



Innovation in Natural Food
Colouring and Flavourings
**OUR GLOBAL DISTRIBUTION
AVAILABLE IN 49 COUNTRIES**



Food Protection Systems



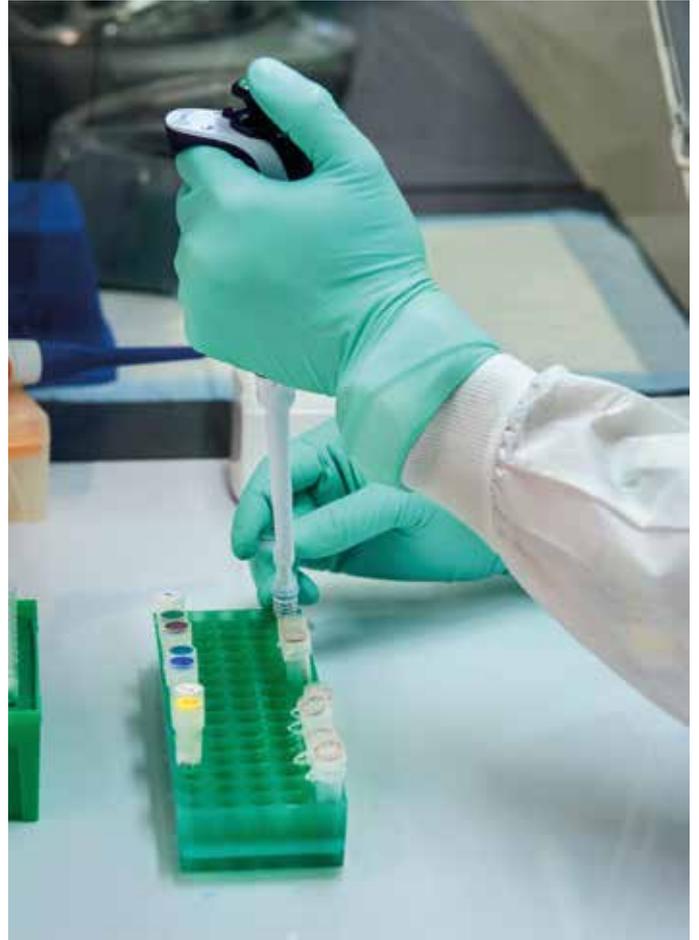
Innovation naturally

WHY PLANT-EX?

Established in 2010 and boasting an industry experience of more than 25 years, the Plant-Ex team have developed a portfolio of ingredients which are supplied into the food and feed industry across the globe. Individual development laboratories combined with experience of a multitude of different applications means that the organisation knows how to deliver a product that performs.

Taste, colour and function are critical elements in nutrition for both humans and animals. Our expertise spans the three subjects and our factories and raw material routes are well placed to give customers and their animals the best options that nature can offer.

Taste	Pallatability, flavour and preference
Colour	Appearance, differentiation and brand value
Function	Nutrition, shelf life and health



*Talk to our team about legislatively compliant options with supportive studies assured to assist in the development of great products for our charges in the animal population.

WHAT ARE FPS?

The Plant-Ex Food Protection Systems (FPS) department are dedicated to the development of clean label natural antioxidants and preservatives.

Like our customers, food safety and quality is at the forefront of everything we do, protecting reputations as well as products is something we at Plant-Ex pride ourselves on.

WHY USE FPS?

Consumer demands for fresher, longer lasting, safe foods that use familiar clean label ingredients are increasingly growing. This has caused a reduction in the need for chemical additives, paving the way for natural clean label solutions that fight oxidation and spoilage organisms.

FPS products target oxidation and spoilage organisms using natural, clean label ingredients.

WWW.PLANT-EX.COM

VISIT OUR WEBSITE TO GET MORE INFORMATION

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UNDERSTANDING LIPID OXIDATION (RANCIDITY)

Lipid oxidation is a highly complex set of free radical reactions that occur between fatty acids and oxygen, this results in the oxidative degradation of lipids, which is also known as rancidity.

