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STUDY ON THE USE OF PALM OIL IN PASTRY MAKING

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ABSTRACT

One of the main reasons why palm oil has recently been found in many restaurant kitchens, canteens, bakeries, and pastry shops is its low burning point, which causes the substances in the oil to degrade slowly, allowing palm oil to be reused multiple times compared to other edible oils on the market.

This study analyses the qualitative aspects of palm oil used in the production of pastries, including organoleptic analysis and the determination of the leading quality indicators of the oil: acidity index and peroxide index, which are the primary objectives of this research.

INTRODUCTION

A significant portion of the annual global palm oil production is utilised in food applications, which is of interest to researchers studying the fatty acid composition and nutrient content of this product (Khosla, 2006).

This oil has proven to be an alternative to partially hydrogenated oils, which are associated with oils rich in saturated fatty acids (Ismail et al., 2003, Nallusamy, 2006, Zaliha et al., 2014, Nurkhuzaiah et al., 2015).

However, the stability of palm oils does not depend solely on the properties of the oils, but also on the conditions of production, storage, etc. (oil temperature, processing time, frying duration or cycle, frying system and materials used to manufacture the processing vats, replenishment with fresh oil) and the composition of the foods undergoing the frying process (Tarmizi et al., 2016). Through the frying process, a significant amount of oil is absorbed into the food being fried, so attention is focused on the quality of the oil to preserve both its quality and that of the food being fried. Keeping the oil at an excessive temperature threshold for a long period of time, combined with the presence of air and humidity, can lead to reversible degradation of both the oil and the product undergoing the frying process (Dueik & Bouchon, 2011, Karoui et al., 2011).

The oil palm is not a demanding plant (low water requirements, little fertilizer and pesticides), which makes it an economical crop, but the destruction of other crops to establish oil palm plantations reduces the sustainable potential of those areas, with repercussions on the environment (Choong, 2014, Begum et al., 2019, Bejarano, 2022). Palm oil can be reused because it remains stable even at high temperatures (230°C), with resistance to burning being one of its most essential characteristics. This characteristic makes it highly sought after for industrial use, with

pastry making being a key target industry in this regard. In its non-hydrogenated form, it remains stable at temperatures of up to 230-240 °C, while sunflower oil can withstand a maximum of 160 °C (Căpruciu, 2011).

The commercial quality of palm oil-based products is a crucial economic attribute, and precise and reproducible analytical methods are necessary to measure this characteristic (Abdul-Hamid et al., 2020; Cheah et al., 2023).

MATERIAL AND METHODS

To make pastries at SC SWEET SEPTEMBER SRL, 10 kg blocks of palm fat are used (Figure 1). The fat is used as is, at room temperature (it is highly malleable when kneaded and can be easily incorporated into the dough), or in liquid form, as specified in the recipe (e.g., chocolate sauce).

Figure 1 Palm oil fat blocks

To conduct the study, two samples were prepared (Figure 2) and labelled as follows:

a) P1 b) P2

Figure 2. Palm fat/oil samples a) P1—solid form; b) P2—liquid form

The samples were subjected to organoleptic analysis and quality indicator analyses, as described below.

The organoleptic examination consisted of assessing the appearance, color, smell, and taste. The assessment was conducted by 10 individuals aged between 20 and 40. The cumulative data were reported as an average. To assess the appearance, the samples were placed in Petri dishes, and the examination was carried out at room temperature (for both the liquid and solid forms) (Figure 1). The general appearance was assessed, as well as whether the sample was clear, without any uncharacteristic odour, without suspensions or sediment. The color was assessed in natural light. The smell was assessed by rapid inhalation from a covered

vessel for a few seconds, after preheating the oil samples under study to 40 ºC. The smell should be pleasant, without any foreign odors. The taste was assessed by tasting the sample at a temperature of 23^{0}C. It shall be noted in accordance with the standard, and any unsatisfactory aspects shall be noted in the observations: foreign taste, rancid, bitter, honey (mite infestation), etc.

The acidity index was expressed in milligrams per gram and was determined by titration with a basic solution in the presence of phenolphthalein as an indicator.

The peroxide value (PV) indicates the degree of oxidative degradation (rancidity) of palm oil and is expressed as the number of ml of 0.002 N sodium thiosulfate consumed per gram of fat (Căpruciu, 2016). The determination is performed titrimetrically with a sodium thiosulfate solution of known titre, according to the standard.

The palm fat/oil samples analysed are used in the SC SWEET SEPTEMBER SRL bakery, with quantitative determinations carried out at the Research Centre for Applied Life Sciences and Biotechnology, Faculty of Horticulture.

