INTERNATIONAL
OLIVE
COUNCIL

COI/T.28/Doc. No 1/Rev. 7
June 2023

ENGLISH
Original: ENGLISH

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GUIDELINES FOR THE ACCOMPLISHMENT OF REQUIREMENTS OF STANDARD ISO 17025 OF SENSORY TESTING LABORATORIES WITH PARTICULAR REFERENCE TO VIRGIN OLIVE OIL

Introduction

For the accreditation of sensory testing laboratories, all the requirements of ISO/IEC 17025:2017 must be met and verified by the competent accreditation body. However, because implementing the standard in sensory tasting laboratories presents certain difficulties, the IOC has issued this additional guide which deals with the correct organisational management of a sensory testing laboratory, as interpreted for the purposes of standard ISO/IEC 17025:2017.

Scope and field of application

The guidelines outline the steps for complying with the requirements stipulated in ISO/IEC 17025:2017 for the accreditation of sensory testing laboratories, with particular reference to virgin olive oil, under the International Testing Laboratory Accreditation scheme.

The scope of this guide is to provide a source of recommendations, guidance and suggestions for panel leaders and laboratories interested in obtaining accreditation, as well as a source of guidance and uniformity for inspectors responsible for auditing systems for the sensory analysis of virgin olive oil.

This guideline document is not a mandatory list of requirements for the accreditation of a panel under ISO 17025:2017.

Normative references

ISO/IEC 17025:2017. General requirements for the competence of testing and calibration laboratories
ISO 9001:2015. Quality management systems – Requirements
ISO 13299:2016: General guidance for establishing a sensory profile
EA-4/09 G:2017. Accreditation for Sensory Testing Laboratories
COI/T.20/Doc. No 4. General basic vocabulary
ISO 16657:2006. Sensory analysis Apparatus Olive oil tasting glass (COI/T.20/Doc. No 5).
COI/T.20/Doc. No 6. Guide for the installation of a test room
COI/T.20/Doc. No 14. Guide for the selection, training and monitoring of skilled virgin olive oil tasters
COI/T.20/Doc. No 15. Method for the organoleptic assessment of virgin olive oil
COI/T.20/Doc. No 22. Method for the organoleptic assessment of extra virgin olive oil applying to use a designation of origin
COI/T.20/Doc. No 17. Internal quality control guidelines for sensory laboratories
ISO 5555:2001. Animal and vegetable fats and oils – Sampling

Scope of accreditation

Approved accreditation bodies only accredit objective sensory tests that are suitably documented and validated. Laboratories should prove that tests have been performed under control by demonstrating that they obtain results within defined limits. In so far as possible, they should also demonstrate that they obtain equivalent results to those obtained by other accredited laboratories.

Accredited sensory testing laboratories must have adequate documentation demonstrating the repeatability and reproducibility of testing within a specific laboratory and between a considerable number of laboratories, otherwise known as an interlaboratory test.

Laboratories undertaking the sensory analysis of virgin olive oils should prove to accreditation inspectors that when performing such analysis, they comply with the IOC reference standards for the testing methodology.

Review of requirements

General

The main factors determining whether the activities of a sensory testing laboratory are performed correctly and reliably are:

- Human factors;
- Environmental and workstation conditions;
- Equipment;
- Traceability of measurements;
- Testing, calibration and validation methods;
- Handling of test items;
- Control of technical records;
- Ensuring the validity of results.

The laboratory should take the above factors into consideration when developing testing methods and related procedures and when training or qualifying technical personnel and sensory analysis assessors of virgin olive oils.

Structural requirements (5 ISO//IEC 17025:2017)

The sensory testing laboratory shall: be a legal entity or be defined as part of a legal entity; define its organisation and management system structure; and have its procedures documented to the extent necessary to assure the consistent application of its activities and thus validity of its results.

The implemented management system must guarantee the identification of deviations and the application of measures to prevent or minimise such deviations, ensuring the required validity of the laboratory's activities.

Personnel (6.2 ISO/IEC 17025:2017)

The laboratory manager should ensure that every individual involved in testing is competent and aware of their roles.

For laboratories undertaking the sensory analysis of virgin olive oils, personnel include the panel leader, the deputy panel leader and, optionally, panel technicians who assist the panel leader in performing sensory tests. The sensory evaluations of virgin olive oils are performed by the sensory assessors of virgin olive oils ("tasters") who have the analytical tools to perform the test. Usually, they are not considered as staff because their primary role is not related to the management of sensory laboratory. Tasters are either recruited among the members of the laboratory, from the organisation to which it belongs to or from external members, and they constitute a true measuring instrument. Sensory laboratories should ensure that tasters operate under the principles of voluntariness, impartiality and the confidentiality of all private information.

