



A new photometric method for the determination of olive oil oxidative stability

A recent study has shown that the OxiTester method used for the determination of polyphenol content/stability index offers a valid alternative to the Rancimat method for the evaluation of oil stability index.

Abstract

To be able to predict olive oil shelf life, it is necessary to determine its oxidative stability. This parameter is usually measured using the Rancimat official method for the evaluation of the oil stability index.

A study published in the Journal of AOAC International [Vol. 91, No 4, 2008] validated and compared the OxiTester photometric method for the determination of oil polyphenol content/stability index with the Rancimat method.

The OxiTester method, which is simple and quick to perform, proved to be a valid alternative to the Rancimat method. In fact, the researchers determined a good correlation between the two methods for a wide range of oil samples with remarkably different characteristics. Furthermore, the testing time of OxiTester is significantly lower as compared to that of the Rancimat method.

Oil oxidative stability

One of the most critical factors that affects the quality of oil is rancidity, which is an oxidative phenomenon typical of all fatty substances.

Oil shelf life therefore depends on its capacity to withstand rancidity, that is on its resistance to oxidation, i.e. its oxidative stability.

The oxidative stability of an oil depends mainly on the natural content of phenols and tocopherols, but is also affected by the characteristics of the olives, their degree of maturation and the technology used during the production phase, for example during defoliation, crushing, extraction, centrifuging and filtration.

Therefore, in order to be able to prevent and slow down the occurrence of oxidative phenomena, it is vital to carefully manage the oil production and preservation technologies. Only an approach of this kind can prevent the degradation of the product quality and preserve its organoleptic and qualitative profile. Once oxidized, olive oil cannot in fact be classified as extra virgin oil.

Assessing oil oxidative stability

Evaluating the oxidative stability of oil is complex because this parameter is influenced by several factors. The indexes that enable to assess the resistance of oil to rancidity are the fraction in fatty acids with a low unsaturation degree, acidity, number of peroxides, specific absorbance, organoleptic qualities and the amount of phenol compounds.

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The method most widely used to estimate the overall resistance to rancidity during storage is the one that measures the oil stability index (OSI), approved by the *American Oil Chemists Society (AOCS) Cd 12b-92*[1] and generally known as the Rancimat method.

The Rancimat method

The Rancimat method involves conveying a flow of air through the oil sample contained in a sealed and heated container. This method produces peroxides during the primary oxidation phase and organic acids with a low molecular weight, aldehydes and ketones with a typical rancid odor during the secondary oxidation phase. These compounds are conveyed by the air flow into a second reservoir containing distilled water that is continuously monitored for conductivity. The sudden variation of conductivity shows the presence of organic acids. The time that elapses between the beginning of the process and the appearance of the secondary reaction products is the so-called **oxidation induction period** or **oil stability index (OSI)**. For olive oil, this time should be around an average of 10 – 12 hours, though it may even reach higher values for extra virgin oils that are very rich in polyphenols and thus have a high antioxidant capacity.

Other methods

Although there are other methods to determine oxidative stability, none of these is supported by commonly marketed instruments or equipment. In addition, these methods require a very long time to perform and high testing temperatures, which may sometimes cause discrepancies between the results obtained and the actual oxidation phenomena that occur during storage.[2]

Comparison of the OxiTester and Rancimat methods for the determination of oil oxidative stability

In a study [3] carried out by Minerva S.A. and Asteriadis S.A. in partnership with the University of Athens, which was published in the *Journal of AOAC International*, researchers validated and compared the OxiTester method for the determination of oil polyphenol content/stability index with the official method used to evaluate the stability of oil, that is the Rancimat method.

The OxiTester method

OxiTester enables to determine, within a few minutes and with a high degree of accuracy, the amount of acidity, peroxides, polyphenols/stability index and K270 value on oil.

The system comprises a spectrophotometric analyzer, kits with disposable pre-filled reagent vials prepared by the research laboratories of CDR and pre-calibrated pipettes designed to enable operators to collect exact amounts of sample.

