Analele Universităţii din Oradea Fascicula: Ecotoxicologie, Zootehnie şi Tehnologii de Industrie Alimentară, 2010

DETERMINATION OF CHANGES IN OXIDATION PROCESS DURING STORAGE OF REFREGERATED AND FROZEN LARD

Bura Giani*

*University of Oradea , Faculty of Environmental Protection, 26 Gen. Magheru St. 410048 Oradea; Romania

Abstract

The aim of this research is the the determinate the changes in oxidation process on refrigereted and frozen lard. The practical work was on butter, how was from S.C. GHITTA S.R.L. from Baia Mare with the gas-cromatography method and Kreis reaction. For fatty acids determination it was used: Gas chromatography with Flame Ion Detector (Shimadzu GC-17 A with FID detector), spectrophotometer tip UV/VIS (T60U). It was made for peroxide index, for acidity tree series with14 probes from chilled butter and 7 probes from freezing butter. The value of peroxide index of chilled conditions for the probes, the fresh lard was 5.9 mec O_2/kg lard and the evolution had an ascendant pant and in frozen conditions for the probes, the peroxide index grow up easy until the 5 or 6 mounts when the oxidation process is initiated.

Key words: fat, fatty acids, spectrophotometer methods, butter, oxidation.

INTRODUCTION

Oxidation of food under the action of atmospheric oxygen is explained by the mechanism of chain reactions with formation of free radicals which are molecules in which one atom has a free valence.

Unsaturated fats are less hazardous and contain large amounts of body fat-soluble vitamins particularly useful, which function as both antioxidant and fatty foods mainly in the human body, preventing many diseases caused by oxidative stress.

Lipids are found both in the animal kingdom and plant kingdom as well as in microorganisms (bacteria, yeasts, molds).

Some of unsaturated fatty acids fulfill important functions in the human body, so they were essential fatty acids. Some authors refer to him again and that C vitamin is essential because the body like vitamins.

Following the oxidative degradation of fats in food suffered appear as direct effects, some changes to products and their nutritional value, and that indirect effects, the possibility of altering the health of the consumer and some economic consequences.

MATERIAL AND METHODS

Determination of changes in oxidation process to lard since production from S.C. GHITTA S.R.L. Baia Mare and is made using determination of fat, on refrigerated lard and freezing lard.

The biologic material was storage at the temperature for two experimental variants: chilled to 2 ... 4 ° C and freezing at -15 ...- 18 ° C; and the during storage for refrigeration is few days and for freezing some mounts.

Sampling was done at the factory premises, immediately after production, then melted and filtered. They were portioned and packed in vacuumed polythene bags to prevent direct contact with atmospheric oxygen and were stored under refrigeration and freezing seeking alterative installation process: hydrolysis and oxidation.

Codification of the samples:

- U_{HP} - Lard, since production
  - U_{PR} - refrigerated pork lard
  - U_{PC} - frozen pork lard

To achieve the objectives, the following physico-chemical parameters were determined and stored under refrigeration and freezing samples:

- Content of saturated and unsaturated fatty acids;
- Peroxide index;
- Kreis reaction (epihidrinic aldehyde)

For the fatty acids we use the method Gas chromatography with Flame Ion Detector (GC-FID), were the fatty acids from butter were transform in methylic esters, then the compounds were separated on chromatography colon and following the identification of fatty acids by compare with the etalon the determination of quantity of fatty acids. The results were in % fatty acids. We use gas-chromatograph Shimadzu GC-17 A with FID detector. Gas - chromatograph colon is an Alltech AT-WAX colon, 0.25mm I.D., 0.25µm stationary faze (polyethylene glycol). The gas that we use was helium at 147 kPa pressure, the temperature of injector and of detector was 260°C.

For the peroxide index we use UV - VIS T60U spectrophotometer (England): the temperature was between 5 and 45°C; the wavelength 190 - 1100 nm; the accuracy of wavelength is 0.1 nm. It were determinate the absorbance of the solution of Fe^{3+} at 500 nm. Then was build the calibration curve and the peroxide index is like mec O_2/kg fatnea.

Kreis reaction is the identification of aldehyde, which is a constant result of advanced fat oxidation. The epihidrinic aldehyde, form on advanced oxidation process of fat, deliberated on acids medium, it will have an reaction with flour gluing and results an colorant compound. The color intensity is proportional with the quantity of epihidrinic aldehyde and with oxidation process too.

The studied was on three sets of samples for each indicator in both methods of preservation (refrigeration, freezing).

The probes for chilled buttes was U_{P0}-fresh lard, U_{Pr5}-lard to 5 days refrigerated, U_{Pr10}- lard to 10 days refrigerated, U_{Prl5} - lard to 15 days refrigerated, U_{Pr20}- lard to 20 days refrigerated, U_{Pr25}- lard to 25 days refrigerated, U_{Pr30} - lard30 days refrigerated, U_{Pr35}-lard to 35 days refrigerated, U_{Pr40}- lard to 40 days refrigerated, U_{Pr45} – lard to 45 days refrigerated, U_{Pr50}-lard to 50 days refrigerated, U_{Pr55}-lard to 55 days refrigerated, U_{Pr60}-lard to 60 days refrigeration, U_{Pr65}- lard to 65 days refrigerated.

