DETERMINATION OF CHANGES IN OXIDATION PROCESS DURING STORAGE OF CHILLED AND FROZEN BUTTER

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Abstract

The aim of this research is the the determinate the changes in oxidation process on butter chilled and frozen. The practical work was on butter, how was from S.C. HUMANA PROD 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 indices, for acidity tree series with 8 probes from chilled butter and 13 probes from freezing butter. The value of peroxide indices of chilled conditions for the probes, the fresh butter was 0.4 mec O_2/kg butter and the evolution had an ascendant pant and in frozen conditions for the probes, the peroxide indices grow up easy until the 8 mounts when the oxidation process is initiated.

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

INTRODUCTION

The degradation of fats transformations, known as oxidation, is defined as the change of fat characteristic in taste and odor from the reactions of oxidative, hydrolytic, decomposition and condensation is a complex process, distinguished three types of oxidation:

a) hydrolytic rancidity

b) aldehyde rancidity

c) Ketene rancidity

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 butter is made using determination of fat, the milk fat on butter with 80% fat, collected and packed in 250 gram packages, on S.C. HUMANA PROD S.R.L. from Baia Mare.

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_0 - butter at obtaining
  - U_r - butter stored at refrigeration
  - U_c - butter stored at freezing

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 indices 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 indices 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 [31].

The probes for chilled buttes was U0 – fresh butter, Ur1 –butter after 1 mounth of refrigeration, Ur2 – butter after 2 mounth of refrigeration, U_r3 – butter after 3 mounth of refrigeration, Ur4 - butter after 4 mounth of refrigeration, Ur5 – butter after 5 mounth of refrigeration, Ur6 – butter after 6 mounth of refrigeration, Ur7 – butter after 7 mounth of refrigeration.

The probes for freezing butter was U0 – fresh butter, Uc10 – butter after 10 days of freezing, Uc20 - butter after 20 days of freezing, Uc30 - butter after 30 days of freezing, Uc40 - butter after 140 days of freezing.

RESULTS AND DISCUSSION

If chilled butter the acidity presented a increasing variation. The results showed that butter containing 16% water, hydrolysis is triggered and takes place early pace, after 5 days of refrigeration was a moderate increase in acidity, it is intensifying during storage. It was found that the hydrolysis process is advanced after 15 days of refrigeration, acidity exceeding 2% (g oleic acid), and maximum value, because they released lower saturated fatty acids which are volatile, there are changes in taste (sour) and odor (butyric, sudorific), butter becoming unfit for consumption.

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

The peroxide value was 0.4 mec O2/kg for fresh butter, evolution following an upward slope. In the first four months of refrigerated storage has been a slow increase of the peroxide, which corresponds to initiate the oxidation stage, followed by a corresponding surge propagation phase which forms the largest amount of hydro – peroxides as well as compounds mayors of oxidation, reaching 3.4 mec O2/kg in six months is relatively steady growth, up from 3.9 mec O2/kg due balance is formed between the peroxide and secondary compounds, after which the peroxide value decreases hydro – peroxides following the split in secondary compounds, at this point is positive Kreis reaction indicating the presence of epihidrinic aldehyde when was installing and advanced oxidation process, there are changes in color (yellow) and taste (rancidity), butter must be excluded from the food chain. Evolution of the peroxide is consistent with the results mentioned by Naz et al., 2005.

In the first 8 months of storage in freezing conditions has been a slow increase of the peroxide, which corresponds to initiate the oxidation stage, followed by a corresponding surge propagation phase formed the highest amount of peroxides in the following 2 months because growth is relatively constant equilibrium formed between the peroxide and secondary compounds, and 11 months after the peroxide value decreases due to split hydro – peroxides in secondary compounds, at this point is positive Kreis reaction indicating the installation of advanced oxidation process.

Hydrolysis processes it was install earlier than oxidative processes in both refrigeration and freezing content, oxidation is prevented by limiting contact with atmospheric oxygen and light intensity.

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 values are similar to those of Krause and 2007.

The content of saturated fatty acids (72.87%) in butter was higher than the content of monounsaturated fatty acids (24.37%) and polyunsaturated fatty acids (2.72%), which also reflects the low value and refractive index the iodine value, moderate value of melting point and high value of the saponification index. The main fatty acids present in butter were butyric acid, myristic, palmitic, stearic and oleic. Palmitic acid was determined in the highest proportion (24.09%), the results are consistent with previous studies performed on cow's milk butter (Glewe, Okolo, Chuang and Vanderjagt 1999; samat-Bali, Ayadi and Attia, 2008). Lower content of saturated fatty acids which are volatile: butyric, caprylic, capric, lauric, makes the installation process of hydrolysis butter butyric smell, sudorific to be confused with the installation of the oxidation process, appreciating the wrong impression that butter is alteredoxidative to those required by determining the physico-chemical analysis for detection of acid hydrolysis installation.

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REFERENCES

1. Attia H., N. Kherouatou, N. Fakhfakh, T. Khorchani, N. Trigui, 2000, Dromedary milk fat: biochemical, microscopic and rheological characteristics, Journal of Food Lipids 7, pp. 95–112.
2. Banu C., Preda N., Vasu S.S., 1982, Produsele alimentare şi inocuitatea lor. Edit. Tehnică, Bucureşti, 216-245;
3. Glew R.H., S.N. Okolo, L.T. Chuang, Y.S. Huang, D.J. VanderJagt, 1999, Fatty acid composition of Fulani butter oil made from cow's milk, Journal of Food Composition and Analysis 12, pp. 235–240.
4. Naz S., R. Siddiqi, H. Sheikh, S. Asad Sayeed, 2005 - Deterioration of olive, corn and soybean oils due to air, light, heat and deep-frying. Food Research International, 38, 127-134.
5. Samet-Bali O., M.A. Ayadi, H. Attia, 2008, Tradiţional Tunisian butter: Physicochemical and microbial characteristics and storage stability of the oii fraction. Food Science and Technology, 30, 1-7.
6. Sağdiç O., M. Dönmez, M. Demirci, 2004, Comparison of characteristics and fatty acid profiles of traditional Turkish yayik butters produced from goats', ewes' or cows' milk, Food Control 15, pp. 485–490.

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