LABAQUA

ESTUDY OF ODOUR REMOVAL EFFICIENCY IN THE FAST CHEF ELITE + FRYER

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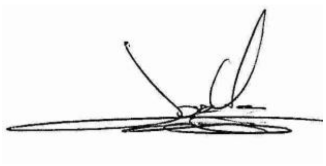	
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1. INTRODUCTION

QualityFry is interested in assessing the odour removal efficiency of the deodorization system fitted to the Fast Chef Elite+ Fryer. To carry out the assessment, a sampling campaign was programmed in which the effectiveness of odours removal was studied during 3 different processes of frying, with 2 different products (chips and squid) and using 2 different types of oil (olive oil and sunflower oil).

This report includes the results of the campaign of sampling and analysis of samples of odours, held on October 4, 2017 at the facilities of Labaqua.

The relationship which exists between the odours emitted by a particular installation and the way these affect the local population is very complicated to determine, because participating within this relationship are not only components such as physical objects and chemical compounds, which are easily measured, but also many others which are subjective in character and so much more difficult to evaluate. For example, the nuisance, and therefore the complaints for bad smells that come from the population, does not only depend on the concentration and duration of the exposure to the smells, but also depends on the type of smell perceived (whether it is more or less agreeable), the olfactory characteristics of each person, and the environment in which they find themselves (agricultural, livestock, industrial, urban) and the particular attitudes of each individual towards the installation responsible for the odours, previous history, etc. The relationship between the odour in the environment and the nuisance to the population is, as we have seen, difficult to determine unequivocally. For these reasons, the evaluation of smell nuisance and the search for solutions has been using **olfactometry**, a methodology with wide acceptance throughout Europe and the rest of the world.

Olfactometry is based on establishing a relationship between possible origins or sources of odours, and their nuisance in the surrounding areas. The methodology used in this study is based on the European standard UNE-EN 13725 "Quantification of odour concentration by dynamic olfactometry".

The three aspects that determine the problems caused by emission points are:

- Generation: concentration of odour produced by a source, in odour units per cubic meter (uo_E/m^3).
- Emission: which is linked to air flow emitted by the focus, and is measured in odour units per unit time.
- Immission: concentration of odor in the environment (uo_E/m^3), which is a function of, among other factors, the odour emission of each installation, the normal meteorological conditions of the area, and the orthography of the area.

The possible nuisance caused in the population is related to the odour concentration in the environment, and the frequency with which certain odour limits are exceeded. The results of immission simulation models are represented by lines that determine the areas of the environment in which nuisance is caused by bad odours, and the extent of these problems.

Annex 1 of this report describes in greater detail the methodology used in the execution of this study.

2. BACKGROUND AND OBJECTIVES OF THE STUDY

The objective of the study is to assess the deodorization system fitted in the Fast Chef Elite+ Fryer. With this aim in view, the following activities have been carried out:

- Simultaneous sampling of odours, at the inlet and outlet of the deodorization system for each frying process, posterior analysis of the samples in the laboratory and quantification in terms of odour concentration (OU_E/m^3), in accordance with regulation UNE-EN 13725 "Determination of odour concentration by dynamic olfactometry".
- Assessment of the odour removal efficiency of deodorization system.

3. DESCRIPTION OF THE ODOUR ABBATTEMENT SYSTEM FAST CHEF ELITE + FRYER

The system is described below in accordance with the information provided by QualityFry.

Figure 3.1. an external image of the equipment is shown, while Figure 3.2. shows the inside of the equipment.

Figure 3.1. Exterior view of the fryer “Fast Chef Elite +”

Figure 3.2. Inside view of the fryer.

Figure 3.3. is an inside view of the equipment, the deodorization system consists in an extractor and condensator of vapors, in addition to a particulate filter and an activated carbon filter, located in the back of the frying tank.

At the beginning of the frying process the product enters the fryer automatically, which is fully automated and watertight, when the frying program is selected, to finally expel the product depending on the selected program. The trapdoor that allows the product to enter closes and the vapors are drawn through the condensation system by a pipe located near the products inlet, the gases are then passed through the particulate filter and finally through the carbon filter, which deodorizes them before being expelled to the environment.

