ASSESSMENT OF THE OXIDATION LEVEL OF FAT RELEASED DURING THE PREPARATION OF GRILLED CHICKEN

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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.

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

Аннотация. В статье показана пригодность масла, выделяющегося при приготовлении курицы- в инфракрасных гриль аппаратах, к употреблению или повторному использованию для приготовления пищевых продуктов путем определения и сравнения степени её окисления химическими и спектральными методами. При этом, изучены кислотное, перекисное, анизидиновое числа, индекс Totox, температура задымления масла и сопоставлены с результатами инфракрасной спектроскопии.

Ключевые слова: Куриный жир, гриль, декантант, окисление, пероксиды, гидропероксиды, инфракрасное излучение, термическое воздействие, температура копчения, спектроскопия.

Annotatsiya. Maqolada infraqizil nurlanish asosida ishlaydigan apparatlarda tovuq grilini tayyorlashda ajralib chiqqan yog‘ning iste’molga yoki oziq-ovqat mahsulotlarini tayyorlash uchun qayta ishlatishga yaroqliligi kimyoviy va spectral usullarda ularning oksidlanganlik darajasini aniqlash hamda solishtirish yo‘li bilan ko‘rsatilgan. Bunda yog‘ning kislota, peroksid, anizidin sonlari, Totox ko‘rsatkichi, dudlash harorati o‘rganilib, infraqizil spektroskopiya tahlili natijalari bilan qiyoslangan.

Kalit so‘zlar: Tovuq yog‘i, grill’, dekantant, oksidlanish, peroksidlar, gidroperoksidlar, infraqizil nurlanish, termik ta’sir, dudlash harorati, spektroskopiya.

Introduction

One of the most important components of the human diet is fats, which make up about 35% of the energy consumed. Nowadays, it is impossible to imagine the

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preparation of many delicious and very nutritious fried products without fats, whether they are part of food ingredients and components or are included separately. Animal fats, especially those found in animal meat, deserve special attention. Broiler chicken meat has high nutritional value, is dietary, and has a wonderful 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 growing, where the consumption of fried chicken in special apparatuses equipped with infrared energy elements has recently increased. As is known, in this case, the main part of the chicken fat (carcass) flows into the tray and accumulates. Its practical application, although it is occurring, has not yet been regulated. At the same time, the negative impact of fat oxidation products on human health is especially significant, and one of the main factors in product safety is the safety of fats.

In oils, with any heat treatment method, both hydrolytic and oxidative changes occur due to the influence of high temperature, air, and water on the oil. The predominance of a particular process depends on the temperature and duration of heating, the degree of water and air exposure 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 can exhibit high sensitivity to oxidative changes during heat treatment. In this regard, to study the rate of oxidation processes in chicken fat collected by dripping on a tray under real conditions of grilling, such indicators as peroxide, acid, anisidine numbers, and Totox were studied.

The fat content in the fat tissues of chickens averages 87%, the average moisture content of which is 9.3%. After washing the carcass, the average moisture content of the fatty tissues was 11.2%. The source of infrared radiation in the grill is metal electric heaters with hermetically sealed tubes. In the apparatuses, semi-finished products (chicken carcasses) are inserted into special spagates (sponges) installed on the conveyor, so that they also rotate during the movement of the conveyor. The temperature in the cooking (frying) chamber of the grill apparatus is 220-270^{0}C, the temperature of the surface layer of the carcass is 130-140^{0}C, and the temperature of the deeper layer is 85-90^{0}C. Cooking time for grilled chicken is 35 minutes. During this time, the above indicators of the collected chicken fat in the apparatus tray were determined and analyzed.

It should also be noted that in public catering establishments, such as gril-bars and gril-cafes, modern devices based mainly on infrared radiation are used for cooking chicken grill, but sometimes when the number of such devices in these enterprises (in terms of power or productivity) is insufficient to fulfill the customer's order, roasting ovens are also widely used for additional product

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preparation. In this case, the temperature in the oven's frying chamber is 180^0C, and the cooking time is 35-40 minutes.