The mechanism driving lipid oxidation begins with a reaction of unsaturated fatty acid with oxygen (O₂) forming a primary oxidation product known as a lipid hydroperoxide (LOOH).



The **lipid hydroperoxides** split **fatty acid chains, polymers and dimers** to form epoxides, alcohols, aldehydes and ketones which interact negatively with food constituents such as proteins, sugars, pigments and vitamins, negatively modifying their properties leading to off flavours, bad aromas, colour loss (fading of foods) and nutritional deficits.



Lipid oxidation in food stuffs can be classified into two types, autoxidation and photooxidation:

- **Autoxidation** – The auto-catalytic generation of free radicals and the main cause of rancidity in foodstuffs, this occurs in three phases:

- **Initiation** – A hydrogen atom is abstracted in the presence of initiators such as light, heat, metals or oxygen, this forms a lipid radical which reacts with oxygen making a lipid peroxide radical.

- **Propagation** – The peroxide radical reacts with a second lipid which creates a lipid radical and a hydroxy peroxide, the lipid radical formed then propagates the chain of autoxidation forming a new reaction in the cycle.

- **Termination** – Antioxidants may terminate or block the propagating cycle by effectively ending or blocking the hydroperoxide formation thus delaying the onset of rancidity.

- **Photo oxidation** – this is the same as autoxidation but begins when nonreactive triplet oxygen (3O_2) is converted to a reactive singlet oxygen (1O_2) through exposure of UV light radiation.

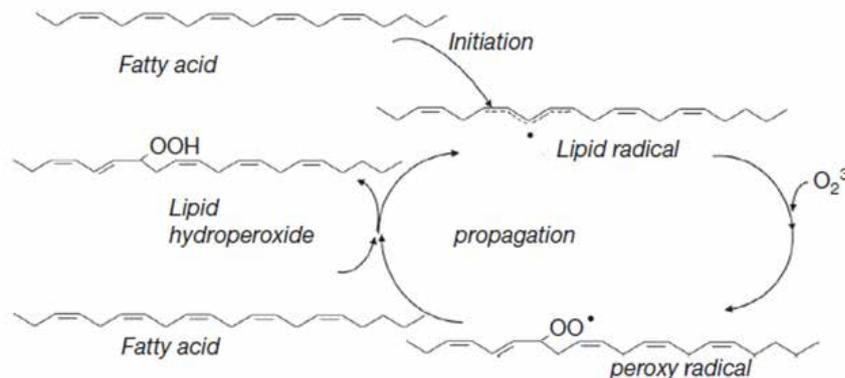


Figure 1 – Diagram to show the three stages of autoxidation - Reproduced from Frankel, E. N. (2005). Lipid oxidation. Bridgewater: Oily Press.

COMBATING LIPID OXIDATION

Lipid oxidation is inevitable, it will occur in all food stuffs containing lipids eventually, however there are some factors that will impact the rate of these oxidation reactions:

- **Storage conditions** – temperature, light exposure, oxygen availability and water activity all impact the rate at which lipid oxidation occurs.
- **Type of lipid** – triacylglycerols and phospholipids oxidise differently.
- **Antioxidants** – antioxidants are used to terminate branches of the autooxidation cycle, this slows further lipid radical and hydroperoxide production allowing for an improved resistance to rancidity.

TO SUMMARISE

- Rancidity is **inevitable** in all lipids exposed to oxygen.
- It is responsible for **off flavours, smells** and colour loss alongside **nutritional losses**.
- It is inevitable but it **can be slowed** efficiently with **proper storage conditions, packaging** and the use of **effective antioxidants** that prevent the auto-catalytic generation of free radicals.



OUR FPS ANTIOXIDANT SOLUTIONS

Our range of effective antioxidant solutions provide effective measures to help solve issues associated with rancidity such as colour degradation, flavour loss, and nutritional degradation. This enables a high-quality product, boasting clean label ingredients that protect effectively against oxidation.

