RESEARCH CONCERNING THE INFLUENCE OF THERMAL TREATMENT ON SOME BIOCHEMICAL PARAMETERS OF MAIZE AND SUNFLOWER REFINED OILS

Marcel Avramiuc

"Ştefan cel Mare" University of Suceava, Faculty of Food Engineering ,
Str. Universitatii,
no. 13, 720229, Suceava, Romania, e-mail: avramiucm@usv.ro

Abstract: *In this work it has studied, comparatively, the evolution of some biochemical indices of some refined oil samples, subjected to thermal processings various periods of time. The biological material consisted in maize and sunflower refined oil samples whose peroxyde, saponification and acidity indices have been determined before and after thermal treatment (boiling) applied 15, 30, 45 and 60 minutes to the both oil types.*

The results of determinations have evidenced changes of the mentioned biochemical indices, depending on oil type and action length of the thermal treatment. Thus, beside blank (samples unsubjected to thermal treatment), in the both oil types, the highest increase of peroxyde index have been after 60 minutes of thermal processing, with superior values for sunflower oil.

The saponification index has registered increase in all samples, once with increase of thermal processing period, the highest values being registered in maize refined oil. In the two oil types, at the both analysed indices (peroxyde and saponification) the highest differences among registered values have been between 15 and 30, respectively between 30 and 45 minutes, and the least differences have been between 45 and 60 minutes of thermal processing.

As compared to nonprocessed samples, the maize and sunflower oils acidity index has registered constant increase, once with thermal processing period increase, the highest values being found in maize oil samples.

Keywords: *Peroxyde, saponification, acidity, index, refined oil, maize, sunflower.*

Introduction

Depending on storage and processing conditions, oils can suffer some modifications, which can be: *lipolyse*, when mainly act enzymes from tissues and those ones produced by micoorganisms, *oxidation*, produced through microorganisms action (β-oxidation of short chain fatty acids) or through air oxygen (autooxidation or aldedydic rancidation) with peroxydes formation, and *thermal degradation* in the presence of oxygen (Sevanian et al., 1988; Banu et al., 1997; Neamțu, 1997; Leonte and Florea, 1998; Georgescu at al., 2000; Banu et al., 2002).

The thermal transformations are processes occuring during thermal oxidation of fatts, biochemicaly evidenced through decrease of iodine index and increase of refraction index and viscousity of respective lipids (Banu et al., 2002).

In this work it has studied, comparatively, the evolution of peroxyde, saponification and acidity indices of some maize and sunflower refined oil samples, thermal treated (boiled) various time periods, in order to see to what extent the thermal treatment length modifies the values of the above mentioned indices.

Materials and methods

The biological material consisted in maize and sunflower refined oil samples whose peroxyde, saponification and acidity indices have been determined before and after thermal treatment (boiling) applied 15, 30, 45 and 60 minutes to the both oil types.

In the table 1 are reproduced the values of the three indices of maize and sunflower oil samples, determined before experiment beginning (blank samples).

Table 1 The peroxyde, saponification and acidity indices (blank samples) of maize and sunflower oils, before experiment beginning

Determination / Product	Peroxyde index (% Iodine)	Saponification index (mg KOH/g)*	Acidity index (mg KOH/g)**
Maize oil	0,014	48,940	2,120
Sunflower oil	0,028	38,870	1,780

* mg KOH required for saponification of one gram of fat; ** mg KOH required for free fatty acids neutralization from one gram of fat.

The oil samples boiling was made using a gas burner Bunsen, whose flame was regulated to the same burning force in all analised samples.

The peroxyde index was evaluated by means a method based on titration with $Na_2S_2O_3$ of iodine released by peroxydes from KI (Sahleanu V. and Sahlenu E., 1989). The determination of acidity index was made through a titration method, based on measurement of volume of KOH solution 0,1 N, which neutralizes free fatty acids from one gram of fat, and the saponification index through titration of KI solution 0,5 N (remained after heat saponification of oil) with HCl solution 0,5 N (Beschea and Toma, 1984; Sahleanu V. and Sahlenu E., 2000).

Results and discussion

In the table number 2 are rendered the peroxyde index values of oil samples thermal processed certain time interrvals.

Table 2 Maize and sunflower oil peroxyde index values determined at established time intervals

Determination / Oil samples	Peroxyde index (% Iodine)			
	TP*15 minutes	TP 30 minutes	TP 45 minutes	TP 60 minutes
Maize	0,360	0,602	1,405	1,431
Sunflower	0,428	0,625	1,740	1,803

TP = thermal processing

Analysing the peroxyde index values, one can see that in the both oils the highest increase of this index (as compared to blanks) have been after 60 minutes of thermal processing. In sunflower oil the index values were greater than in maize oil, due, probably, to superior content in polyunsaturated fatty acids of the first one. In the both oil types, the highest differences among peroxyde index values, determined at established time intervals, have been between 15 and 30, respective between 30 and 45 minutes, and the least differences between 45 and 60 minutes. Therefore, 30 minutes of thermal processing (under above mentioned conditions) of has led to the accumulation of peroxydes whose amount was much more than those one coming from 15 minutes of processing. One can ascertain the same thing at 45 minutes comparatively with 30 minutes of thermal processing.