The probes for freezing butter was U_{P0}-fresh lard, U_{Pc1}- lard from a month freezing, U_{Pc2} - lard frozen for 2 months freezing, U_{Pc3}-lard for 3 months freezing, U_{Pc4}- lard for 4 months freezing, U_{Pc5}-lard for 5 months freezing, U_{Pc6}-lard for 6 months freezing.

RESULTS AND DISCUSSION

To assess the degree of freshness and intensity of chilled fat oxidation process were determined as an indicator of peroxide oxidation stage and the presence of epihidrinic aldehyde as an indicator of advanced oxidation, performed measurements at one month intervals until Kreis showed positive reaction to determine when the installation of advanced oxidation process.

In the first two months of refrigerated storage has been a slow increase of the peroxide, which corresponds to the oxidation initiation phase, followed by a corresponding surge propagation phase which forms the largest amount of hydro - peroxides as oxidation of primary compounds, reaching 5.9 mec O_2/kg and four months in the peroxide value decreases as a result of the split secondary hydro - peroxides into compounds at this point is positive Kreis reaction indicating the presence of epihidrinic aldehyde.

In the first three months of freezing storage conditions has been a slow increase of the peroxide index, which corresponds to initiate the oxidation stage, followed by a corresponding surge propagation phase formed the highest amount of peroxides index 5 and 6 months is relatively constant increase due balance is formed between the peroxide and secondary compounds, and 6 months after the peroxide index value decreases because hydro - peroxides split in secondary compounds, at this point the Kreis reaction is positive indicating the installation of advanced oxidation process appears taste and smell oxidations of fatty acids.

If oxidized pork lard content saturated fatty acids increased from 48.32% to 49.18%, the monounsaturated fatty acids decreased from 36.78% to 35.93%, and the polyunsaturated fatty acids from 14.89% to 13.81%. Myristic acids, palmitic, stearic showed increasing variation, margarita acid remained constant, and palmitoleic acid, cis-10-heptadecanoic, oleic, vaccenic, linoleic and alfalinolenic showed a decreasing variation, showing more marked changes in polyunsaturated fatty acids, relationship between

fatty acid groups was saturated fatty acids: monounsaturated fatty acids: polyunsaturated fatty acids = 3.59: 2,63:1.

CONCLUSIONS

Evolution physico - chemical parameters during storage of butter under refrigeration (2 ... 4 ° C) and freezing (-15 ...- 18 ° C) can be interpreted as, peroxide also presented a increasing variation in storage, which is all the more pronounced the higher fat contains a higher proportion of unsaturated fatty acids.

Based on these results we can say that the advanced oxidation process occurs after 6 months and frozen butter advanced oxidation process occurs after 11 months of storage.

The chemical composition of fresh pork lard was as follows: saturated fatty acids (48.32%), monounsaturated fatty acids (36.78%) and polyunsaturated fatty acids (14.89%) emoticon to reflect the higher refractive index and iodine value in comparison with butter. Oleic acid was determined in the highest proportion (33.51%), followed by palmitic acid (26.92%) and stearic (19.6%), which also reflects the consistency of soft, ointments of lard.

During storage of animal fats instead of variations in their chemical composition, the most significant increase in saturated fatty acids was found followed by butter fat, lard, poultry fat and fish oil, and the decrease in monounsaturated fatty semnificativ acids and polyunsaturated fatty acids has been found for lard.

Acknowledgments

This work is a part of a research project, we thank for ICAR laboratory from USAMV Cluj, because a lot of analyses we made there.

REFERENCES

1. Banu C., N. Preda, S. Vasu, 1982, Produsele alimentare şi inocuitatea lor. Edit. Tehnică, Bucureşti, 216-245.
2. Coppen P., 1983, The use of antioxidant. In: Rancidity in Foods. Applied Science Publishers, New York.
3. Dimitriu M., M. Paraschiv, 1978, Chimia produselor alimentare, Ed. didactică şi pedagogică, Bucureşti.
4. Hara A.T., N. Kimura, Y. Saito, K. Miyashit, 2003, Effecls of Emulsifiers and Fatty Acyl Components on the Oxidative Stability of Polyunsaturated Triacylglycerols in Emulsion System, 94th AOCS Annual Meeting & Expo, Kansas City, Kansas, USA.
5. Jadhav S. J., S. Nimbalkar, A.D. Kulkarni., D. Madhavi., 1996, Lipid oxidation in biological and food systems. In: Food Antioxidants: Techological, Toxicological and Health Perspectives. Dekker, New-York.

*** Standard International ISO 3976, 2006.