THE ACIDITY INDEX EVOLUTION OF MAIZE AND SUNFLOWER CRUDE OILS UNDER STORAGE CONDITIONS

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Keywords: Acidity index, sample, crude oil, maize, sunflower.
Abstract: In this work it has searched, comparatively, the evolution of the acidity index of some maize and sunflower crude (unrefined) oil samples stored under certain conditions of temperature and light, during 60 days. The material for experiment was represented by crude oil, whose acidity index has been determined at once after obtaining, as well as at 5, 30 and 60 days of keeping at 4ºC (in dark and light) and at +20ºC (in dark and light). The storage of maize and sunflower crude oils at +4ºC and +20°C, in dark and and light has led, comparatively with fresh samples, to increase of the acidity index after 30, and especially after 60 days. The highest values of this index have been registered after 60 days of keeeping at +20°C. During storage at the two thermic thresholds, the lighting regime has not influenced the acidity index value in the both analysed oils. Comparing the evolution of the acidity index of the two crude oil types, one can say that after 5 days of storage at +20°C the values of this index have risen more in maize oil, as compared to sunflower one. After 30 days the rises have been wery close in the both oil types, but after 60 days the acidity index values have registered rises much bigger in sunflower oil.

INTRODUCTION

Sunflower oils are predominantly composed of triacylglycerols (98–99%) and a small proportion of phospholipids. The so-called unsaponifiable matter contains tocopherols, sterols and waxes, among other substances (Grompone, 2011).

According to Moreau (2011), the major components of crude corn germ oil are triacylglycerols (TAG), but crude corn oil also contains other minor non-polar and polar lipid components: free fatty acids, pigments, volatiles, phospholipids, and waxes - the major undesirable components removed by several refining steps.

The lipolyse, caused by enzymes from tissues and/or produced by micoorganisms, *the oxidation*, produced through microorganisms action (β-oxidation) or through oxygen from air (autooxidation), and *the thermal degradation* in the presence of oxygen are modifications which can be suffered by lipids from food raw materials (Banu et al., 2002; Georgescu at al., 2000; Leonte and Florea, 1998; Sevanian et al., 1988; Banu et al., 1997; Neamţu, 1997).

Due to the moisture and lipase enzymes from crude fats, the lipolitic transformations lead to the partial hydrolyse of glycerides up to glycerol and fatty acids (Neamţu, 1997).

In this work it has studied, comparatively, the evolution of the acidity index of some samples from maize and sunflower crude oils, stored under certain temperature and light conditions during 60 days, to see to what extent the thermal and/or lighting regime or storage period can modify the acidity index values of those samples.

MATERIALS AND METHODS

The experimental material was represented by samples of maize and sunflower crude oil, whose acidity index was determined at once after obtaining (table 1), as well as at 5, 30 and 60 days of keeping under certain conditions.

Table 1. Acidity index values of maize and sunflower fresh crude oils

Determination	Acidity index (mg KOH/g oil)	
Produce	Maize oil	Sunflower oil
Values	5,1	4,5

Some oil samples coming from the both seed species have been stored at +4ºC (in dark and light) and other ones at +20ºC (in dark and light).

The determination of acidity index was made through a titration method, based on measurement of volume of KOH 0,1 N solution, which neutralizes free fatty acids from one gram of oil (Beschea and Toma, 1984; Sahleanu V. and Sahlenu E., 2000).

The data of experiments (consisting in 4 replicates for each determination) were statistically processed. The analysis of variance was used to calculate differences between the results, significant differences being considered those ones at $p < 0.05$.

RESULTS AND DISCUSSIONS

In the Table 2 are reproduced the maize oil acidity index values.

Table 2. Maize oil acidity index values at certain time intervals

Thermic regime	+4ºC		+20ºC	
Lighting regime	Dark	Light	Dark	Light
Time*	Acidity (mg KOH/g oil)			
5 days	5.4	5,4	12.1	13.2
30 days	10.3	9,9	19.7	20.3
60 days	16.1	16,8	28.2	27.9

*Intervals of determination

As seen in the Table 2, during the storage period, the acidity index, known as lipolitic process indicator, has evidenced increases in all analyzed maize oil samples. Thus, if in crude fresh oil (blank sample) the index value was 5.1 mg KOH/g oil, after 5 days of storage at +4ºC this value has become 5.4 mg KOH/g oil (in dark and light too), after 30 days the index has increased to 10.3 (in dark) and to 9.9 mg KOH/g oil (in light), that is almost 2 times compared to the blank, and after 60 days of storage the acidity index has increased to 16.1 (in dark) and to 16.8 mg KOH/g oil (in light), that is 3.1-3.3 times compared to blank sample.