On the top of the unit there are 2 ventilators. The ventilator situated on the right expels all the vapours after passing through different cleansing systems, so they are forced out. The ventilator situated on the left allows the condenser, which consists of a steel coil to cool down. The air that pushes this ventilator goes through the coil, cooling the gases that come out of the deep fryer, thus achieving that a large part of the moisture condenses, and drops of grease are also removed. After that, the gases pass from the condenser to the active carbon filter where they are treated and a large amount of the volatile organic compounds are removed.

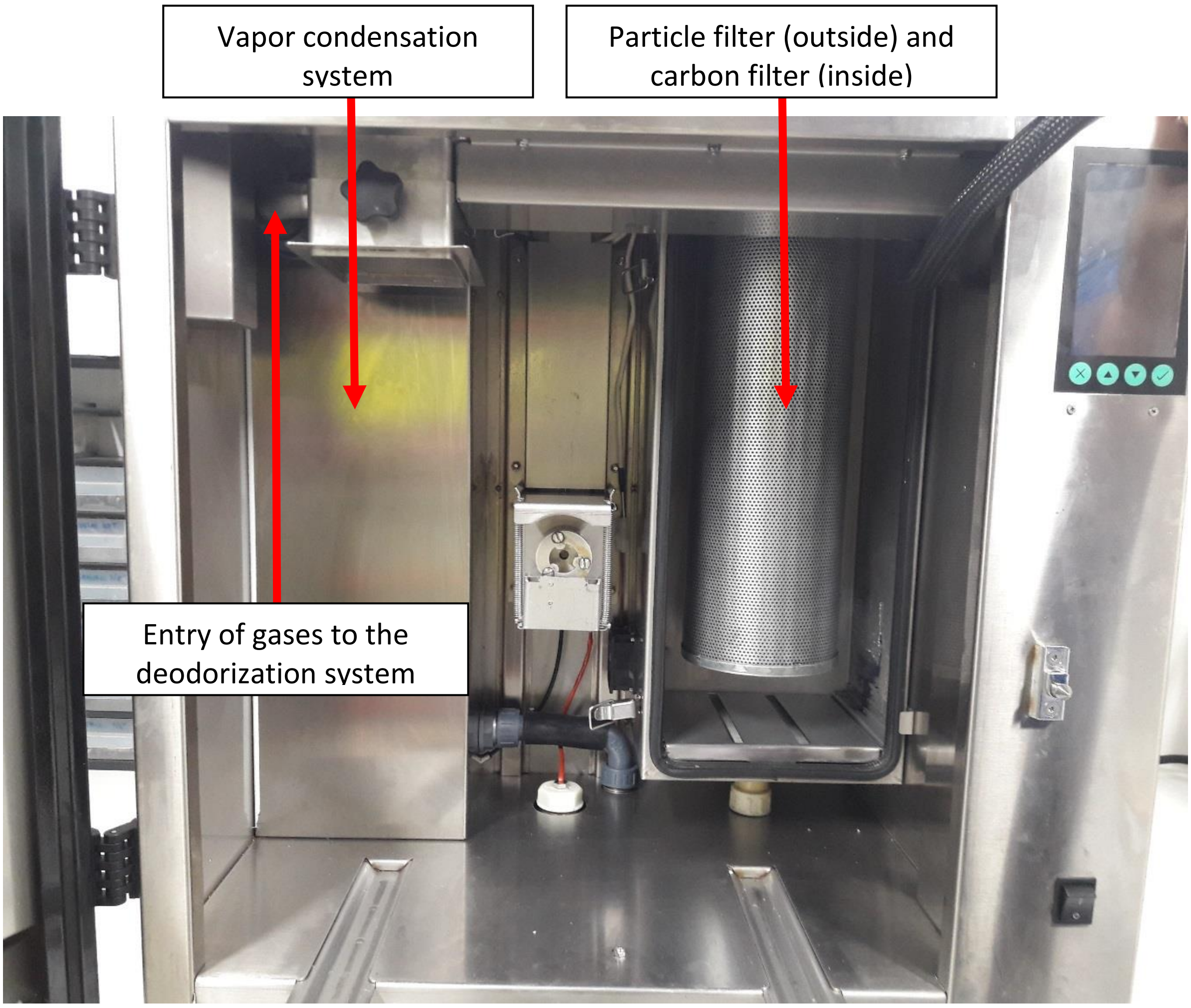


Figure 3.3. Inside detail view of the fryer.