Mixed tocopherols (Vitamin E) (label friendly)

Label friendly, effective in many applications, this popular antioxidant is useful at preventing oxidation of oils and fats and lipid rich foods.

Rosemary extracts (clean label)

The phenolic contents of natural carnosic acid provide great antioxidant capabilities for – cooking oils, snacks, roasted nuts, meats and fish products.

Green tea extracts (clean label)

Water soluble catechins are suitable for preventing oxidation in baked products

OUR FPS ANTIOXIDANT SOLUTIONS

Grapeseed extract (clean label)

Packed with phenolic antioxidants, grapeseed extract can be suitable for stabilizing rancidity in meat products, keeping the product fresher for longer.

Olive extracts (clean label)

Contains phenolic compounds such as hydroxytyrosol and oleuropein that are effective antioxidants that inhibit lipid oxidation.

Synergistic Blends (label friendly/clean label)

Synergistic blends of antioxidants that can prevent rancidity on two levels, a primary antioxidant that delays the onset of oxidation at the initiation stage, and a secondary antioxidant that decomposes hydroperoxides into non-reactive products before they propagate the chain of autooxidation. These synergistic blends allow for fresher, longer lasting products.

Get in touch to discuss a solution for your product.



ANTIMICROBIALS AND PRESERVATIVES

The reliance on synthetic antimicrobials and preservatives in the food industry has shown undesirable consequences such as the development of allergies, toxic side effects and developmental issues amongst children. Alongside this, recent world events have highlighted the unnecessary over usage of antibiotics for food production.

Sourcing clean label preservatives for shelf life enhancement has never been more important. Businesses are increasingly taking the steps necessary to provide clean label preservation methods for their products to satiate the consumer's growing awareness of clean label ingredients.

Inhibiting microbial growth, preserving quality and enhancing flavor naturally is a crucial step forward as the food industry moves further away from synthetic ingredients, our natural preservatives and antimicrobial products provide multi-faceted solutions for many applications.

Acerola cherry (clean label)

Contains natural organic acids that aid food preservation, due to the ascorbic acid content of acerola cherry, microbial growth is inhibited greatly.

Buffered Spirit vinegar (clean label)

The acetic acid content in spirit vinegar is helpful in protecting processed meat and poultry from spoilage bacteria and foodborne pathogens. Due to its low pH, buffered spirit vinegar helps to maintain pathogen control without altering taste.

Buffered Lemon juice (clean label)

Natural citric acid and sodium citrate found in lemon juice are prominent preservatives used in many foods and beverages, the acidic content is useful in bringing the pH level down inhibiting microbial growth.

Rosemary extracts (clean label)

Antimicrobial properties are also linked to rosemarinic acid found in rosemary extract, helping to further preserve a range of products.



OUR SERVICES AND SUPPORT

We pride ourselves on being able to provide our customers with technical support to help find the most suitable solution to combat rancidity, a major part of this process involves product sample testing of your product with a range of antioxidants that will have been matched to your needs. This helps us to ensure we get it right every time as well as peace of mind that your product will be protected against oxidation.

The testing and support solutions that we offer:

- Enhanced light stability testing**
- Rancimat rancidity testing**
- Shelf life evaluation testing**



ENHANCED LIGHT STABILITY TESTING

The consumer judges the quality of a product with their eyes, the fading of foods due to lipidic photooxidation can severely impact quality perception amongst consumer groups. Our enhanced light stability testing has a proven track record of problem-solving such colour loss issues.

