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# VITAMINS AND PLANT SAPONINA IN PRODUCTION OF FUNCTIONAL MARGARINES AND SPREADS POSSESSING ANTIOXIDANT PROPERTIES

The composition of margarine products and spreads with the increased emulsion stability and prolonged expiration date is developed in the factory laboratory. A distinctive feature is the use of plant saponins as emulsifiers and ascorbic acid as an antioxidant water-soluble component. The use of these additional ingredients makes margarines and spreads the products of functional food. It is established that the use of saponins and vitamins with antioxidant properties increases the expiration date of the product. It was shown that the licorice saponins and ascorbic acid inhibit hydrolysis and lipid peroxidation (the speed of growth of acid number and concentration of malondialdehyde).

**Introduction.** Margarines and spreads are emulsion systems on the basis of vegetable and animal lipids and water.

According to their usage, especially in recent years, all of them have gained more and more the value of functional food, i.e. from cheap substitutes of butter margarines and spreads turn into the healthy products.

Being a product of emulsion type, spread represents itself a convenient object for water- and fat-soluble ingredients enrichment. At the production of spreadsit is possible:

– regulation of fatty acid composition of a lipidic phase;

– application of ingredients of functional purpose into water and lipidic phases [1].

Application of vegetable lipids with nonsaturated fatty acids in margarines and spreads makes them more useful to health. However a vital problem of emulsion systems are two processes worsening consumer properties of margarines and spreads:

– hydrolysis of lipids with release of fatty acids;

– lipid peroxidation.

These reactions can be slowed down using water- and fat-soluble antioxidants. Ascorbic acid or polyphenolic compounds for example can act as antioxidant soluble in a water phase, and α-tocopherol (vitamin E) or retinol (vitamin A) – in a lipidic phase.

Stability and the structure of emulsion system are provided by emulsifiers which, being surface-active substances, reduce a superficial tension on the dividing border of phases. Among these compounds the substances, capable to inhibit both hydrolysis and lipid peroxidation can be potentially found. Probably, some vegetable saponins can belong to such compounds [2]. We chose the licorice saponins as the interest to these compounds, has increased in recent years especially in the USA and Japan where patents on their use in the food industry as emulsifiers, air-foam agents, solubilizers and food additives are granted [3].

Thus, the purpose of the real work were the receiving and analysing of functional margarines and spreads containing vitamins and saponins with the improved consumer properties and the increased expiration date.

**Main part.** On the laboratory pilot device samples of margarines and spreads, containing licorice saponins and vitamins A, E and C were received.

For the assessment of the extent of lipids hydrolysis we defined the acid number in the course of storage. On analytical scales in a conic flask about 2.0 g of margarine (accurately weighed portion) were weighed. The flask with the contents was slightly heated on a water bath up to margarine melting, 20.0 $cm^3$ of alcohol-ether mix, five drops of phenolphtalein were added and then it was titrated by 0.1 N of potassium hydroxide solution until the emergence of the pink coloring not disappearing within 1 min.

The acidity of margarine $X$, ºK (Kettstorfer's degrees) was calculated according to the Formula [4]

$$X = \frac{10 \cdot V \cdot K}{m}, \qquad (1)$$

where $V$ – volume of 0.1 N of the KOH solution which has gone for titration, $cm^3$; $K$ – titr adjustment 0.1 N of KOH solution; $m$ – mass of margarine, g.

In Fig. 1 the researches results, testifying that the applying of licorice saponins in combination with other emulsifiers – dimodan (DIMODAN® HP 85-S6) and lecithin – leads to decrease of hydrolysis speed of lipids are presented, and the most effective is the combination of dimodan and licorice saponins.

In the course of lipid peroxidation the first stage is the formation of diene conjugates, then the hydroperoxides of fatty acids appear, and the final product – malondialdehyde. The content of hydroperoxides is controled by the peroxile number which is determined by the iodinemetric titration [5].

In Fig. 2 the change of peroxile number (PN) in the course of storage of spreads containing vitamins with antioxidant properties is presented.

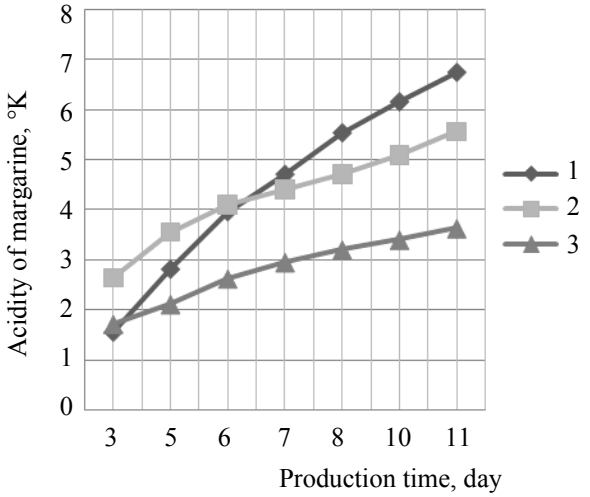


Fig. 1. Accumulation of fatty acids in the course of storage of margarine samples with different emulsifiers: *1* – margarine sample with dimodan and lecithin; *2* – margarine sample with dimodan, lecithin and licorice saponins; *3* – margarine sample with dimodan and licorice saponins

The application of vitamins in spread inhibits lipid peroxidation, and the greatest effect is caused by the water-soluble vitamin C. All samples of spreads had a uniform, brilliant, plastic consistence, without moisture traces on a cut and when grinding. At spreads gustation it was noted that in the course of storage a rancidity of the check sample appeared while the trial sample had no it.