With the OxiTester method, the reducing action of polyphenols, tocopherols and other antioxidants contained in oil is identified using a specific colorimetric reagent. In other words, the natural action performed by polyphenols against free radicals is simulated in a tube and oil resistance to rancidity is thus quantified. The reagent that contains free radicals highlights the reducing action of antioxidants through discoloring, which is measured by OxiTester and automatically correlated to the total amount of polyphenols. **The test can be performed in approximately 6 minutes.**

OxiTester was conceived, devised and produced by **CDR s.r.l.**, an engineering company based in Florence Italy active in several fields, such as telematics (automatic toll collection systems for motorways and parking places), medical diagnostics (hematology and hemostasis systems), and food diagnostics (systems for the prompt analysis of food).

The study

The study, published in the **Journal of AOAC International**, was carried out by Vassilis N. Kamvissis (Minerva S.A. Edible Oils Enterprises, Analytical Department), Emmanouil G. Barbounis (N. Asteriadis



S.A., Application Department), Nikolaos C. Megoulas and Michel A. Koupparis (University of Athens, Laboratory of Analytical Chemistry, Department of Chemistry).

The purpose of the study was to compare the OxiTester and Rancimat methods in relation to their ability to evaluate antioxidant properties of olive oil.

The study was performed on 65 samples of oil in order to determine oxidative stability, acidity, organoleptic characteristics, peroxide content, UV test and percentage of fatty acids with the aim of confirming the validity of the method for oils with remarkably different characteristics.

Results

The correlation coefficient between the two methods is above 0.88 for all types of virgin and extra virgin olive oils. Therefore, the OxiTester method for the determination of polyphenols/stability index appears to offer a quick and reliable approach for the evaluation of olive oil stability index, both for oils with normal and very low acidity, in addition to showing a good correlation with the Rancimat method. Unlike the Rancimat method, OxiTester is however also able to determine a reduction of the antioxidant properties in virgin olive oils with defective organoleptic properties. In fact, the OxiTester method determines oil antioxidant capacity via measuring polyphenol content, in non altered environmental conditions, using the free radicals present in the reagent. The system basically simulates, in a tube, the natural oxidation process that oil is prone to, while the Rancimat method foresees that oil is oxidized in a forced way.

The study also shows that, unlike the Rancimat method, the OxiTester method is able to provide information on the content of linoleic acid, which is critical for the determination of the level of oil degradation.

Conclusions

The OxiTester method for the determination of polyphenols/stability index offers a valid alternative to the Rancimat method. In fact, the correlation between the two methods appears to be good for a wide number of virgin and extra virgin olive oil samples.

Another innovative feature of this method derives from its ability to highlight the organoleptic qualities of oil due to the fact that the test shows a good correlation with the total amount of polyphenols.

As compared to the Rancimat method, the OxiTester can be performed in a shorter time, that is in approximately 6 minutes vs. the 10 - 12 hours of the Rancimat method. A further advantage of the OxiTester method lies in the fact that it does not require the instrumentation to be flushed.

Bibliography

[1] Official Methods of Analysis of AOCS, Cd 12b-92, "Oil Stability Index"

[2] Velasco, J., & Dobarganes, C. (2002) Eur. J. Lipid Sci. Technol. 104, 661–676

[3] "A novel photometric method for evaluation of oxidative stability of virgin olive oils". [VN Kamvissis. Minerva S.A. Edible Oils Enterprises, Analytical Laboratory Department. EG Barbounis. N. Asteriadis S.A., Application Department. NC Megoulas, MA Koupparis. University of Athens, Laboratory of Analytical Chemistry. Journal of AOAC International Vol. 91, No 4,2008]

The OxiTester system

- Enables to determine oil acidity level, peroxide and polyphenol content/stability index and K270 in few minutes and with extreme accuracy
- Does not require specialized personnel
- Maintenance cost-free
- Testing method is simple, thus minimizing waste
- Reagents come in disposable pre-filled vials
- Does not require calibration
- High sensitivity and excellent resolution, along with accurate and repeatable measurements
- Compliant with reference standards
- Represents a valid alternative to the Rancimat method for the determination of oil oxidative stability: it



measures oil stability index in 6 minutes, against 10-12 hours required by the Rancimat method

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