THE ADITION OF ANTIOXIDANTS TO OILS AND FATS

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Abstract

This study was conducted in order to assess antioxidant activity of Ascorbyl Palmitate and d-α-Tocopherol, and their performance in retarding lipid oxidation in foodstuffs. For the purpose of studying the antioxidant efficiency in real systems, was used as fats: butterfat, peanut oil and lard.
Also, the study refers to the synergistic properties of mixtures by Ascorbyl Palmitate and d-α-Tocopherol, named ,,Ronoxan A''(made by Hoffmann La Roche). The determination of peroxid value was used for studing thermal resistance and antioxidant efficiency at high temperatures.
The results of antioxidant capacity test showed that the mixtures by Ascorbyl Palmitate and d-α-Tocopherol has done better in comparition with the single antioxidant. Apart from the synergism of Ascorbyl Palmitate and d-α-Tocopherol, Ronoxan A has the advantage of better solubility compared with ascorbyl palmitate. The results of experiments showed that the antioxidant activity of Ronoxan A was higher than Ascorbyl Palmitate and d-α-Tocopherol.
Keywords: *antioxidant, Ronoxan A, peroxid value, induction period.*

Introduction

The shelf life of foodstuff is a decisive factor in ensuring the supply of satisfying nutrition for the increasing the level of life's population.

The shelf life of most food components, such as proteins, fats, carbohydrates, vitamins, is limited. Fats in particular are very susceptible to deterioration (Banu, 2002)

Lipid oxidation occurs when oxygen reacts with lipids in a series of free radical chain reaction that lead to complex chemical changes(Fakumoto and Mazza, 2000). This reaction is known as a major food deterioration process and cause quality loss due to off-flavor formation, degradation of essentialfatty and vitamins as well a toxic compounds formation (Larson 1997).Free radicals are thought to be responsible for several pathological processes, such as cancer, atherosclerosis and negative cellular changes

associated with aging (Pellegrini et al.,2001). At present, addition of synthetic antioxidants is the most popular way to delay oxidation in foods. Use of such compounds has been increased greatly for improving food's shelf-life and increasing the stability of lipids and fat-base food (Madhavi et al.,1995).

Experimental

Materials:

The most commonly used antioxidants at the present time are Ascorbyl Palmitate and d-α-Tocopherol. They are added to a wide variaty of foods such margarine, biscuits, chocolate fillings, dietary and baby foods, dairy products, essential oils (Banu, 2000).

Ascorbyl Palmitate:

- appearance: is a white to slightly yellowish crystalline powder, practically odourless.
- solubility: it is soluble in alcohol (100g/kg), in some other solvents, in most vegetable oils (0,3g/kg), particularly in coconut oil (1,2g/kg at 20°C and 50g/kg at 100°C), but practically insoluble in water.
- stability: it is fairly stable to air if protected from humidity, but somewhat sensitive to light and heat.

The product ascorbyl palmitate, still has the full biological activity of vitamin C (1 mg vitamin C = 2,36 mg ascorbyl palmitate). Ascorbyl palmitate breaks down in the digestive tract releasing ascorbic acid.

- application: Ascorbyl palmitate is an antioxidant for fats, oils and fat containing foods, and a stabilizer for dehydrated vegetable products. It may be used by itself or in combination with other active substances. Together with d-α-tocopherol, it acts as a powerful synergist. Ascorbyl palmitate is thus suitable for stabilizing vegetable fats and oils having a high natural tocopherol content (coconut oil 10-80mg/kg; palm oil 20-500mg/kg; olive oil 30-300mg/kg; soybean oil 150-1400mg/kg; peanut oil 260-600mg/kg; sunflower oil 600-700mg/kg; wheat germ oil 1200-1500mg/kg)

In general, quantities of 100-500mg ascorbyl palmitate/kg fat are needed for stabilization.

D-α-Tocopherol:

- appearance: is a clear, yellow, viscous oil, practically odourless.
- solubility: it is miscible with oils and solvents for fat, insoluble in water.

- stability: it is ratherresistnt to changes of pH and temperature up to 200°C in the absenceof oxygen.

D-α-Tocopherol is commonly known as vitamin E. 1g of d-α-Tocopherol is equivalent to 1,1 International Units (I.U.) of vitamin E.