The referenced standard COI/T.20/Doc. No 14 specifies the training required of the panel leader and of the sensory assessors of virgin olive oil. It also lays down the methodology for determining the detection threshold for characteristic attributes of the panel, for selecting tasters by the intensity rating method and techniques for monitoring panel proficiency.

A) Panel leader

Sensory analysis must be carried out under the supervision of an appropriately qualified and experienced panel leader. Management should assign the panel leader a post on the organisation chart. They should provide the necessary means and sufficient time for the panel leader to carry out their tasks and should give adequate recognition of the work carried out.

Paragraph 8.1 of document COI/T.20/Doc. No 15 "method for the organoleptic assessment of virgin olive oil" describes the duties of panel leaders in detail, and paragraph 7.2 of document COI/T20/Doc. No 14 outlines the knowledge and experience required for panel leaders.

B) Assessors (tasters)

A sensory analysis panel is a measurement tool and the results of the analyses performed depend on the members of the panel. Since the tasters of a panel are the measuring instruments in sensory analysis, strict requirements in terms of qualification are demanded for the taster to be a member of a panel and give reliable results. These requirements are specified in paragraph 7.1 of document COI/T20/Doc. No 14.

The laboratory should document the screening and training programme to make sure that all sensory assessors are properly trained for their role.

C) Additional training

The laboratory should have procedures and criteria in place for additional training of sensory assessors who have not performed a test for some time or whose results do not lie inside acceptable limits. Paragraph 6 of document COI/T20/Doc. No 14 notes the cases in which a taster must be retrained.

Facilities and environmental conditions (6.3 ISO/IEC 17025:2017)

6.3.1. The laboratory should have all the necessary equipment to ensure the optimal performance of the sensory tests. Laboratory ware should facilitate the performance of the tests.

Tasting glasses and the device for heating glasses to the optimal temperature are key for tasting virgin olive oils. The technical details of the tasting glass and heating device are given in standard COI/T.20/Doc. No 5 (ISO16657:2006).

The panel leader should ensure that the environmental conditions are adequate so that results are not rendered invalid or lower in quality.

6.3.2. The panel leader should monitor, control and record the environmental conditions, which should comply with the specified conditions. The recommended room temperature is specified

in the reference standard for the installation of a laboratory undertaking the sensory analysis of virgin olive oils (COI/T.20/Doc. No 6), to ensure the *comfort* of tasters when performing the analyses.

Special attention should be paid when sampling virgin olive oil. Suitable facilities should be in place for storing the product in temperature-controlled conditions by means of systems which can be checked and recorded.

6.3.3. The tests should be carried out in an area dedicated specifically for this purpose. In general, the premises used for carrying out sensory tests should be quiet and free from distractions. They should have individual booths to keep visual contact to a minimum, odour- free surfaces and adequate ventilation and lighting; the walls should be neutral in colour. A separate area should be set aside for preparing the samples (COI/T.20/Doc. No 6).

6.3.4. If the sample preparation area is not near the testing area, care should be taken when transporting samples. Access to the sample preparation area by the panellists should be controlled to prevent visual cues from influencing the analysis.

6.3.5. The laboratory manager and technicians should be aware of the importance of keeping the test and sample preparation areas clean and tidy.

Equipment (6.4 ISO/IEC 17025:2017)

The laboratory should have all the equipment required for sampling, storing and performing the sensory assessment of olive oils.

The laboratory should carry out regular maintenance and checks to ensure the equipment complies with the technical specifications. Calibrations and checks are necessary when the equipment may have a significant influence on the result of the test.

Equipment not used directly in the analysis or tests, such as washers or water purifiers, should undergo a suitable maintenance and cleaning programme. The laboratory should keep a record of maintenance work.

Equipment should be labelled. Each piece of equipment should be identified, except for tasting glasses and lids.

Regular calibrations and any maintenance should be recorded for each piece of identified equipment. Recording should include:

- Identification
- Name of manufacturer
- Conformity checks
- Location in laboratory
- Manufacturer’s instructions
- Calibration dates and certificates
- Maintenance plan
- Evident nonconformities (non-compliant equipment should be taken out of use).

The equipment required for the sensory assessment of virgin olive oils comprises:

- Glass for virgin olive oils tasting (COI/T.20/Doc. No 5 – ISO 16657:2006)
- Thermostat-controlled heating device (COI/T.20/Doc. No 5)
- Sensory testing laboratory (COI/T.20/Doc. No 6).

