Evaluation of deep-fat frying oils; oil disposal by fast methods and determination of trans isomers, oil content and moisture in fried foods.

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INTRODUCTION

Deep-fat frying consists in a fast process of food cooking. Concomitantly as the oil incorporation occurs, food loses moisture, providing desirable sensory characteristics of taste, smell and texture. Due to this oil assembly, the quality of the oil used in frying reveals an essential importance to foods and their final composition. The oil used must be tracked and its disposal must comply with the recommendations of ANVISA, especially with regard to the content of total polar compounds (TPC). The acceptable limit for the oil TPC content is equivalent to 25%, recommended by ANVISA [1].

Another important parameter under the nutritional point of view is the amount of trans isomers. The injuries to health, originating in consumption of trans fatty acids, are known and their presence in food is undesirable. Since August 2006, ANVISA requires the declaration of trans in packaged food [2]. In frying, they are formed during the oil heating and are transferred to the fried food.

OBJECTIVE

The aim of this work was the data survey on the process of deep-fat frying of commercial establishments of the city of Campinas. To achieve this, available commercial kits for determination of TPC were used, whose advantages are: convenience, analysis quickness and evaluation of frying oil "in situ". Furthermore, slices of chicken breast and slices of meat, both with flour coating, were fried discontinuously in cottonseed oil and palm olein. The following parameters were evaluated in the fried food: oil incorporation, moisture loss and the content of trans fatty acids.

MATERIAL

The samples of frying oil were collected in establishments of Campinas and the commercial kits used for the oil evaluation were: Viscofrit, Testo 265, and Fri-Check. For the second part, it was utilized: frier (FryMaster®, 28L), meat products with flour coating (Braslo), cottonseed oil (Cargill) and palm olein (Agropalma).

Figure 1. Viscofrit

Figure 2. Testo 265

Figure 3. Fri-Check

METHODS

Moisture: According to the method of the Laboratory of Meat and Processes (FEA/UNICAMP), based mainly in the AOAC methodology [3].

Oil content: By acid Hydrolysis, according to the proceeding of the Laboratory of Oils and Fats [4].

Fatty Acids Composition: Official Method of AOCS Ce 1-62 [5].

RESULTS AND DISCUSSION

Table 1 shows the results of the frying oil evaluation corresponding to the samples collected in the establishments. Table 2 features the analysis of the fried meat.

Table 1. Results for the kits of the discarded oil samples.

	Testo 265	Viscofrit	Fri-Check	Official Method [6]
Sample	**TPC (%)**	**Is the TPC > 25%?**	**TPC (%)**	**TPC (%)**
1	12.0 ± 0.9	Yes	4.4 ± 0.4	9.1 ± 1.6
2	33.0 ± 3.5	Yes	3.8 ± 0.7	19.9 ± 1.4
3	23.3 ± 0.3	Yes	5.9 ± 1.3	22.2 ± 2.2
4	10.2 ± 2.0	No	5.0 ± 0.6	10.1 ± 3.6
5	10.7 ± 0.8	Yes	4.1 ± 0.8	11.0 ± 1.5
6	10.7 ± 0.3	Yes	11.8 ± 0.9	14.1 ± 1.0
7/A	16.8 ± 0.3	Yes	9.0 ± 0.4	11.2 ± 0.1
7/B	25.5 ± 0.5	Yes	17.5 ± 3.9	32.0 ± 0.9
8/A	33.8 ± 1.2	No	7.3 ± 0.6	35.1 ± 0.7
8/B	27.7 ± 0.3	Yes	5.1 ± 0.4	30.5 ± 0.2
8/C	33.5 ± 0.5	No	4.8 ± 0.6	35.5 ± 2.3
9/A	16.8 ± 0.3	Yes	5.8 ± 1.0	14.3 ± 0.2
9/B	10.5 ± 0.5	Yes	5.1 ± 0.6	8.9 ± 0.0
10	15.0 ± 1.5	No	3.3 ± 0.3	14.6 ± 0.4
11/A	10.8 ± 0.3	No	4.0 ± 0.2	8.7 ± 0.8
11/B	9.2 ± 0.3	Yes	5.9 ± 0.5	10.4 ± 0.8
11/C	8.8 ± 0.3	Yes	6.9 ± 0.3	7.3 ± 0.1
11/D	9.2 ± 0.3	Yes	5.9 ± 0.5	6.8 ± 0.6
11/E	15.3 ± 0.3	Yes	4.5 ± 0.9	12.7 ± 0.2
12	17.8 ± 0.8	No	7.4 ± 0.3	21.8 ± 3.2
13	11.3 ± 0.3	Yes	11.2 ± 1.6	17.0 ± 1.3