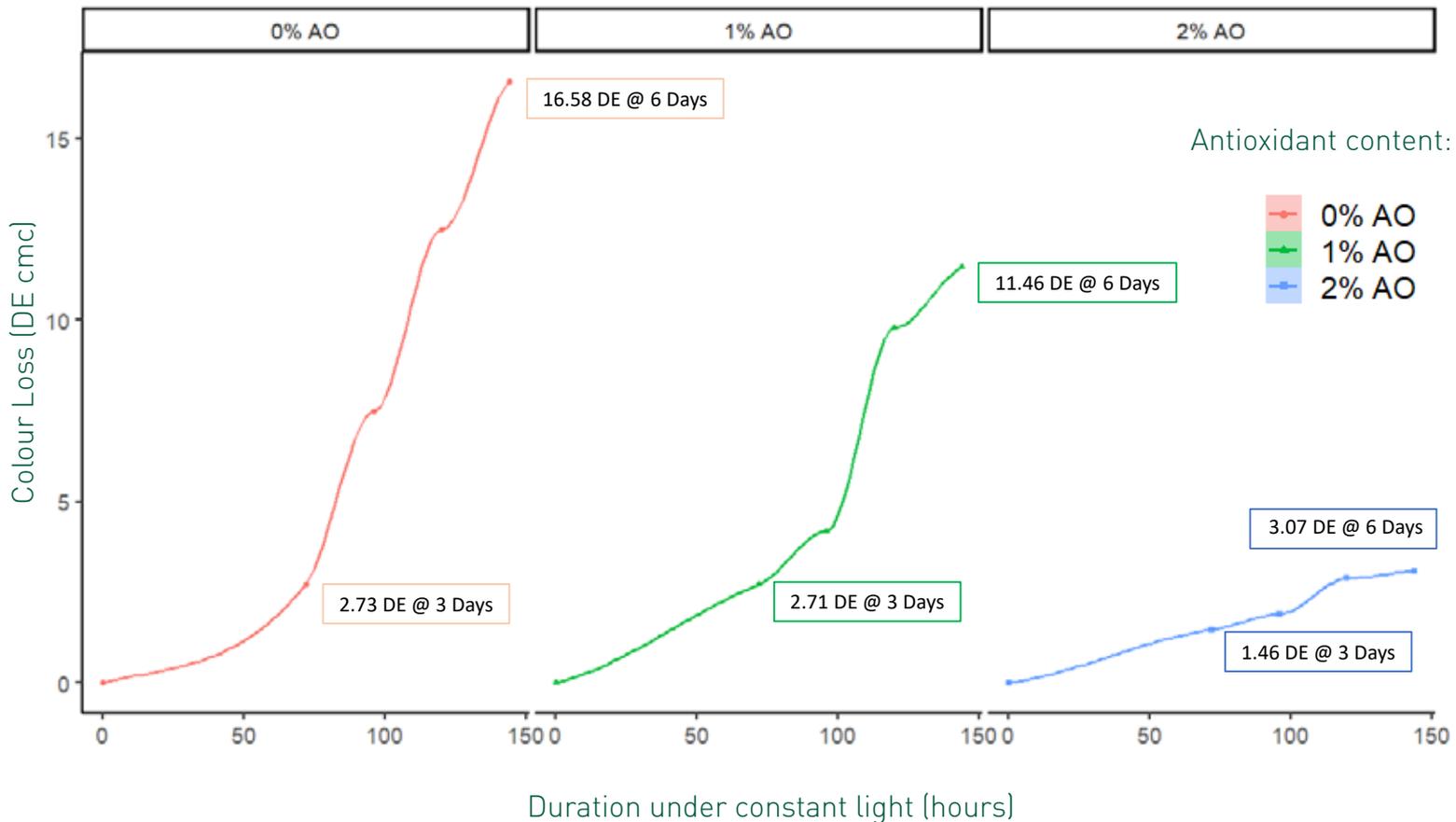


Figure 2 – Graph showing efficacy of an antioxidant product in Paprika Oleoresin exposed to enhanced light stability testing over 150 hours.



