DETERMINING THE DEGREE OF OXIDATION OF FAT SEPARATED WHEN COOKING GRILLED CHICKEN

Umurova Maftuna Madiyorovna
Bukhara engineering-technological institute.

Annotation. In the article, the suitability of the oil released during the preparation of chicken grill in infrared devices for consumption or reuse for the preparation of food products is shown by determining and comparing their oxidation level using chemical and spectral methods. Acid, peroxide, anisidine numbers, *Totox* index, smoking temperature of the oil were studied and compared with the results of infrared spectroscopy analysis.

Key words: *Chicken fat, grill, decanter, oxidation, peroxides, hydroperoxides, infrared radiation, thermal effects, smoking temperature, spectroscopy.*

One of the most important components of the human diet are fats, which make up about 35% of the energy consumed. Currently, it is impossible to imagine the preparation of many tasty and very nutritious fried products without fats, whether they are included in food ingredients and components or are included separately. Animal fats, especially those found in animal meat, deserve special attention. The meat of broiler chickens has high nutritional value, nutritious and excellent taste. The content of essential amino acids in them is much higher than in the meat of other animals. [1,2] Every year, the number of restaurants, and especially private catering establishments, is increasing, where recently the consumption of fried chicken in special devices equipped with infrared energy elements is increasing. It is known that in this case, the main part of chicken meat (carcass) fat flows into the pan and collects. Its implementation, although it is happening, has not yet been regulated.

Meanwhile, the negative impact of fat oxidation products on human health is particularly significant, and one of the main factors of product safety is the safety of fats. With any method of heat treatment in oils, both hydrolytic and oxidative changes occur due to the effect of high temperature, air and water on the oil. The superiority of one or another process depends on the temperature and duration of heating, the degree of exposure of water and air to the oil, as well as the presence of substances that can chemically interact with the oil. [3].

Since chicken fat is richer in unsaturated fatty acids than other animal fats, it may show a higher sensitivity to oxidative changes during thermal processing. In this regard, in order to study the speed of oxidation processes in chicken oil dripped onto a tray under real conditions of grilling, its indicators such as peroxide, acid, anisidine number and Totox were studied.

These parameters in the original crude chicken fat isolated from the carcass had the following values, respectively: acid number 1.4 mg KOH/g, peroxide number 2.8

mmol 0.5O2/kg, anisidine number 1.612. The average fat content of chicken adipose tissue is 87%, and the average moisture content of this adipose tissue is 9.3%. After washing the carcass, the average moisture content of fat tissue was 11.2%. The source of infrared radiation in the grill is metal electric heaters with hermetic tubes. In the apparatus, semi-finished products (chicken carcasses) are pressed onto special skewers (shampurs) installed on the conveyor, so that they also rotate during the movement of the conveyor.

The temperature in the cooking (roasting) chamber of the grill apparatus is 220-2700C, the temperature of the surface layer of the carcass is 130-1400C, and the temperature of the deep layer is 85-900C. Cooking time for grilled chicken is 35 minutes. During this time, the above indicators of chicken fat collected in the apparatus tray were determined and analyzed.

It should also be noted that in public catering establishments such as grill bars and grill cafes, modern devices that work on the basis of infrared radiation are mainly used for cooking grilled chicken, but sometimes the number (power or performance) of such devices in these establishments (according to) when there is not enough to fulfill the order of the customers, roasting ovens are also widely used to prepare the product in addition. In this case, the temperature in the frying chamber of the oven is 1800C, and the cooking time is 35-40 minutes.

Thus, 3 types of samples were taken for analysis, these are: raw (diluted) chicken fat;

fat decant that flows when cooking chicken on a grill;

fat released when cooking chicken in the oven.

