lipid oxidation, it undergoes degradation and transforms into carnosol, which is another lipid-soluble antioxidant.

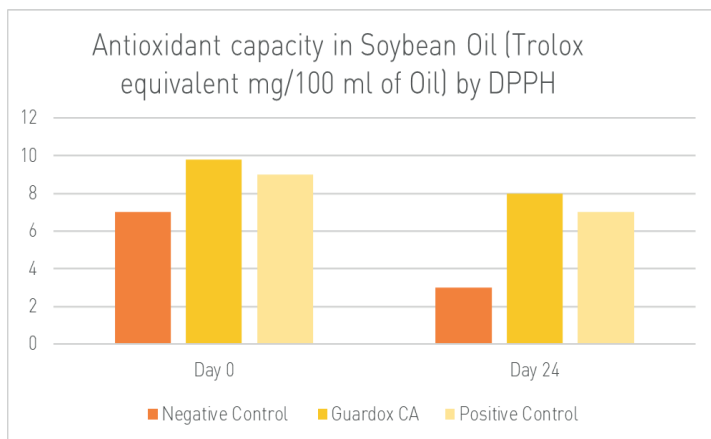
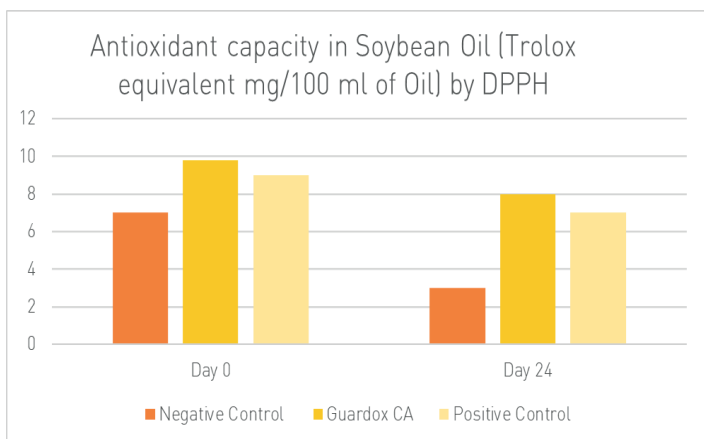
#### Fig 1 Guardox™ CA in Frying Oil

**Guardox™ CA**, was tested directly 400 mg/Kg in different vegetal oils such as Soybean oil, Cottonseed Oil and Rice bran Oil. After the addition of **Guardox™ CA**, oil samples were stirred for 10 minutes at room temperature.

The graphs below show the results of the antioxidant activity for different vegetal oils. The study compares the difference between samples with addition of **Guardox™ CA**, negative control (without any addition), and positive control (a mixture of synthetic antioxidants BHA and BHT).

Over the course of the 24-day storage period, there was a significant decrease in the antioxidant capacity of both negative control, samples with **Guardox™ CA** and samples with synthetic antioxidants.

However, on Day 24, soybean oil and cottonseed oil with **Guardox™ CA** exhibited a significantly higher antioxidant capacity compared to oil with synthetic antioxidants.



### Table. Natural Shelf-life Solutions for Oils and Fats

Ingredients	Application		Benefits	Dosage
Guardox™ TG	Water-in-Oil Emulsions	Margarine, Fat, Spreads	Antioxidant, Delay of Rancidity	400-600ppm
	Oil-in-Water Emulsions	Mayonnaise, Salade, Dressings, Sauces	Antioxidant, Delay of Rancidity	400-600ppm
	Vegetable Oils, Frying Oils	Sunflower Oil, Canola Oil, Soybean oil	Antioxidant, Delay of Rancidity	400-600ppm
Guardox™ CA	Vegetable Oils, Frying Oils	Sunflower Oil, Canola Oil, Soybean oil	Antioxidant, Delay of Rancidity	400-600ppm