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ВИЗНАЧЕННЯ СТРОКУ ЗБЕРІГАННЯ СОНЯШНИКОВОЇ ОЛІЇ ПРИСКОРЕНИМ МЕТОДОМ

А.О. Демидова, О.Ф. Аксенова, І.М. Демидов

Досліджено кінетику окиснення соняшникової олії за різних температур на волюметричній установці, одержано дані щодо швидкості окиснення та самоініціювання соняшникової олії, розроблено спосіб прогнозування строків зберігання.

Ключові слова: *окиснення, прогнозування строку зберігання.*

ОПРЕДЕЛЕНИЕ СРОКА ХРАНЕНИЯ ПОДСОЛНЕЧНОГО МАСЛА УСКОРЕННЫМ МЕТОДОМ

А.А. Демидова, Е.Ф. Аксенова, И.Н. Демидов

Исследована кинетика окисления подсолнечного масла при разных температурах на волюметрической установке, получены данные по скорости

окисления и самоинициирования подсолнечного масла, разработан способ прогнозирования сроков хранения.

Ключевые слова: *окисление, прогнозирование срока хранения.*

DETERMINATION OF THE SUNFLOWER OIL STORAGE PERIOD BY THE ACCELERATED METHOD

A. Demidova, O. Aksenova, I. Demidov

Abstract. *Kinetics of sunflower oil is investigated at different temperatures for Volumetric installation. The data on the oxidation rate and speed of oil self-initiation are obtained. Prediction method of the storage period is developed.*
The method has the following advantages: allows you to define the term pressed together shelf life form; forecasts for periods of storage do not refer to temperature and for anyone, it is possible to give broad guidelines store chains; the required amount of research can be conducted within couple days rather than months, dramatically reducing costs; the study is low-cost, because it does not require expenses on reagents.

Keywords: *oxidation, prediction of the retention period.*

Introduction. Domestic and international food industry dramatically needs to develop the methods of accelerated determination of the terms of food storage.

This especially can be applied to food containing fat phase, especially because of its short term of storage.

As you know, the process of oils and fats oxidation can be divided into several stages. Oxidation is slow in the first stage, with the formation of mainly primary products of hydro peroxides oxidation. This is so called induction period. The end of this stage coincides with the end of the storage period of a fat-containing product. Then the oxidation stage begins, during which the hydroperoxides like avalanche accumulate and begin to form secondary oxidation products - aldehydes, ketones, hydroxyl acid, etc. At this stage, in the product hazardous to human health compounds appear very quickly, so that it is no longer a food product.

Analysis of recent research and publications. At present, there is no simple reliable method of accelerated study periods of oils and fats storage. There are the following instrumental methods: 2-TBA-test, diene conjugates determination, OIT determination using Ransimat equipment, Oxidograph, Omnion OSI, FIRA-Astell. SCA, HPLC and other methods have a number of significant fundamental flaws [1–5]. Equipment, which these methods require is quite expensive, and only few domestic producers may buy it.

The purpose of the article is to develop and test a universal method for determining the induction period of oil or fat which would be characterized by the following features:

– Low speed of research - during a day (nowadays it takes several weeks to months to determine the terms of storage);

– versatility for any oil or fat that contains antioxidants of natural or synthetic origin or has them in its composition;

– simplicity of research;

– low cost of equipment;

– the ability to create prognostic model.

The main material research. The research was carried out on Volumetric installation (Fig. 1) according to the radical chain mechanism of lipid oxidation, described in [6]. A sample sunflower refined deodorized oil was used.

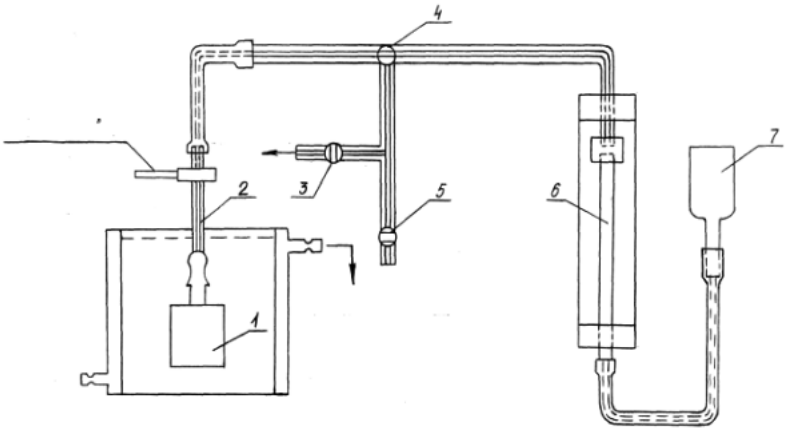

Fig. 1. equipment for measuring oxygen uptake (1 – reactor 2 – glass capillary, 3.5 – one-pass faucet, 4 – three-way faucet, 6 – measuring burette 7 – leveling vessel)

The method provides the determination of the dependence of a number of absorbed oxygen on time. The obtained kinetic curves allow to determine the period of the sample's induction (in Fig. 2 it equals 36 min.).