RESULTS AND DISCUSSIONS

Palm oil is widely used in the food industry (packaged foods, snacks, margarines, and cooking oils) due to its technological efficiency and structural durability.

Organoleptic analysis is the most common oil quality analysis, providing primary data on product quality. The formation of samples for organoleptic analysis consisted of sampling the palm fat used at the time of the study in the pastry section. Thus, samples were taken from the 10 kg block and brought to the laboratory for qualitative analysis. To form the liquid sample (Figure 2b), the solid sample (Figure 2a) was heated gently to 50 ºC for 10 minutes. The organoleptic analysis of the palm oil was performed under standard laboratory conditions at a constant temperature of 23 ºC and in natural light, with the observations recorded in Table 1.

Table 1

Leading sensory indices of palm fat/oil—observations

IS* / **Characterization**	**General aspect**	Taste	Smell	Colour
	Compact/Clear, no sediment. Medium viscosity.	Sweet, pleasant. No rancid or bitter taste.	Pleasant, specific, without foreign nuances	Uniform cream/light yellow, no spots caused by suspensions

IS- Sensory indices*

The overall appearance is clear, with no sediment. No characteristic odour, no foreign odour. Upon tasting, no rancid or bitter aroma was detected. The color detected in natural light and on a white work surface was intense yellow, with no spots caused by suspensions (Figure 3).

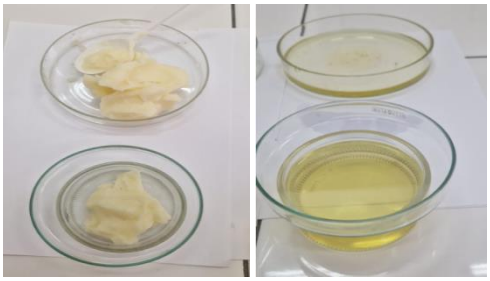

Figure 2: Determination of the color and smell of palm oil

For the smell analysis, the oil was heated to 50°C and quickly inhaled from a covered container for a few seconds. The oil analysed had a slight smell that did not linger. The smell of the samples analysed was pleasant and specific, without any foreign nuances.

Determination of the quality indicators of palm oil/margarine used in pastry

Palm fat is easily malleable, making it extremely easy to incorporate into pastry recipes and increasing the efficiency of the technological process (working time, dough homogenization—well-homogenised dough, without lumps, tender, odourless, uniform colour, etc.)—Figure 3.

Figure 3. Palm fat dough used in pastry products
a) Incorporation of solid palm fat; b) Incorporation of liquid palm fat

The palm fat was divided into two samples (obtained as described in Materials and Methods), each sample weighing 200 g. The quality indices were analysed from the initial samples upon opening the package, as well as after 15 and 30 days of storage. Under the established conditions, the acidity index and peroxide index, the primary physicochemical quality indicators, were determined according to STAS. These indicators provide information on the degradation of palm fat and its shelf life. The determinations were made according to the analysis protocol, and the results obtained are recorded in Table 2. It should be noted that all samples subjected to physicochemical analysis were taken immediately after the container was unsealed.

Table 2

Determination of some quality indicators of palm fat

Palm oil		Quality indicators *	
		IA (mgKOH/g)	IP (meq/kg)
Initially		0.6	10.1
15 days	Refrigerate	0.6	10.0
	Room temperature	0.7	10.2
30 days	Refrigerate	0.7	10.2
	Room temperature	0.9	10.7

***IA—acidity index; IP—peroxide index*

It was found that free acidity, expressed in mg KOH/g, was higher in samples stored at room temperature, with no significant differences (Table 2). The peroxide index (meq/kg) also showed small differences, depending on the storage method. The peroxide index values show that the samples are fresh, although there were slight differences depending on the type of fat from which the samples were taken. For proper storage, it is recommended that palm fat be stored under appropriate conditions in the bakery's warehouse after unsealing.

CONCLUSIONS

Sensory analysis of palm fat/oil revealed consistent, high-quality characteristics.

Both the acidity and peroxide indices remained within the standard range during the testing period, under appropriate storage conditions (in darkness and at temperatures not exceeding 20 ^{o}C), with a slight increase in acidity observed after 30 days at room temperature.

The analysis of quality indicators on palm fat/oil samples revealed no significant differences over a short period (30 days). This indicates that, from a compositional perspective, palm oil is stable, with high stability being one of the key criteria for its use in pastry. Therefore, this study has demonstrated that qualitative determinations on palm oil samples used in pastry making can indicate the frequency of its use, as well as the period during which fat packages can be stored under controlled conditions.

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