

Characterization of performances of various natural antioxidants in the formulation of food, feed and pet food, to identify the best processing conditions

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This PhD thesis research project is aimed to study new antioxidant substances able to prevent and slow down the lipid oxidation in food, feed and pet food matrices, thereby extending their shelf life. The focus will be on antioxidant molecules, preferably extracted from by-products. At the same time, this project will conduct a detailed study of the antioxidant additives currently used in the cited sectors, in order to identify the optimal usage conditions and ensure the best performances.

State of the art:

Lipid oxidation is the primary cause of **shelf life** reduction in processed foods - including pet food and feed - containing fats. This chemical modification not only compromises **safety**, but also affects **organoleptic characteristics**, making the products unappetizing to both humans and animals.

Oxidation is a non-reversible and auto-catalytic reaction: once it starts, it cannot be stopped, but only prevented and/or slowed down extending the initiation phase as much as possible [2].

Regarding food, pet food, and feed susceptible to lipid oxidation, nowadays industries make use of a wide variety of **antioxidant additives**. The most commonly used are:

Synthetic antioxidants

- BHA (butylated hydroxyanisole) – E320
- BHT (butylated hydroxytoluene) – E321
- TBHQ (tertiary butylhydroquinone) – E319
- Propyl gallate – E310
- Ascorbyl palmitate – E304

Natural antioxidants

- Tocopherols – E306, E307, E308, E309
- Rosemary extract – E392
- Citric acid – E330.



Several studies suggest that the **performances** of natural antioxidants are often **equal to or better** than synthetic ones. Also for this reason, the use of tocopherols and phenolic compounds from rosemary is already widespread. Even more studies are focusing on other **plant-derived antioxidants**, such as vitamins, carotenoids and other phenolic compounds. However, these are still less commonly used as technological additives, while many are already added as nutritional antioxidants [1, 3, 4].

Gantt diagram for this PhD thesis project:

Activity	Months	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
A1) Bibliographic research																			
A2) Study of target products and antioxidant molecules																			
1) study of oxidation processes in target products																			
2) study of antioxidant molecules																			
3) Production of antioxidant blends on laboratory scale																			
A3) Blends testing on laboratory scale products																			
A4) Shelf life assessment of products and comparison																			
1) chemical analyses and ASLT																			
2) sensory analyses																			
A5) Evaluation of analytical methods																			
A6) Feasibility assessment and scale up																			
A7) Thesis and papers writing																			

Expected results:

The goal of this research is to identify **new potential natural antioxidants** to be used in food and feed matrices, and to define the optimal parameters for the practical application of these antioxidants and/or those already used in the industry. Indeed, the existing scientific literature lacks precise information about the most suitable antioxidants for specific matrices, their dose and their best formulation during the production process. The aim will be to evaluate, through the assessment of specific shelf life parameters, the performances of antioxidants based on their **conditions of use**: antioxidant-matrix combination, food/feed structure and fat characteristics, thermal treatments, storage conditions, composition and physical state of antioxidant blends, dose of use and formulation technology.

References:

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