To predict the period of oils storage, be aware that they are kept at different temperatures, so you need to determine the self-initiation speed. The rate of self-initiation can be determined as the ratio of the oxidation speed to the initiation speed:

$$W_c = W_o / W_i.$$

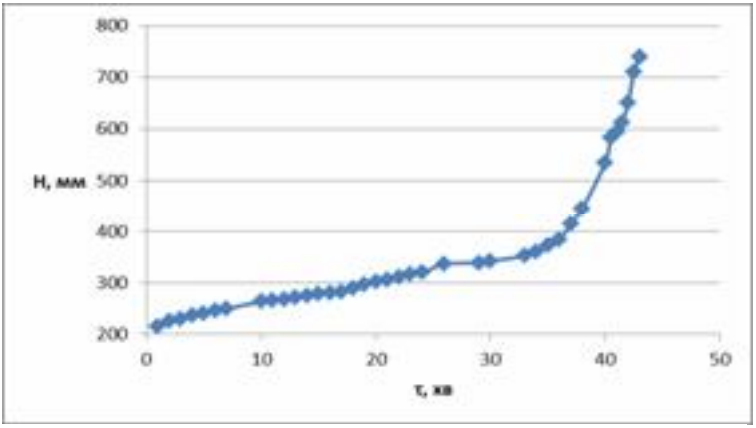

Fig. 2. The kinetic curve of sunflower oil oxidation at the research temperature of 90° C and the amount of AIBN initiator 0.4 ml

The initiation speed may be determined by adding different amounts of initiator or inhibitor to the sample. We used the method of adding different amounts of initiator oxidation - azodiizobutronitryl acid dissolved in xylene (the solvent that is not oxidized).

The oxidation speed periods of induction were determined by the sample oils obtained on condition of different amounts of oxidation initiator. To determine the self-initiation speed, it is necessary to determine oxidation speed and initiation of oil sample initiation at different temperatures. The research was conducted at temperatures of 90, 80 and 70°C. For each temperature the period of the sample induction on condition of different amounts of oxidation initiator was determined. The results of the research are presented in Table.

Dependence of the oxidation speed on initiation speed in the so-called Arrhenius coordinates we obtain by the following logarithm table data. This graph (Fig. 3) is self initiation speed value. Due to its extrapolation to lower 70…90°C (temperature of the research) temperature, self initiate speed value can be obtained, thus determining the term of the sample storage.

Table

Kinetic data of sunflower oil sample oxidation

The temperature of research, °C	The speed of initiation W_i, mol /l·s	The speed of oxidation W_0, mol /l·s
90	$2,8*10^{-7}$	$7,4*10^{-7}$
90	$3,5*10^{-7}$	$9,1*10^{-7}$
90	$4,9*10^{-7}$	$9,8*10^{-7}$
80	$4,3*10^{-8}$	$2,33*10^{-7}$
80	$8,5*10^{-8}$	$2,44*10^{-7}$
80	$1,1*10^{-7}$	$2,66*10^{-7}$
70	$8,2*10^{-9}$	$1,2*10^{-7}$
70	$2,2*10^{-8}$	$1,5*10^{-7}$
70	$5,2*10^{-8}$	$1,7*10^{-7}$

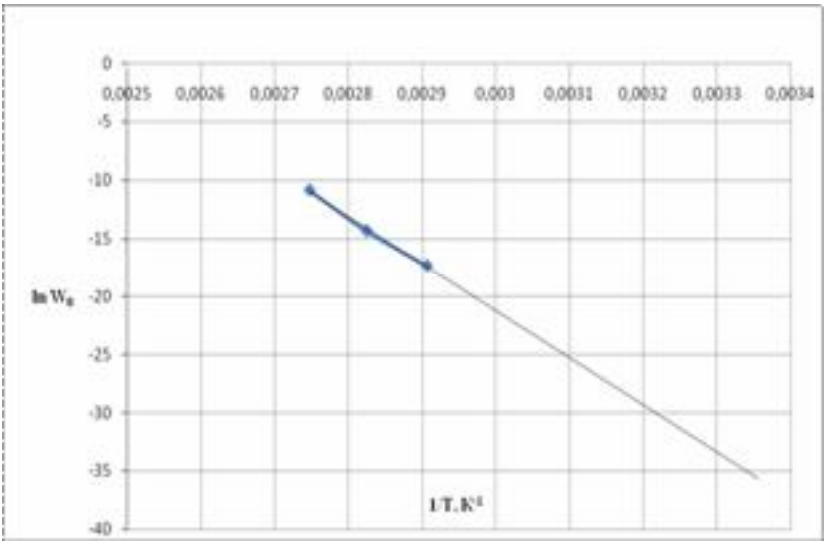

Fig. 3. The relationship between initiating speed and speed of oxidation of the sample oil in Arrhenius coordinates

To test the experimental data obtained at high temperature (70…90℃), it is necessary to determine the kinetics of oxidation of the oil samples at normal temperature. For this purpose, peroxidation number of oil which is stored in an open vessel, exposed to light and oxygen, at ambient

temperature 24°C is determined. Data, obtained from the scientific literature, demonstrate that in the initial period of oxidation, peroxide compounds accumulate. The number of secondary oxidation products during this period does not increase by more than 20%, so it is quite correct to use the data of accumulating only peroxide compounds.

Conclusions. The method with the following advantages was developed:

– it enables to determine the terms of storage of the sample in a short time;

– it forecasts the periods of storage including any temperature, so it is possible to give broad recommendations trading nets;

– the required amount of research can be conducted over two days, not months. This greatly reduces labor costs;

– The cost of research is low, so it does not require the expenses on reagents.

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ТЕХНОЛОГІЯ ПРЯНИКОВИХ ВИРОБІВ, ЗБАГАЧЕНИХ КУНЖУТНИМ І КЕДРОВИМ ШРОТОМ

М.Ф. Кравченко, Н.Ю. Ярошенко

Розглянуто напрями поліпшення харчової цінності борошняних кондитерських виробів. Наведено результати досліджень хімічного складу пряників із кунжутного та кедрового шроту та зміни, що відбуваються в складі цих виробів. Установлено оптимальне співвідношення компонентів у