JAP&T
TPA-Timişoara

Available online at http://journal-of-agroalimentary.ro

Journal of Agroalimentary Processes and Technologies 2012, *18* (4), 315-317

Journal of Agroalimentary Processes and Technologies

Analysis of the oxidation sunflower oil bottled in containers of different capacities

Căpruciu Ramona*, Săvescu Petre

Faculty of Agriculture and Horticulture, Department: Horticulture and Food Science, Street. A.I.Cuza, No. 13, Craiova, Romania

Received: 29 September 2012; Accepted: 14 November 2012

Abstract

The assessment of sunflower seeds in terms of quantity/quality is a complex activity and requires a high degree of attention and rigor in the technological process steps for obtaining sunflower oil because this is part of the human being's daily nutrition, improving or not his health.

This study aims to assess the degree of oxidative alteration (rancidity) of the oil bottled and stored in two ways (PET and drums), in this respect an analysis of some quality indicators is performed that can highlight the quality of the end product and its suitability for storage.

The performed analyses on sunflower oil samples stored in laboratory conditions (room temperature, light) that match those in stores, supermarkets or hypermarkets, highlight the oxidative nature of fatty materials under certain conditions.

The different behaviour of the oil stored in different packaging is due to different storage conditions, primarily due to the absence of light influence and temperature variation as well as the presence of a smaller amount of air in the barrel.

Keywords: sunflower oil, oxidative rancidity, storage

1. Introduction

During the process of obtaining and refining and also storage of sunflower oil, there are some changes in its mass (in particular a high acidification) in the presence of air, the oil degrades slowly or accentuated (depending on composition), being affected by oxidation. As a result the oxidative potential of sunflower oil depends primarily on the nature and concentration of the fatty acids from the composition and also on storage conditions (light, temperature, humidity).

The nutritional value of sunflower oil is given by its content of pro-vitamins and fat soluble vitamins (A, D, E) and by the presence of phosphatides, of the vitamin B4 (choline) and B8 (inositol), fractions that have an important biological action for the body [2].

The vegetable oils have also an energetic role for the living organisms, being important in the fight against the cold; they contribute to the absorption of fat soluble vitamins, elimination of bile (exocrine function of the pancreas), improve the taste of food and cause the sensation of saturation [1].

The studies in recent years show the role of fatty acids in maintaining a good cholesterol (HDL) at optimal level and lower the bad cholesterol (LDL) at levels that do not endanger the body health [3,6].

The alteration of fats (rancidity) is a complex biochemical process that consists of successively or simultaneously physicochemical transformations, of which the most important are the hydrolysis of fat, fatty acids oxidation, formation of aldehydes and ketones [7].

* Corresponding author: *e-mail:* ramonacapruciu@yahoo.com

2. Materials and methods

The material used in the study consisted of sunflower seeds whose fats have been dosed for finding the content of botanical oil and of oil samples stored in PET bottles of 1 litre and respectively in stainless steel barrels of 50 litres that have been analyzed in terms of oxidative rancidity every month for a period of 6 months.

The dosage of the oil seeds fats (oil) was done directly at heat using the light petroleum as organic solvent with a distillation temperature between 40 ... 60 ° C with residue after the complete evaporation of 2 mg per 100 cm^3.

A sample of 30 g is taken through the reduction method from the laboratory sample consisting of sunflower seeds, impurities-free, according to the regulations in force. The material is triturated and is passed in the extraction cartridge of the Soxhlet apparatus.

According to the standard methodology, the oil extraction takes place in two stages.

At the end of the first extraction stage, the cartridge is removed from the extractor and it is left 15 minutes for evaporation, and then its content is passed in the mortar and it is mixed very well. The mortar content is reintroduced in the cartridge (repeating the operations from stage I) and the extraction continues. After finishing the extraction, the cartridge is removed and the solvent is recovered by distillation. The oil remaining in the flask must be transparent and impurities- free. Otherwise, it is dissolved in ether and then filtered into another flask with determined mass or the analysis is repeated. The oil flask is kept about 15 minutes leaning on the water bath that the remaining solvent to be evaporated. Then it is dried in the oven for 1 hour at a temperature of 103±2°C. Then it is cooled in the desiccators and weighed. The calculations are done and the results are expressed in %.

The determination of the sunflower seeds moisture was achieved by drying them in an oven.

The peroxide index was determined by analyzing the degree of oxidation of the studied oil.

The peroxide index is measured by determining the amount of iodide converted to iodine by the action of active oxygen in peroxides. The result was expressed in the number of mille-equivalents of active O_2 / kg of fat.

3. Results and Discussion

The edible vegetable oil derived from the processing of sunflower seeds has a high share on the Romanian market, being on the first place in the consumer preference.

To perform the study, all the stages of the technologic process of obtaining the refined sunflower oil are done starting from the qualitative reception of sunflower seeds to bottling and storage of oil.

From the measurements made on the industrial core of the sunflower seeds there is shown in Table 1 that for each stage the moisture is at the superior limit, with small increases during the cleaning stage due to the injected steam. The operations required in this case, of drying the seeds (before and after pre-cleaning), lowers the moisture in this interval, taking place also an insignificant decrease in oil content. After M. M. Duda et al. - 2007 [4] the critical level of moisture is established depending on the species, being determined by the chemical composition of seeds: it is lower at the seeds with high oil content and higher for the ones with high content of carbohydrates.