The disposal samples consist in quantifying the polar compounds content of the oil after the last day of its usage. In these samples it was expected a considerable increase in the amount of TPC, since the oil degrading reactions occur in an advanced stage after a certain period of frying. However, few results presented a TPC index above the limit, largely indicating an early disposal by the establishments.

Table 2. Results of the fried food analysis.

Food	Days of Frying	Oil	Moisture Content (%)	Oil Content (%)
Raw Chicken	0	None	64.7 ± 0.36	1.6 ± 0.24
Fried Meat	1	Palm Olein	43.3 ± 0.24	10.1 ± 1.57
Fried Meat	6	Palm Olein	43.3 ± 1.52	14.0 ± 0.76
Fried Chicken	1	Palm Olein	56.1 ± 0.08	2.2 ± 0.02
Fried Chicken	5	Palm Olein	48.6 ± 0.52	10.2 ± 0.95
Fried Chicken	1	Cottonseed Oil	55.1 ± 0.19	6.7 ± 0.13
Fried Chicken	6	Cottonseed Oil	49.1 ± 0.92	8.6 ± 0.99

The examination of these results permits to verify that the moisture reduction rate and the increase of oil absorption in the food are directly dependent on the type of oil used, the variety of fried food and the conditions of the frying process. In this context, it can be asserted that the parameters variation for the fried meat were very reduced. On the other hand, for the chicken fried in palm olein, it was observed a considerable variation between the moisture levels and oil incorporation. The same can be said about the chicken fried in cottonseed oil.

In Table 2, it was not considered the levels of trans, once they were detected in low quantities. Therefore, these fried products presented, in terms of portion, zero trans, according to the RDC n°360 and n°359 of ANVISA [2].

CONCLUSION

In this work, it could be found out that the fast kit Testo 265 was the one that stood out, due to the greater correlation among the results in comparison to the official methodology. Viscofrit and Fri-Check showed huge discrepancies in their results, denoted mainly by the lack of precision in their analysis.

REFERENCES

[1] ANVISA – National Health Surveillance Agency. **Oil and Fats used in Frying.** Technical Report nº11 of October 5, 2004.
[2] ANVISA – National Health Surveillance Agency. **Resolutions RDC n°359 and RDC n°360** of December 23, 2003.
[3] HORWITZ, W. **AOAC: Official methods of Analysis of Association of Official Analytical Chemists.** 13ª ed., Washington D. C., 1980.
[4] SHAHIDI, F.; WANASUNDARA, J. P. D. Extraction and analysis of lipids. In: AKOH, C. C.; MIN, D. B. **Food lipids: chemistry, nutrition, and biotechnology.** New York: Marcel Dekker, cap. 5, 1998.
[5] AOCS. **Official methods and recommended practices of the American Oil Chemists' Society**. Champaign: American Oil Chemists' Society, 2004.
[6] OSAWA, C. C.; GONÇALVES, L. A. G. **Fried food and state of the art for cottonseed oil and olein palm in battered meat products.** Project Ph.D. in Food Technology – DTA/FEA – UNICAMP. CNPq: Process 140387/2005-6. Thesis in progress, since 2005.