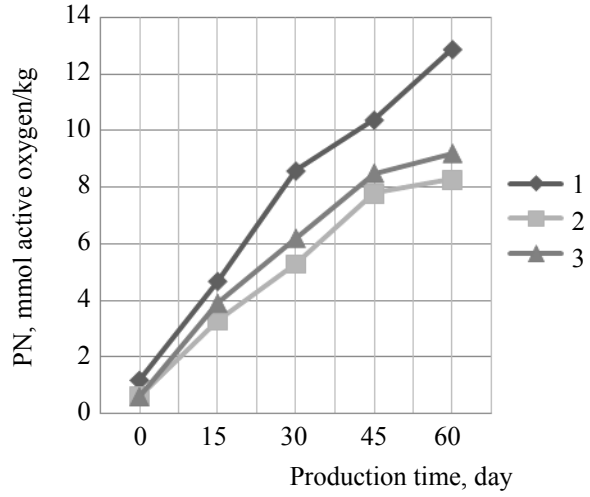


Fig. 2. Accumulation of hydroperoxides in samples of spreads with antioxidant vitamins: *1* – spread sample (check); *2* – spread sample with vitamins A, E and C; *3* – spread sample with vitamin C

Thus, the introduction of vitamins possessing antioxidant properties in margarine and spreads, possessing antioxidant properties allows to receive functional products with the prolonged expiration date.

As the final product of lipid peroxidation is malondialdehyde, the researches on its contents in margarines and the spreads containing licorice saponins as emulsifiers were conducted.

Determination is based on the fact that when heating in the sour medium malondialdehyde reacts with 2-thiobarbituric acid, forming the coloured trimethine complex with the absorption maximum at 532 nm [6].

Margarines were heated on a water bath up to their melting. About 2.0 $cm^3$ of the melted margarine were selected into the centrifugal test tubes, then we added 3.0 $cm^3$ of isopropyl alcohol and 1.0 $cm^3$ of 20% solution of trichloroacetic acid for proteins sedimentation. The sediment was separated by centrifugation within 10 min at 4,000 $min^{-1}$. Supernatant on 2.0 $cm^3$ was transferred to test tubes, 1.0 $cm^3$ of 0.8% water solution of 2-thiobarbituric acid was added and then placed samples for 40 min. Into the boiling water bath. As a test the sample containing isopropyl alcohol instead of supernatant. After the development of pink coloring samples were cooled to room temperature and an extinction at 532 nm against check sample was measured.

The concentration of malondialdehyde *C*, mol, was calculated according to a formula

$$C = \frac{E}{l \cdot \varepsilon}, \qquad (2)$$

where *E* – extinction; *l* – length of the optical layer (thickness cuvettes), cm; ε – molar coefficient of the extinction ($1.56 \cdot 10^5$ $cm^{-1} \cdot M^{-1}$).

Results of definition of change of concentration malondialdehyde in the course of storage of samples of margarine are presented in Fig. 3.

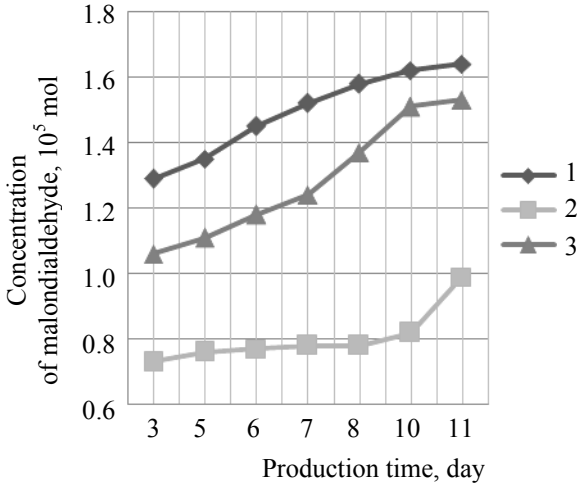


Fig. 3. Accumulation of malondialdehyde in the course of storage of samples of margarines with different emulsifiers: *1* – margarine sample with dimodan and lecithin; *2* – margarine sample with dimodan, lecithin and licorice saponins; *3* – margarine sample with dimodan and licorice saponins

The obtained data testify that in the course of storage the least quantity of malondialdehyde was accumulated in the sample of margarine containing dimodany, lecithin and licorice saponins as emulsifiers. The joint use of these emulsifiers led to the fact that within 10 days malondialdehyde in the sample No. 2 practically was not accumulated (Fig. 3), but hydrolysis of lipids was observed (Fig. 1), that was caused by the antioxidant properties of licorice saponins and corresponds to [7].

**Conclusion.** The conducted researches showed that applying of licorice saponins and antioxidant vitamins in margarines and spreads transfers them into the products of functional food with the prolonged expiration date. The share of such products in food ration has to raise, first of all, due to their promoting and range expansion, and due to the quality improvement and attraction either. The various flavoring shades meeting any requirements of consumers can be given to margarines and spreads, and thanks to rheological properties of these products different types of packaging providing their safety and convenience of consumption can be used.

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