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

Table 1

Quality Assessment Results

Parameter	Measured Value	Status
Acid Value	2.0 mg KOH/g	✓
Peroxide Value	6.5 mmol active O2/kg	✓
Anisidine Value	1.85	✓
TOTOX Index	14.86	✓
Smoke Point	183 degrees C	✓

As can be seen, in the samples subjected to thermal exposure, an increase in the values of the indicators given in the table is observed. This is, of course, natural. However, it is not difficult to notice that the degree of increase in the values of these indicators in these samples is different. In this case, it can be seen that in oven-fried chicken fat, oxidation products are formed significantly more often than in the fat released during the baking of chicken grill using IR radiation energy. An increase in the acid number indicates the degree of fat hydrolysis, which is caused by the formation of free fatty acids. Further, during the heat treatment (baking) process, the peroxide number in the samples also increases due to the formation of peroxides and hydroperoxides, i.e., primary oxidation products, from these fatty acids.

When cooking chicken grill in an IR furnace, the accumulation of thermal oxidation products in the separated fat is reduced, and this thermal effect lasts relatively less.

Consequently, the fat drained during the cooking of broiler chicken in a grill can be reused in the production of food products and in public catering establishments as melted poultry (chicken) fat that meets standard requirements, while the chicken fat released during frying in the oven is not suitable for this.

To confirm this conclusion, the smoking (smoke generation, smoking) temperature of the tested oil samples was determined. From the analysis of the literature, it is known that the smoking temperature of fats intended for frying

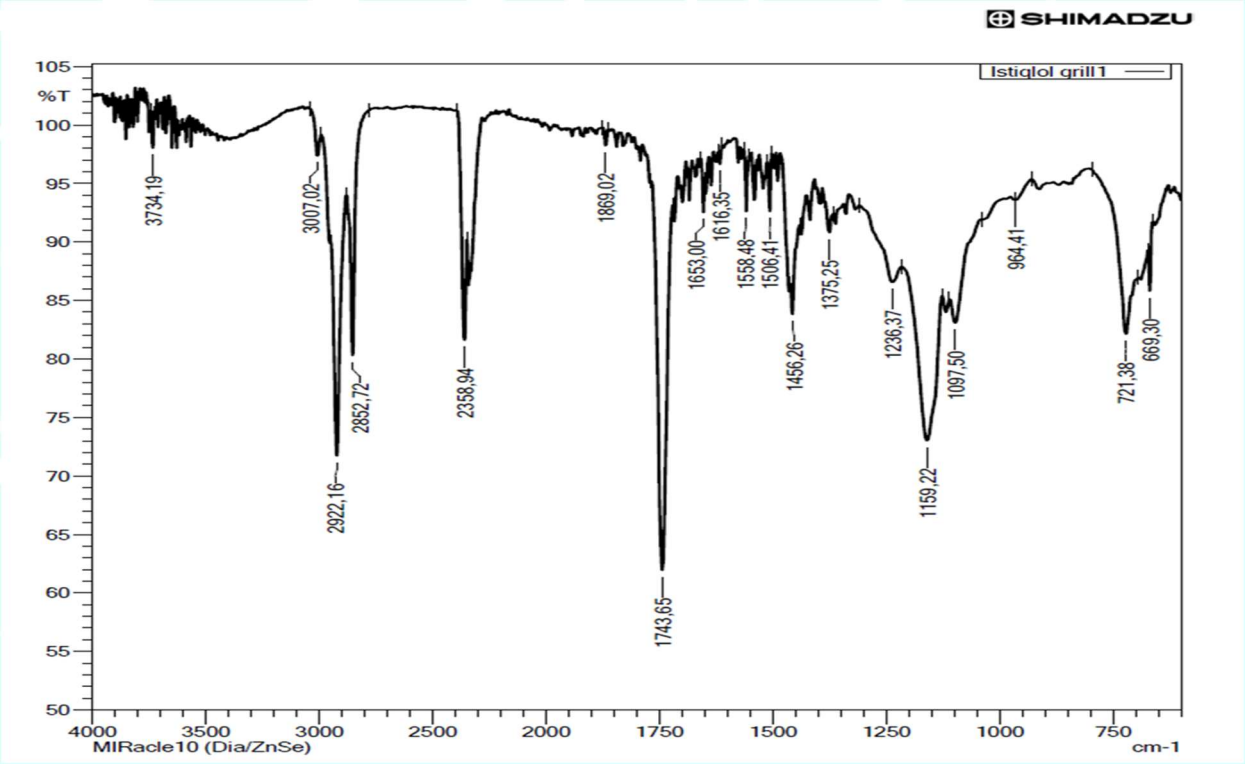
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should not be lower than 170^{0}C. Studies show that while the smoking temperature of raw chicken fat was 190^0 C, the smoking temperature of the fat released during the preparation of chicken grill in an IR furnace was 183^{0}C.