The table 3 reproduces the saponification index values of maize and sunflower thermal processed oils.

Table 3 Maize and sunflower oil saponification index values determined at certain time intervals

Determination	Saponification index (mg KOH/g)			
Oil samples	TP*15 minutes	TP 30 minutes	TP 45 minutes	TP 60 minutes
Maize	55,960	59,930	68,650	69,120
Sunflower	40,450	48,270	59,580	64,330

TP = thermal processing

As seen in the table 3, the saponification index has registered increase in the both oil types, once with thermal processing time increase. In all analysed termal processing intervals, the maize refined oil has had the highest values of this index. Also in this case, in the both oil types it can see that greater differences among saponification index values have been between 15 and 30, respectively between 30 and 45 minutes, and the least ones between 45 and 60 minutes of thermal processing. It is known that the saponification index has higher values in fats containing greater amounts of fatty acids with low molecular weight. Because of products of acid oxidation, the fats saponification index increases (Beschea and Toma, 1984). It is the case of rancid fats, in course of rancidation or having a certain degree of oxidation, like maize and sunflower oils within our experiment.

In the table 4 are reproduced the acidity index values of analysed oil samples.

Table 4 Maize and sunflower oil acidity index values determined at certain time intervals

Determination	Acidity index (mg KOH/g)			
Oil samples	TP*15 minutes	TP 30 minutes	TP 45 minutes	TP 60 minutes
Maize	3,063	5,720	7,610	12,500
Sunflower	2,410	4,445	5,930	9,700

TP = thermal processing

Beside blank samples, maize and sunflower oils acidity index has registered constant increase, once with thermal processing time increase (tab.4). The highest values have been in maize oil samples. The heat and oxygen action have determined fat changes, ended with free acidity increase, stronger after 60 minutes of thermal processing, as compared to acidity increase produced at the other thermal processing intervals analysed within this work.

Conclusions

The study of some maize and sunflower refined oil samples thermal processed certain time intervals (15, 30, 45 and 60 minutes) has evidenced modifications of peroxyded, saponification and acidity indices, depending on oil type and thermal treatment action length.

Beside blanks (samples nonsubjected to thermal treatment), in the both oil types, the highest increase of peroxyde index have been after 60 minutes of thermal processing, with superior values for sunflower oil. In the both analysed oils, the highest differences among values of this index, determined at established time intervals, have been between 15 and 30, respectively between 30 and 45 minutes, and the least ones between 45 and 60 minutes.

The saponification index has registered increase in all samples, once with increase of thermal processing period, the highest values being registered in maize refined oil. In the two oil types, at the both analysed indices (peroxyde and saponification) the highest differences among registered values have been

between 15 and 30, respectively between 30 and 45 minutes, and the least differences have been between 45 and 60 minutes of thermal processing.

As compared to nonprocessed samples, the maize and sunflower oils acidity index has registered constant increase, once with thermal processing period increase. The highest values were found in maize oil samples.

References

C. Banu, C. Vizireanu, P. Alexe - *Procesarea industrială a cărnii*. Editura Tehnică, Bucureşti, 1997, 156-157.

C. BANU ş.a.- *Tratat de chimia alimentelor*. Editura AGIR, Bucureşti, 2002, 61-66.

Magda BESCHEA, Gabriela TOMA, - *Caiet de lucrări practice de chimie organică şi biochimie specială* (Fascicola 1 şi 2), Galaţi, 1984, 70-77.

GEORGESCU, GH. ş.a. - *Tratat de producerea, procesarea şi valorificarea cărnii*. Editura CERES, Bucureşti, 2000, 85-87.

M. LEONTE, T . FLOREA - *Chimia alimentelor, vol I*. Editura Pax-Aura Mundi, Galaţi, 1998, 93-94.

NEAMŢU, G., 1997 - *Biochimie alimentară*. Editura CERES, Bucureşti, p. 106-107.

SAHLEANU, V., SAHLEANU, E., 1998 - Îndrumar pentru analiza cărnii şi produselor din carne. Editura Universităţii Suceava, 55-65.

SEVANIAN A, (Ed)., 1988 - *Lipid peroxidation in Biological Systems*. Am. Oil Chem. Soc., Champaign, II, 143-147.