RANCI-MAT RANCIDITY DETERMINATION

Knowing which antioxidant product works harmoniously with your product is key to providing efficient solutions that combat rancidity. Our state-of-the-art induction rancimat testing utilises accelerated testing methods, giving us a picture of lipid oxidation that would normally take place over weeks/months, in just mere hours. Our technical support team will then advise you on the most efficient antioxidant solution for your product.

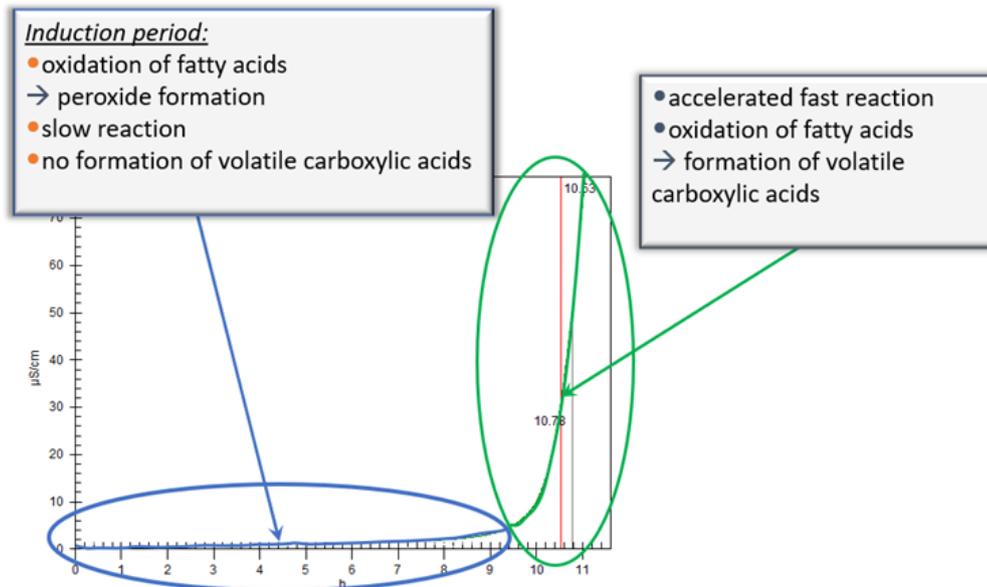
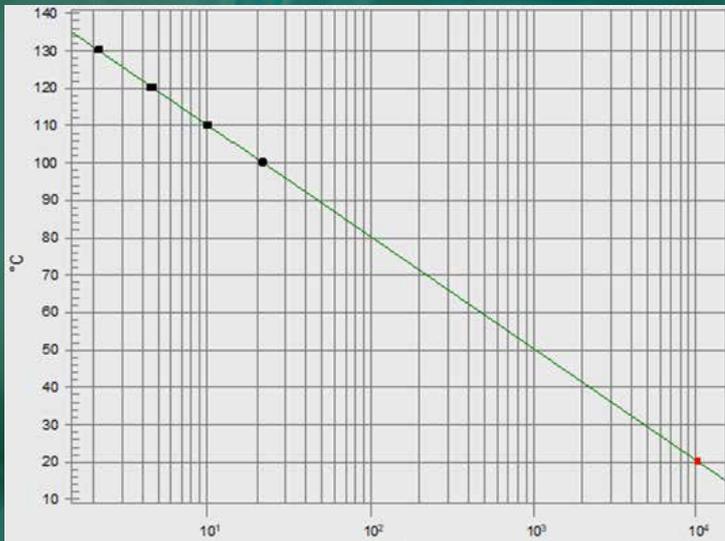


Figure 3 – Rancimat method determination of rancidity.

SHELF LIFE EVALUATION TESTING

Shelf life evaluation testing of your product with antioxidants shows the true efficacy of antioxidants in your product, you will see an improvement in your product immediately with the correct usage of our antioxidant products.



**4 temperatures: 100°C,
110°C, 120°C, 130 °C**

**Estimated life time at
20°C: 1.2 years**

Figure 4 – Graph showing estimated shelf life of sesame oil at room temperature.



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