Acid, peroxide, anisidine, thiobarbitur numbers were determined in these samples and Totox index was calculated. The results are presented in Table 1

Table 1

The amount of oxidation products in oil samples

descriptive indicators

Sample name	Indicators				
	Acid number, mgKON/g	Peroxide number, mol active oxygen/kg	Anisidine number	*Totox indicator*	thiobarbiturate number, MDA/1 kg of fat
Raw chicken fat	1,4	4,2	1,612	10,012	0,037
Chicken grill oil (decant)	2,0	6,5	1,857	14,857	0,045
Chicken fat fried in the oven	3,2	11,0	2,914	24,914	0,056

As it can be seen, the thermally affected samples show an increase in the values of the indicators presented in the table. This is certainly natural. However, it is not difficult to notice that the degree of increase in the values of these indicators is different in these samples. In this case, it can be seen that the oxidation products in the oil of chicken fried in the oven are much higher compared to the oil that is released when cooking grilled chicken using the energy of infrared rays. An increase in the acid number indicates the degree of hydrolysis of the fat, which causes the formation of free fatty acids. Later, during the heat treatment (cooking) process, peroxides and hydroperoxides, i.e., primary oxidation products, are formed from these fatty acids, and the peroxide value in the samples also increases. Nevertheless, we can observe that chicken fat fully meets the requirements of GOST R-54676-2011 standard for poultry fat according to the indicators describing the amount of oxidation products listed in Table 1. The parameters determined in the oil of chicken fried in the oven show that primary and secondary products of thermal oxidation accumulate in this oil in large quantities and do not meet the requirements of the above standard.

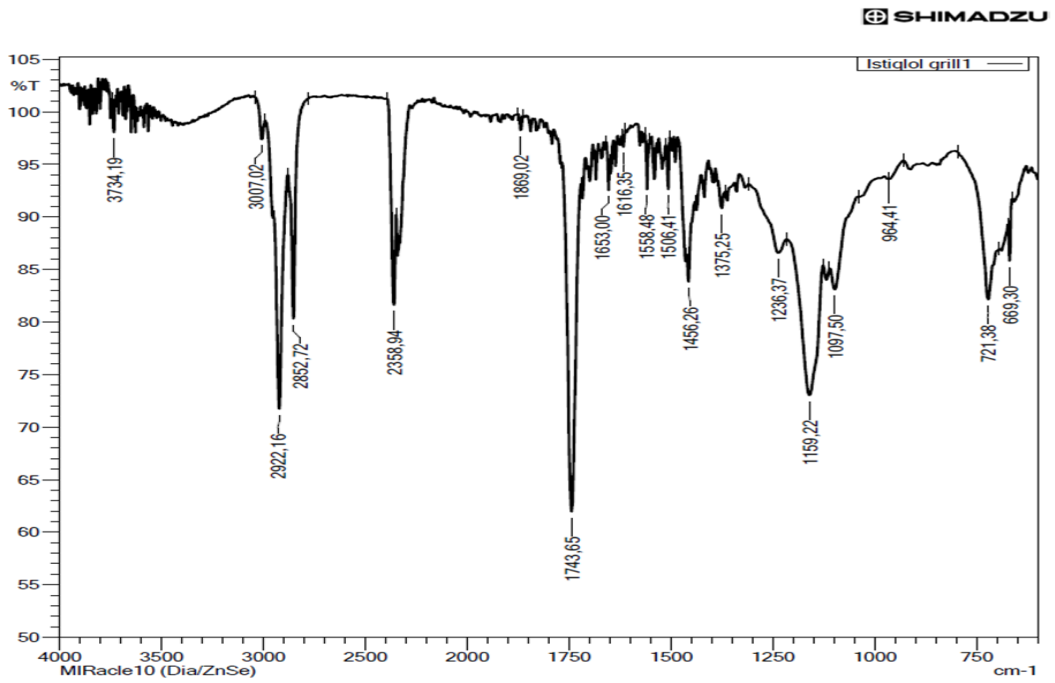
Less accumulation of thermal oxidation products in the oil released when cooking grilled chicken in an IR oven is due to the relatively shorter duration of this thermal effect, that is, the shorter duration of cooking, and at the same time, during the flow of oil droplets to the oven tray, their it can be caused by exclusion from the zone of high thermal influence. And the fat released from the grilled chicken in the oven is in the zone of high thermal influence during the entire cooking process. This can explain the formation of more thermal oxidizing substances in it.