4. SAMPLING CAMPAIGN

The sampling campaign was carried out on October 4, 2017 at the facilities of Labaqua in Alicante. A QualityFry technician moved with the Fast Chef Elite+ fryer to the Labaqua facility, and set up the fryer to carry out the sampling. After carry out the campaign, Labaqua expert technicians determined the sampling points for the assessment of the deodorization effectiveness of the system. The sampling points are presented below.

- Inlet to the deodorization system: inlet tube for gases to the settler.
- Outlet deodorization system: Filter box extraction fan.

Next the first frying process, in which frozen chips were used as the raw material (product 1), was carried out. Sunflower oil was used for this process. Product 1 was placed into the mouth of the fryer, and once the frying process started, one sample was taken from the inlet of the deodorizing system, and another from the outlet of the system, at the same time.

Two replicas were made both at the inlet and the outlet of the fryer with the aim of obtaining a more consistent result.

Sample name	Method [a]	Sampling procedure	Date	Time of sample
Inlet system – Product 1 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	13:34h
Outlet system – Product 1 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	13:34h
Inlet system – Product 1 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:03h
Outlet system – Product 1 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:03h

Afterwards, the second frying process was carried out, in which frozen squid (product 2) was used as the raw material. Sunflower oil was used for this process. Product 2 was placed into the mouth of the deep fryer and once the frying process started, one sample was taken from the inlet of the deodorizing system, and another from the outlet, at the same time.

In the same way, two replicas were made, both at the inlet and the outlet of the fryer with the aim of obtaining a more consistent result.

Sample name	Method [a]	Sampling procedure	Date	Time of sample
	S	UNE-EN 13725	04-10-17	14:32h

Inlet system – Product 2 (replica 1)		A-OLF-PE-003		
Outlet system – Product 2 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:32h
Inlet system – Product 2 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	15:02h
Outlet system – Product 2 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	15:02h

Finally, for the last frying process, product 2 was used as the raw material, but using olive oil, with the aim of determining the difference, with regard to producing and removing smells when using vegetable oil. In this case, only one replica was made, both at the inlet and at the outlet of the deodorizing system.

Sample name	Method [a]	Sampling procedure	Date	Time of sample
Inlet system – Product 2 – Olive oil (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	16:08h
Outlet system – Product 2 – Olive oil (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	16:08h

[a] Método de toma de muestras empleado: S: Sonda para fuentes puntuales

To avoid condensation phenomena, it was necessary to predilute the samples with nitrogen. The applied predilution ratios are show below.

Sample name	Dilution Ratio
Outlet system – Product 1 (replica 1)	18,1
Outlet system – Product 1 (replica 2)	18,1
Outlet system – Product 2 (replica 1)	18,1
Outlet system – Product 2 (replica 2)	18,1
Inlet system – Product 2 – Olive oil (replica 1)	18,1

The sampling campaign was carried out by José Vicente Martínez and Rubén Cerdá, technicians of the Olfactometry department of LABAQUA S.A.

5. ODOUR CONCENTRATION RESULTS

The results of the analysis of the samples using dynamic olfactometry according to UNE-EN-13725 are shown in table 5.1 (in Appendix III the results of the analyses of the samples that are guaranteed by ENAC, are shown).

Table 5.1. Results of the analyses by dynamic olfactometry.