- application: d-α-Tocopherol is an antioxidant for edible oils and fats, fat containing products, cosmetics, pharmaceuticals and essential oils.

The amount of antioxidant used to ensure a proper stabilization should be the smallest possible: for most food, 100-500mg/kg fat are sufficient, for essential oils and chewing gum up to 1000mg/kg fat.

Ronoxan A: is a mixture of antioxidants and synergists containing-ascorbyl palmitate (25%), d-α-tocopherol (5%), lecithin (70%).

- appearance: is a brown to dark brown paste with a slight odor.
- solubility:it is soluble in oils preheated to 60°C to the extend of 2g/kg and remains in solution on cooling to room temperature.
- stability: for maxim shelf-life, Ronoxan A should protected from air, light and heat.
- application: Ronoxan A is an antioxidant mixture suitable for the stabilization of vegetables oils and animal fats and specially for fat containing foods. Apart from the synergism of ascorbyl palmitate and tocopherol, Ronoxan A has the advantage of better solubility compared with ascorbyl palmitate. In the fat or oil is to be subjected to further food processing with other ingradients, it is advantageous to add the antioxidants before or at the start of the process.

Methods for measure the antioxidants (Somogyi,1991).

For the best results, the antioxidants(ascorbyl palmitate and tocopherol) should first dissolved at 100-105°C in a portion of the material to be stabilized(butter fat, peanut oil, lard). This solution is then added to the bulk, preferably while both are still warm (60-70°C).

Warning: ascorbyl palmitate descomposes at approximately 113°C unless oxygen is excluded.

In products where turbidity of the fat phase does not matter (margarine), it is possible to disperse ascorbyl palmitate at relatively low temperature (up to 60°C) by stirring intensely. In fat-containing drinks or dry milk products, it is possible to add a finely dispersed solution of ascorbyl palmitate before homogenization.

The higher solubility of ascorbyl palmitate in coconut oil at 100°C allows a simplified procedure to be used to stabilize mixture of oils. Such oils will became turbid only a low temperatures, but, after standing a while at room temperature, they will be clear again

The amount of Ronoxan A (200-2000mg/kg fat) used for stabilization is heated in a part of the fat to 50-60°C and then added to the bulk while it is still warm or after preheating.

The methods used for analysis: determination of peroxide value using the volumetric method-tiosulphatometria (express into miliequivalents/kg fat) and „Reaction Kreiss'' for freshness fat.

Results and Discussions

Example 1: The results of experiments demonstrate the action of ascorbyl palmitate against antioxidation of peanut oil and butter fat. Samples of butter fat and peanut oil stabilized with 120 mg of ascorbyl palmitate per kg fat, were subjected to tests at 115°C, differents hours. (figure 1 and figure 2).

Table 1 show samples of butterfat stabilized with 100mg of ascorbyl palmitate per kg fat were stored at 37°C, diferents days.