Based on this, it can be recognized that the use of fat released during the cooking of chicken grill in an IR oven in the production of food products is justified, and the use of chicken fat released during frying in an oven in the production of food products is not recommended.

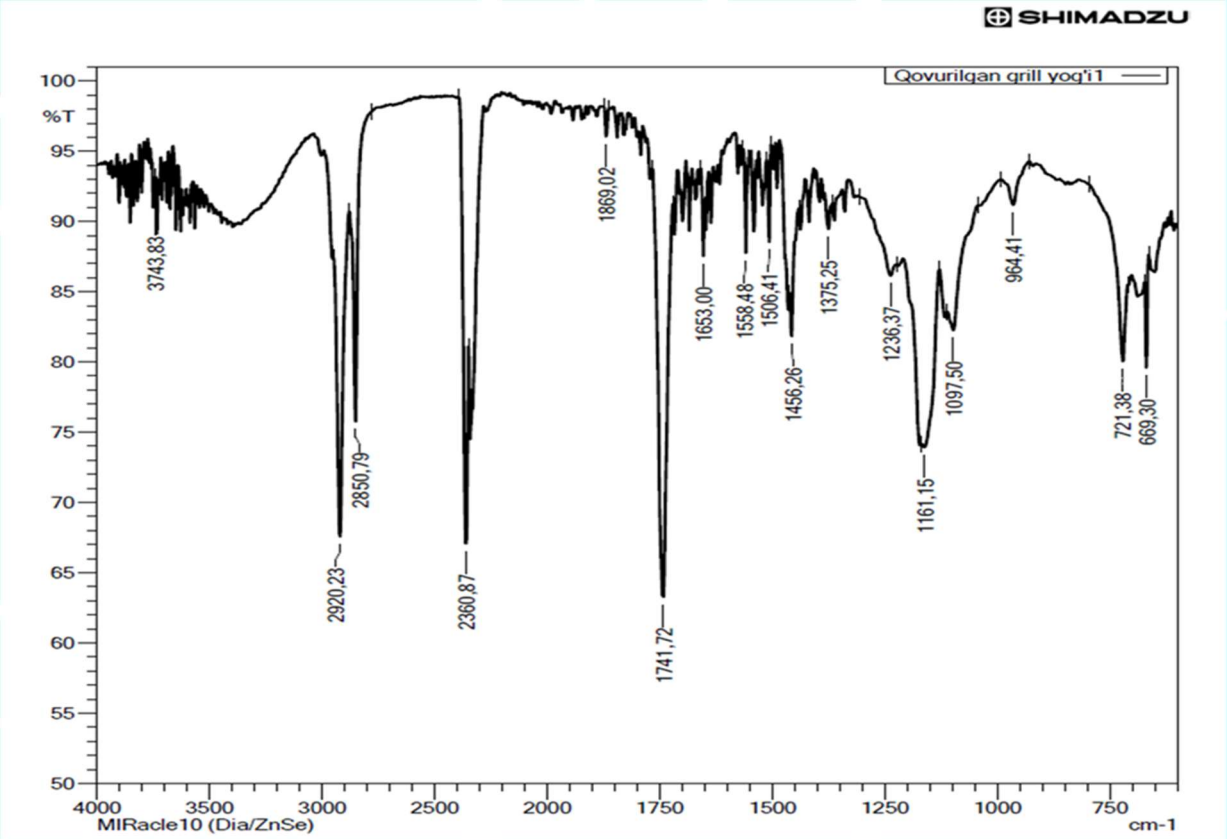
The formation of primary and secondary oxidation products in fats under thermal influence can also be observed by analyzing IR spectra [4.5].

IR spectra of chicken grilled fat (decantant) prepared in an IR furnace and chicken fat fried in an oven were analyzed on an IRSpirit - Zepto Scientific spectrophotometer. Images of the spectrograms are shown in Picture 1.



a

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б

Picture 1. Spectrograms of grilled chicken oil (decantant) in an IR oven (a) and oven-fried chicken oil (b)

The first stage of thermal oxidation in triglycerides with the formation of hydroperoxides can be observed in the region of 3450 - 3475 sm^{-1} of IR spectrograms. In this case, the absorption maximum of the waves of the chicken fat sample, fried in an oven, decreases compared to chicken grilled fat prepared in an IR oven, and the intensity, on the contrary, increases. The appearance of the spectrum in the region of 3535 sm^{-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 chicken fat sample roasted in the oven.

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