Sample code	Sample name	Date and time of arriving of samples		Date and time of start of analysis		Analysis procedure	Odour Conc (uo_E/m^3)
4.131.592	Inlet system – Product 1 (replica 1)	04-10-17	13:45	04-10-17	14:00h	A-OLF-PE-007 UNE-EN 13.725	62.148
4.131.593	Outlet system – Product 1 (replica 1)	04-10-17	13:45	04-10-17	14:00h	A-OLF-PE-007 UNE-EN 13.725	73
4.131.594	Inlet system – Product 1 (replica 2)	04-10-17	14:15h	04-10-17	14:30h	A-OLF-PE-007 UNE-EN 13.725	91.807
4.131.595	Outlet system – Product 1 (replica 2)	04-10-17	14:15h	04-10-17	14:30h	A-OLF-PE-007 UNE-EN 13.725	70
4.131.596	Inlet system – Product 2 (replica 1)	04-10-17	14:45h	04-10-17	14:45h	A-OLF-PE-007 UNE-EN 13.725	303.174
4.131.597	Outlet system – Product 2 (replica 1)	04-10-17	14:45h	04-10-17	14:45h	A-OLF-PE-007 UNE-EN 13.725	96
4.131.598	Inlet system – Product 2 (replica 2)	04-10-17	15:15h	04-10-17	16:00h	A-OLF-PE-007 UNE-EN 13.725	409.293
4.131.599	Outlet system – Product 2 (replica 2)	04-10-17	15:15h	04-10-17	16:00h	A-OLF-PE-007 UNE-EN 13.725	74
4.131.600	Inlet system – Product 2 – Olive oil (replica 1)	04-10-17	16:20	04-10-17	16:30h	A-OLF-PE-007 UNE-EN 13.725	168.593
4.131.601	Outlet system – Product 2 – Olive oil (replica 1)	04-10-17	16:20	04-10-17	16:30h	A-OLF-PE-007 UNE-EN 13.725	45

6. ODOUR REMOVAL EFFICIENCY (%)

Based on the results obtained from the replicas at the inlet and outlet of the deodorizing system for each frying process, the odour removal efficiency of the odour concentration is the following:

Table 6.1. Odour removal Efficiency of the deodorizing system fitted at the Fast Chef Elite+ Fryer made by QualtyFry.

Sampling point			Odour conc. (uo_E/m^3)	Odour removal efficiency (%)	Average Odour removal efficiency (%)
Product 1 Sunflower oil	Replica 1	Inlet	62.148	99,88	**99,90**
		Oulet	73		
	Replica 2	Inlet	91.807	99,92	
		Oulet	70		
Product 2 Sunflower oil	Replica 1	Inlet	303.174	99,97	**99,98**
		Oulet	96		
	Replica 2	Inlet	409.293	99,98	
		Oulet	74		
Producto 2 Olive Oil	Replica 1	Inlet	168.593	99,97	**99,97**
		Oulet	45		

Note 1: Odour removal efficiency of deodorization system fitted in the Fast Chef Elite+ are high, near 100%, regardless of the type of product fried or the type of oil used.

Note 2: The active carbon filtration systems, have an average life according to the inlet load and the absorption capacity of the carbon. How frequently the active carbon should be replaced is a question that has not been assessed in this study, and therefore should be studied, to obtain satisfactory deodorizing effectiveness after using for some time.

7. CONCLUSIONS

The mean odour abatement efficiency for the measurements carried out using product 1 (chips) is 99,90%, and the measurements carried out using product 2 (squid) is 99,98% in the case using sunflower oil and 99,97% in the case studied using olive oil.

By analysing the results, it should be pointed out that the odour abatement efficiency by the deodorisation system is very high.

ANNEX I
OLFACTOMETRY: DESCRIPTION AND METODOLOGY

DESCRIPTION OF OLFACTOMETRY

Bad smells generated by different sources represent an environmental problem and are the origin of numerous complaints from the population. Even when the smelly substances emitted do not have a damaging effect on health, the inconvenience caused by bad smells can represent a serious problem that needs to be assessed, its causes investigated and solved, to respond to society’s complaints.

However, when facing the problems caused by bad smells, a series of problems arise that can complicate the objective assessment of such inconveniences. Firstly, there is the fact that perception of smell is different in each person, both quantitatively (olfactory capacity), and qualitatively (perception subjectivity).

On the other hand, smells can be caused by substances or compounds that are found in a very low proportion in a mixture of gases, so it can be difficult and costly to identify them, and generally, there are no set rules that make it possible to relate the concentration of a smelly material in a mixture with the its resulting smell.