The performance of the heating devices will depend on a series of variables. If they are critical, it may be necessary to establish heating profiles and give clear instructions on how to use the devices on the basis of the profiles.

The temperature of the oil during the test should be checked to prove that all the assessors have tasted the oil at the same temperature (28 ± 2 ºC).

Metrological traceability (6.5 ISO/IEC 17025:2017)

The laboratory should use appropriate reference materials to train sensory assessors, to supervise the laboratory results and to validate and compare methods.

These materials will be certified reference materials (CRM), if they are available to the laboratory. If not, samples from interlaboratory tests conducted by the IOC and other accredited suppliers (according to ISO 17043) can be used. Quality control can be performed with these samples according to the rules found in the document COI/T.20/Doc. No 17. When this is not possible, the laboratory should prepare enough internal material and assign the reference value using the analysis of at least three accredited panels. The criteria for assigning reference values of the main defect and/or fruity attribute should be defined beforehand.

The range of the samples shall be varied in order to cover different classes, intensities and attributes of virgin olive oil, throughout a crop year.

The laboratory must define the "use by" date of the reference material if the supplier has not done so (i.e. samples used for proficiency testing).

Reference materials and chemical standards should be clearly labelled so that they can be readily identified. Information should be available on the period of validity, the storage conditions, the applicability and the restrictions on their use. Reference materials and standards should be handled in such a way as to keep them from all contamination.

Selection, verification and validation of methods (7.2 ISO/IEC 17025:2017)

The procedures complementing the sensory assessment method should be short, concise and effective. The laboratory should document the method in the required amount of detail to ensure it is applied correctly.

The procedure for sensory analysis should include:

a) panel composition
b) training requirements of sensory assessors
c) environmental conditions and special facilities
d) sample preparation and presentation
e) procedure for the execution of the test
f) assessor supervision and monitoring
g) methods for statistical analysis of the results.

The sensory testing method used entails robust techniques, also called distribution-free techniques, which are not sensitive to outliers.

Calculation of the median and control based on the CVr% (non-linear value inversely proportional to the intensity of the attribute) make it possible to overcome these constraints.

The standard referenced COI/T.20/Doc. No 15 sets out the general methodology for the sensory assessment procedure and specifies the statistical methodology. Standard COI/T.20/Doc. No 14 covers the selection, training and monitoring of panel assessors undertaking the sensory analysis of virgin olive oil.

Data are recorded and checked using a spreadsheet so that statistical methods can be applied for the robustness of the results. The data are monitored by the panel leader: they may decide to repeat the test or to approve and sign it, thereby authorising and releasing the test report to the laboratory management.

Validation of methods: The method for the determination of the commercial category of virgin olive oils according to their sensory profile has been validated by a two-year IOC proficiency test involving an international group of official, highly qualified panels in the sensory assessment of virgin olive oils and an accompanying in-depth statistical validation.

Verification of methods: Each laboratory should verify the method by determining the repeatability and reproducibility at least. The verification should be reviewed periodically.

Handling of test items (7.4 ISO /IEC 17025:2017)

The laboratory should have suitable procedures to ensure that samples do not spoil or get damaged and that they can be traced to the laboratory.

The sampler is responsible for transporting the sample to the laboratory, which should be done under the appropriate conditions (ISO 5555:2001). The laboratory is responsible for handling the sample inside the laboratory and should follow the rules in the above-mentioned standard.

The storage room where products are kept prior to analysis should be kept at controlled temperatures, and these records must be available. The product should be traceable throughout the test, i.e. permanent records should be kept of the movement of the sample inside the laboratory.

For samples that are not kept at ambient temperature, the laboratory should have facilities for bringing the sample to the correct, homogeneous temperature and for maintaining that temperature for as long as required. The laboratory should keep records proving that this requirement is met.

When marking sample containers, strong-smelling felt-tip pens should be avoided.

Technical Records (7.5 ISO /IEC 17025:2017)

Records should be regularly checked, updated and monitored. The records of each test should contain the necessary information to be able to repeat it in conditions as close as possible to the original conditions. The following information is of particular importance in sensory analysis:

(a) instructions and questionnaires issued to sensory assessors
(b) test results sheets or references to computer files
(d) identification codes of samples and (sub)samples
(e) method of sample preparation and the equipment used
(f) identity of the personnel who prepare the samples
(g) the order samples are presented to each assessor and details of the presentation
(h) identity of the assessors and suitable level of qualification for the method used
(i) identity of the panel leader
(j) definition of the method of data collection
(k) definition of the method applied for statistical analysis.