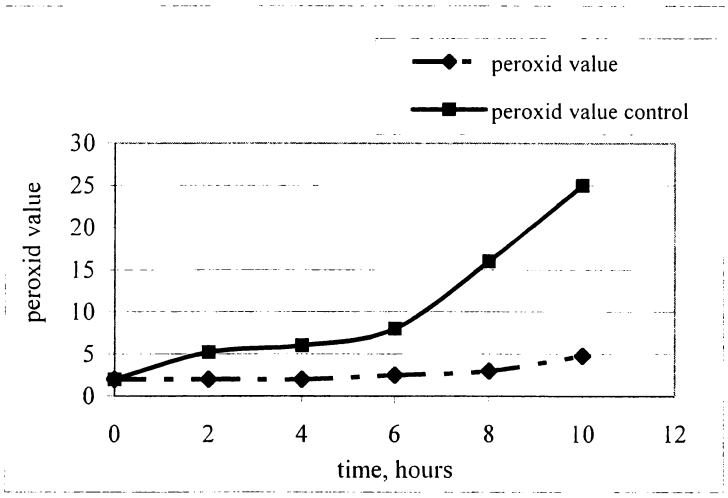

Fig. 1: Action of ascorbyl palmitate in butter fat against autoxidation at 115°C

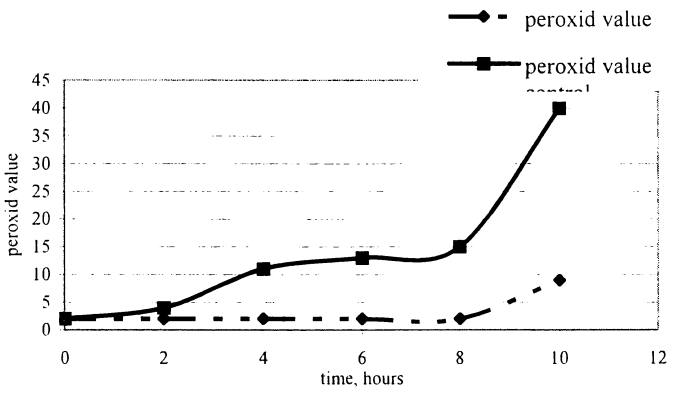

Fig. 2: Action of ascorbyl palmitate in peanut oil against autoxidation at 115°C

Table 1: Action of ascorbyl palmitate in butter fat against autoxidation at 37°C

Sample	Peroxid value after days		
	15	60	120
Control	0,0	14,2	90,1
100mgAP/kg	0,0	0,2	5,7

Example 2: The results of experiments demonstrate the action of tocopherol against antioxidation of lard. Figure 3 demonstrate the benefical effect of tocopherol. The induction period of lard stored at 20°C (determinated by reaction Kreis) is extended significantly.

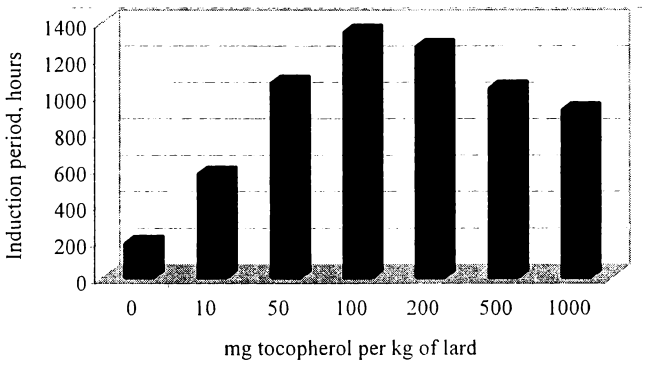

Fig. 3: The benefical effect of tocopherol

Example 3: The samples of butter fat was stabilized with Ronoxan A. The peroxid value measured after a storage test at 105°C in open dishes are showed in table 2; the samples were tested after 24 and 48 hours.

Table 2: The influence of addition of Ronoxan A in butterfat

Sample	Peroxid value after	
	24 hours	48 hours
Control	4	45
100mg/kg	2	18
250mg/kg	1	4,5
500mg/kg	0,5	2,5
1000mg/kg	0,5	1

Conclusions

In practice, the use of antioxidants are of prime importance in animal fats. They may also be used to increase the stability of processed vegetable fats an oils.

Example 1: The increase of peroxide value is retarded in all stabilized samples with ascorbyl palmitate.

Example 2: 100mg of toopherol/ kg lard is the most favorable concentration for increasing the induction period. The example also demonstrates that increasing the concentration of tocopherol does not necessarly increase the stability of fat. Extremely high levels of addition may even have a pro-oxidative effect. Crude vegetables oils have a content of natural tocopherols. However, technological processes, such as refining or hydrogenation can cause considerable or even total loss of natural antioxidants.

Example 3: The optimum addition of Ronoxan A is 250-500mg/kg butterfat.At this level, optimum stabilization is combined with the most favourable quality of fat. The results of antioxidant capacity test showed that the mixtures by Ascorbyl Palmitate and d-α-Tocopherol has done better in comparition with the single antioxidant. Both, ascorbyl palmitate and d-α-tocopherol are fully cleared by the Joint FAO/WHO Expert Committee on Food Additives. Coresponding to the latest evaluation status, the ADI values for ascorbyl palmitate and d-α-tocopherol are 1,25 and 2 mg/kg body-weght, respectively. By using the antioxidants, the shelf-life of food products containing stabilized oils and fats may thus bee extended.

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