In spite of these difficulties, different countries such as United States, Holland, United Kingdom, Germany, France and Denmark have proceeded to or are proceeding to make regulations, to define methodologies that allow quantizing the emission of smells in an objective way, and also list such emissions by the degree of inconvenience they cause to the environment. The majority of these countries have opted for applying olfactometrical methods.

Interest in dynamic olfactometry on a European level led to creating a European regulation UNE-EN 13725 "Air quality - Determination of concentration of smells using dynamic olfactometry" based on the Dutch regulation NVN 2820 and its validation, by means of carrying out intercomparison exercises among different European countries.

In short, olfactometry is a tecnique for sample taking and analysis of smells that, together with the development of dispersion modeling systems, make it possible to assess the inconveniences produced by bad smells and determine their origin. Olfactometrical studies constitute a very useful tool for controlling and reducing bad smells emitted by different types of sources. Not only do these studies enable determining the degree of inconvenience created in the environment, but also identifying the really important sources of smell and adopting efficient removal systems.

A study on smells is based on establishing a relation between the possible origins of the smells and their inconvenience for the environment, by means of monitoring the smelly compounds during their diffusion around the generating sources. On this subject, it is necessary to distinguish three different aspects that determine the problems caused by the emitting sources:

Generation: Generally, as a result of certain industrial processes, whether because of the process itself or because of treating the effluents that come from the process, a series of smells originate. These smells vary depending on the processes themselves and their conditions. In olfactometry, higher or lower intensity of smell is measured by the concentration of smell produced by that source, in units of smell per cubic metre (uo_E/m^3).

Emission: Smells generated with a certain concentration are emitted to the exterior by each of the emission sources. Generally, emission of smells is linked to the airflow that the source emits; and the way in which these smells are liberated is largely determined by the nature of the source. In the case of an emission coming from a chimney for example, the total emission of smell will depend greatly on the quantity of air/gas that is evacuated to the outside of the industry. In the case of smells generated by water surfaces, the emission will depend on factors such as the degree of turbulence, the water-air contact area, and the amount of air injected in aeration units, etc. The emission is measured as units of smell per unit of time (uoE/h; uoE/year).

Immission: Generated smells cause inconvenience in their environment according to various factors:

- Climatolgical factors: diffusion, wind speed and direction, atmospheric stability, temperature, etc.
- Local factors: degree of wind exposure, presence of masking smells (like car exhaust fumes), etc.
- Location: residential or industrial area; among others.

The inconveniences caused to the population are related to the concentration of smell in the environment, as well as the frequency with which some exceed certain limits. Because of this, the results of the immission models are represented by isochores, for given concentrations and percentiles, which determine the areas of the environment where the problems are generated.

From what is expounded above, one can deduce that there is a difference between the concentration of smell generated (that which is perceived by the staff in each of the plants), and the immission of smell in the environment (that which is perceived by the people who live around the plants).