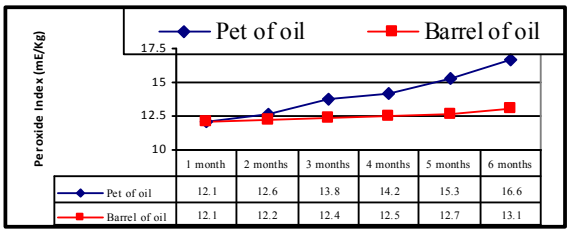
Table 1. Determination of sunflower seeds moisture and botanical oil at different stages in the technological process

Stage		Moisture (%)	Botanical oil in the core (%)
Qualitative reception		11	61.5
Primary storage		12	61.1
Proper processing	Pre-cleaning (before the proper storage)	12	61.1
	Post- cleaning (after passing the seeds in manufacturing)	13	61.0
Drying the oleaginous seeds	Before Pre-cleaning	11	60.6
	After Pre-cleaning	10	60.2
Spreading the seeds		9	59.5

After the spreading process, the moisture drops to 9%, the optimum percentage of sunflower seeds to be subject to pressing in order to obtain crude sunflower oil.

The storage behaviour of the vegetable oils depends essentially on the quality of raw materials as well as on the way of conducting the process for obtaining them.

The data obtained from the analysis of the peroxide index (Figure 1) highlight the more advanced instability character of the oil stored in PET than the one stored in barrels.



	1 month	2 months	3 months	4 months	5 months	6 months
Pet of oil	12.1	12.6	13.8	14.2	15.3	16.6
Barrel of oil	12.1	12.2	12.4	12.5	12.7	13.1

Figure 1. The determination of the sunflower oil oxidation degree

To better observe the period of time in which the sunflower oil begins to deteriorate in terms of oxidation, the samples that were analyzed were stored under the same conditions of temperature, light and moisture as the oil held in different points of sale (various stores, shops, supermarkets, etc.).

The oil samples were collected every month from both PET and barrels. Figure 1 shows that in the storage up to 3 months the peroxide index values are similar for both samples, after 4 months the peroxide value of oil from the barrel is relatively constant until finishing the experiment (6 months) while the peroxide index value of same type of oil stored in PET changes, reaching the rancid smell after about 180 days.

This phenomenon can be caused on the one hand due to the type of packaging used in bottling correlated with the contact time of oil with the air. If in the case of a PET of 1 litre the oxygen comes into contact with a larger oil mass, in the case of a barrel of 50 litres the mass of the oil does not come into contact with the air (it is eliminated at the bottom through an outlet nipple). On the other hand it influences the storage conditions. A direct light quickly degrade the oil in PET than that in barrel (where the light does not enter). The inappropriate temperature and humidity in the storage space can lead to oil rancidity.

A disadvantage of oxidation-prone oils is their doping with antioxidant substances from the antioxidants group. The antioxidants used in oil industry are divided into two groups. On the one hand we find natural substances (tocopherols, ascorbic acid and derivatives, gallic acid and derivatives) and on the other hand we find the substances obtained by synthesis (butylated hydroxyanisole - BHA - most used in fats and oils, diphenyl phenylenediamine, dithio propionic acid) that are added to preserve the quality of fats and oils preventing or delaying the installation of rancidity [5].

4. Conclusion

At the qualitative reception of the oily material the moisture is situated at the higher limit required by Stas for sunflower seeds and it has an optimal botanic oil content. This can lead to the predisposition of the seeds to calefaction followed by rancidity in the case of storage if the process is not conducted properly;

The botanical oil content determined in the industrial core remains at best values throughout the storage period, highlighting a seed lot with outstanding features in terms of this parameter.

The parallel analysis of the oxidation degree between the oil kept in PETs and the oil kept in barrels highlights different physicochemical aspects.

In similar conditions of storage, the oil from the two types of packaging behaved differently, a fact emphasized by the determination of the peroxide index;

After a period of six months, the sunflower oil kept in barrel is more stable in terms of oxidation than the one kept in PET;

In terms of oxidative potential, the purchase and use of oil in barrels is recommended in locations where this type of oil consumption is significant (restaurants, canteens, fast- foods, etc.).

References

1. Elena Marcela Badea, Daniela Săndulescu *Biotehnologii vegetale*, 2001. Fundația Biotech. Bucureşti;
2. Ramona Căpruciu – Tehnologii utilizate în industria uleiului, 2011. Ed. Sitech. Craiova.
3. Cheema S.K., Agellon L.B. - Metabolism of cholesterol is altered in the liver of C3H mice fed fats enriched with different C-18 fatty acids, 1999. J Nutr;
4. M.M Duda, A. Timar – Condiționarea și păstrarea produselor agricole. Editura AcademicPres, 2007. Cluj-Napoca
5. Herdan J.M., Maria Giurgică, Aurelia Meghea – Antioxidanții, 1995. Editura Tehnică. Bucureşti;
6. Phinney S.D., Odin R.S., Jonhson S.B. - Reduced arachidonate in serum phospholipids and cholesteryl esters associated with vegetarian diet in humans, 1990. Am J Clin Nutr; 51: 389-392
7. Scorei Romulus - Rolul aditivilor și auxiliarilor alimentari în asigurarea calității alimentelor, 2004. Editura Sitech. Craiova;