Therefore, the fat that drains from grilling broiler chicken can be reused in food production and catering establishments as melted poultry (chicken) fat that meets the standard requirement, and the chicken fat released when frying in the oven. and it is not suitable for this.

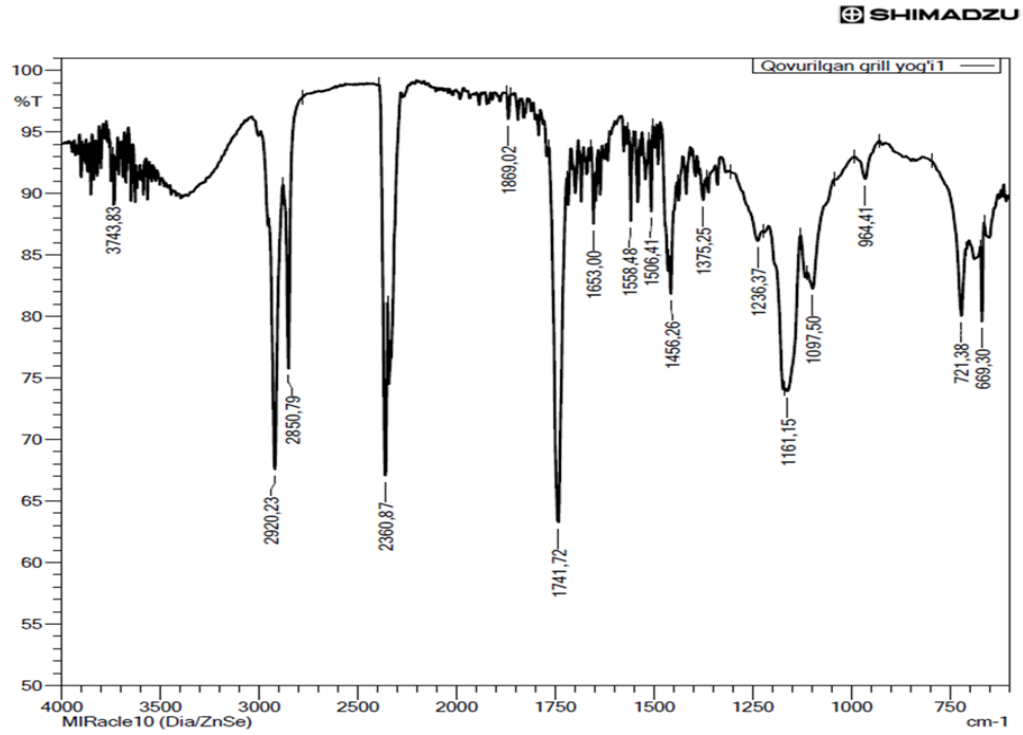
To confirm this conclusion, the smoking (smoke formation, ignition) temperature of the tested oil samples was determined. It is known from the analysis of the literature that the smoking temperature of oils intended for deep-frying should not be lower than 1700C. Tests show that the smoking temperature of raw chicken fat is 1900C, while the smoking temperature of the fat released when cooking grilled chicken in an IR-oven is 1830C. The smoking temperature of chicken oil fried in the oven was 1610C. According to this, it is recommended that the oil released during grilling in the IR-oven can be used in the production of food products, and the chicken oil released during frying in the oven is recommended to be reused in the production of food products. It can be admitted that it is not.

The fact that primary and secondary oxidation products are formed in oils under thermal influence can also be observed by analyzing IR spectra [4.5,6].