Evaluation of measurement uncertainty (7.6 ISO /IEC 17025:2017)

Sensory analysis is a scientific discipline that applies statistical analysis. It does not, however, permit strict, metrological, statistically valid calculation of the uncertainty of measurement.

In some cases, when a numerical result is expressed, the estimation of the uncertainty can be based on repeatability and reproducibility data exclusively.

Ensuring the validity of results (7.7 ISO/IEC 17025:2017)

A) Internal quality control

Although the results of a sensory test are checked statistically (CVr ≤20% for the median of the predominant defect and fruity attribute), a sensory laboratory should have adequate quality control procedures in place to check the validity of their results.

Irrespective of the method employed for quality control, the same method should be used at each tasting session. It should be documented, complete with clearly defined acceptance and rejection criteria. The corresponding evidence should exist and should concur with the documented information.

The level and type of quality control will depend on the nature and frequency of the analysis, and the difficulty and reliability of the tests. For a guide, the frequency of sample checks should be at least 9% of all the samples analysed.

The internal quality control procedures should be applied to both the panel and each individual taster.

The laboratory should define quality control measures in its quality system documents.

The techniques used for internal quality control in sensory laboratories of virgin olive oil are explained in the document COI/T.20/Doc. No 17. This includes a broad variety of procedures, but the application of all the procedures is not compulsory. It is up to the panel leader to select procedures that ensure the competence of tasters and the panel and prove that the results are reliable.

B) Proficiency testing (7.7.2. ISO/IEC 17025:2017)

Laboratories are required by ISO /IEC 17025:2017 to participate in proficiency tests periodically (recommended at least once a year). In some cases, such as for official control laboratories, participation may be compulsory.

Laboratories should apply external quality control not only to detect possible systematic errors but also to check the validity of the entire quality system.

They should evaluate the quality of the results obtained in these tests and issue the corresponding report according to their own criteria, as well as the evaluation performed by the organiser of the proficiency test.

At least three simultaneous criteria are used for this kind of evaluation:

- *Laboratories should correctly classify the sample, taking into account the uncertainty when the samples are on the limits between two categories.*
- *Laboratories should obtain a satisfactory z-score (± 2.0) for the classifying attributes. The action limits for the z-score is ± 3.0.*
- *The intensity of the classifying attributes should keep within previously defined limits. This assessment is performed using the normalised error (En), defined as follows:*

$$\mathrm{En} = \frac{\left|Me_{lab} - Me_{pt}\right|}{\sqrt{{U_{lab}}^2 + {U_{pt}}^2}} \quad \leq 1.0$$

where:

- Me_{lab} is the value of the median of the attribute (positive or negative) obtained by the laboratory.
- Me_{pt} is the value of the median assigned to the proficiency test for the same attribute.
- U_{lab} is (c * u_{lab}), with c (coverage factor)=1.96 for a 95% confidence interval, and u_{lab} is

the experimental s* value obtained by the laboratory.

• U_{pt} is (c * u_{pt}), with c=1.96 for a 95% confidence interval, and u_{pt} being the target s* value of the proficiency testing.

The normalised error must be equal to or lower than 1.0.

For extra virgin olive oil, the z-score and the En value of the fruity attribute must be calculated. For the other categories, the calculation will be performed for the median of the predominant defect and fruitiness, if the latter is present.

The causes of any nonconforming results should be investigated and corrective measures should be established and evaluated after implementation in order to demonstrate that the causes of the poor results have been remedied. Records of such activities should be kept.

Reporting of results (7.8 ISO/IEC 17025:2017)

Results should be presented in a test report comprising the following sections:

- Title (test report)
- Name and address of the laboratory and place where the tests were carried out
- Clear and unequivocal identification of the test report on each page
- Name and address of the customer
- Clear identification of the data provided by the client; the laboratory is not responsible for that information
- Clear specification of the method used
- Description, status and identification of the test samples
- Date of receipt of the samples
- Date of the analysis
- Date of emission of the report
- Reference to sampling plans, if relevant
- Test results – precise classification of the sample or identification of the sensory profile determined
- Name, post and signature of the person authorising the report.

If opinions or interpretations are given in the report, they should be clearly identified as such, and based on the results of the test. The laboratory shall document the process for issuing opinions and interpretations in the appropriate procedure, and those performing this activity must be identified and authorised by management based on their training and experience.

When changing or correcting a published report, the changes shall be clearly identified and the reason for such changes must be justified. An amendment can only be given by issuing another document that clearly states that it is a correction of a previous analysis report, which must be referenced.

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