Under storage conditions at temperatures of +20ºC, the acidity index of maize crude oil has increased after 5 days to 12.1 mg KOH/g oil (in dark) and to 13.2 mg KOH/g oil (in light), that is 2,4-2,5 times compared to the blank sample, after 30 days to 19.7 mg KOH/g oil (in dark) and to 20.3 mg KOH/g oil (in light), that is 3.9-4 times compared to the blank, and after 60 days to 28.2 mg KOH/g oil (in dark), and to 27.9 mg KOH/g oil (in light), that is 5.5-5.4 times compared to blank sample.

The Table 3 reproduces the acidity index values of sunflower crude oil samples.

Table 3. Sunflower oil acidity index values at certain time intervals

Thermic regime	+4ºC		+20ºC	
Lighting regime	Dark	Light	Dark	Light
Time*	Acidity (mg KOH/g oil)			
5 days	4.5	4.5	10.5	9.8
30 days	7.5	7.7	17.8	16.6
60 days	13.3	12,8	30.3	31.7

*Intervals of determination

In the Table 3, it can see that the acidity index of sunflower oil stored 5 days at +4ºC is not changed (in dark and light too), as compared to the blank (4.5 mg KOH/g oil). After 30 days of storage at +4ºC, the acidity index has increased to 7.5 mg KOH/g oil (in dark) and to 7.7 mg KOH/g oil (in light), that is 1,7 times compared to the blank, and after 60 days this index has increased to 13,3 mg KOH/g oil (in dark) and to 12,8 mg KOH/g oil (in light), that is almost 3 times compared to the blank.

At temperatures of +20ºC, the acidity index of sunflower crude oil has increased once with keeping period extension as well. Thus, after 5 days of storage the acidity index has become

10,5 mg KOH/g oil (in dark) and 9.8 mg KOH/g oil (in light), that is 2.2-2.3 times compared to the blank. After 30 days the acidity index was 17.8 mg KOH/g oil (in dark) and 16.6 mg KOH/g oil (in light), that is 4-3.7 times compared to the blank, and after 60 days the same index was 30.3 mg KOH/g oil (in dark) and 31.7 mg KOH/g oil (in light), that is 6.7-7 times compared to the blank.

From the two Tables (2 and 3) it can be seen that both in corn oil and sunflower oil the acidity index values have increased, compared to blanks (fresh samples) at about the same proportions, except the interval of 60 days at 20°C, where the sunflower oil acidity index has increased (compared to blank) of about 7 times beside the corn oil, where the same index has increased about 5.5 times. In the both types of analyzed oil one can observe very small differences between values obtained in the light and dark mode, so the light regime has not influenced the process of hydrolysis.

In Fig. 1 and 2 are shown the linear regressions for correlations between acidity index values and thermal regime, i.e. lighting, at the three analyzed periods (5, 30 and 60 days).

As seen from the two graphs, the positive correlations established for the samples of the both types of oil (at all three time intervals analyzed), have shown higher values of r^2 at 5 and 30 days of storage, in the case of corn oil, and at 60 days in the case of sunflower oil.

CONCLUSIONS

The study of some samples of maize and sunflower crude oils stored 60 days under various conditions (at +4°C and +20°C, in light and dark) has shown modifications of the acidity index, determined at certain time intervals, depending on temperature and storage period as well

The storage of maize and sunflower crude oils at +4ºC and +20°C, in light and dark has led, comparatively with fresh samples, to increase of the acidity index after 30, and especially after 60 days. The highest values of this index have been registered after 60 days of keeping at +20°C.

During storage at the two thermic thresholds, the lighting regime has not influenced the acidity index value in the both analysed oils.

Comparing the evolution of the acidity index of the two oil types, one can say that after 5 days of storage at +20°C the values of this index have risen more in maize oil, as compared to sunflower one. After 30 days, the rises have been very close in the both oil types, but after 60 days the acidity index values have registered rises much bigger in sunflower oil.

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