The IR spectra of the chicken fat prepared in an IR-oven (decantant) and chicken fat fried in an oven were analyzed in the IRSpirit - Zepto Scientific spectrophotometer. Images of the spectrograms are presented in Fig. 1.



a



б

Figure 1. Spectrograms of IR-oven grilled chicken fat (decantant) (a) and oven-fried chicken fat (b)

We can observe the first stage of thermal oxidation of triglycerides with the formation of hydroperoxides in the region of 3450 - 3475 cm-1 of IR-spectrograms. In this case, the absorption maximum of the waves of the chicken oil sample fried in the oven decreases compared to that of the chicken grill oil prepared in the IR-oven, and the intensity, on the contrary, increases. The appearance of a spectrum in the region of 3535 cm-1 indicates the formation of secondary compounds with alcohols or hydroxyl

groups. If you pay attention, it can be noted that the intensity of these wave spectra is high in the sample of chicken fat fried in the oven.

This is one of the characteristic indicators of the stage of oil oxidation

It is the surface of the absorption spectrum in the region of ~3008 cm-1. In the spectrogram, this is represented by a peak at 3007.19 cm-1. This field is associated with valence vibrations of cis - double bonds, and its maximum decrease represents the loss of double bonds in the molecules of polyunsaturated fatty acids.

Absorption maxima of the 2920.23 cm-1 and 2922.16 cm-1 and 2850.79 cm-1 and 2852.72 cm-1 areas recorded in the spectrogram are decreased, and the intensity, on the contrary, increases, represents the oxidation process determined by the number of thiobarbiturates.

By analyzing the spectra in the region of 1800-1500 cm-1 of the spectrogram, we can get some information about the oxidation of triglycerides. The 1750 cm-1 region represents unoxidized carbonyl functional groups. The 1728-1630 cm-1 area represents the formation of aldehyde, ketone functional groups (representing the anisidine number) and free fatty acids (confirming the acid number) from the carbonyl functional groups. In this case, the lower the maxima of this area, the higher the level of oxidation.

Spectra of oil samples in the region of 964.41 cm-1 characterize trans-trans and cis-trans, as well as conjugated double bonds. Since the formation of secondary products of oxidation is accompanied by the breaking of these double bonds, the absorption maximum of the spectrum of this area also decreases and its intensity increases. The same situation is more evident in the IR spectrum of a sample of chicken fat fried in an oven. This spectrum has a higher absorption maximum and a much weaker intensity in chicken grill oil prepared in an IR-oven. In addition, the intensity of the spectrum in the region of 721.38 cm-1 is more strongly manifested in the sample of chicken oil fried in the oven, which means that secondary oxidation products, which are usually expressed by the number of peroxides, are more accumulated in it.

Thus, the results of IR-spectroscopy studies confirm the results determined using chemical methods.

REFERENCES:

1. Переработка мяса птицы и кроликов [Электронный ресурс]: учебное пособие / Е. А. Рыгалова [и др.]; Красноярский государственный аграрный университет. – Красноярск, 2021. – 362 с.

2. https://chefs.az/ru/izmeneniya-zhirov/

3. Н.В. Макарова, М.С. Воронина. Исследование окислительной стабильности животных жиров в разных технологических условиях. Вестник ЮУрГУ. Серия «Пищевые и биотехнологии». 2020. Т. 8, № 2. С. 56–64

4. Muik B., Lendl B., Molina-Diaz A., Valcarcel M. et al. Two-dimensional correlation spectroscopy and multivariate curve resolution for the study of lipid oxidation in edible oils monitored by FTIR and FT-Raman spectroscopy // Anal. Chim. Acta. 2007. Vol. 593. P. 54-67.,

5. Le Dréaua Y., Dupuya N., Artauda J., Ollivier D. et al. Infrared study of aging of edible oils by oxidative spectroscopic index and MCR-ALS chemometric method // Talanta. 2009. Vol. 77. P. 1748-1756.

6. https://lektsii.com/2-93636.html