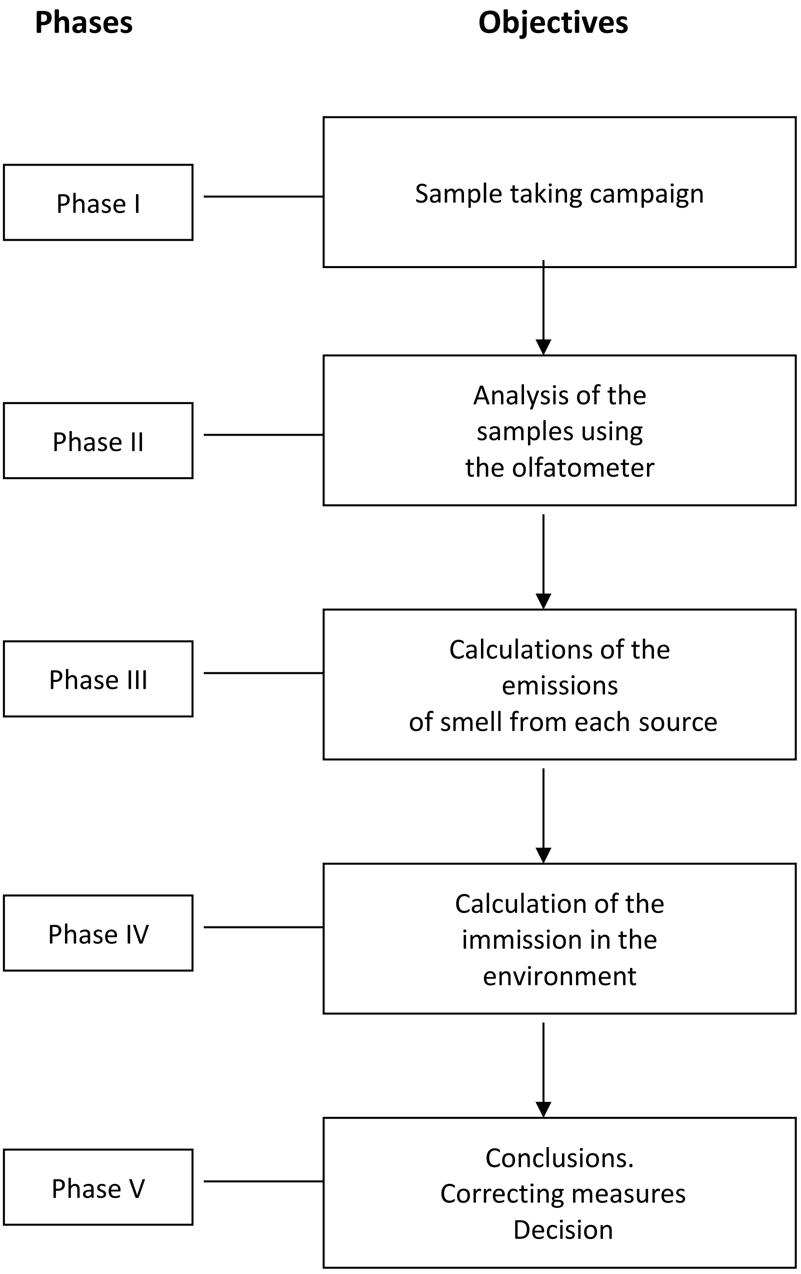
On the other hand, an olfactometrical study enables one to clearly distinguish between concentration of smells and their emission into the atmosphere. On many occasions, sources with heavy concentrations of smell, are always branded a priori as causing the problems, they may have less influence on the environment than other sources of less smell but with larger dimensions and, therefore, are responsible for more pronounced inconveniences in the environment of the installations. In this way, the effects that each unit has on the total emission of the installations can be assessed.

Another big advantage of olfactometry is that it allows one to assess which the smell emission influence area is in the environment, and how each of the individual sources contributes in its progression. In the same way, repercussion of a possible correcting measure can be visualized in the improvement of the leaving situation, thanks to the simulation facility of the different stages that can be found after implanting such a measure.

METHODOLOGY OF THE OLFACTOMETRIC STUDIES

To achieve the objectives described in the previous point, the phases of an olfactometry study are listed as follows (see figure 1):

PHASE I: *Sample taking campaign*
PHASE II: *Analysis of the samples using the olfactometer*
PHASE III: *Calculation of the emissions of smell from each source*
PHASE IV: *Calculation of immission in the environment*
PHASE V: *Conclusions. Correcting measures decision*



The contents of phase II, are described below.

Phase II: Analysis of the samples using dynamic olfatometry

General description of the olfactometer

Analysis is done with the help of an olfactomer (Fig. II.1). This method is based on human beings' real perception of smells, using the human sense of smell, as a smell detector. Generally it is very difficult to quantify smells using analytical methods. The smell of a certain sample of air is the consequence of many factors and a small alteracion in one of the components of the sample can produce unpredictable changes in its smell.

Besides the complexity of establishing a relation between the chemical composition of the sample and its smell, the analytical methods are extremely costly for the objective they pursue.

For these reasons, present day olfactometric methods are based on real perception of the human sense of smell.

An olfactometry laboratory basically consists of these elements:

Olfactometer
Computer
Sample-holding containers
Synthetic compressed air
Accesories

The basic element of the laboratory is the olfactometer, which is a dilution apparatus capable of presenting samples of smells to a panel of 4 "observers" under reproducible conditions. The analyst, basing his work on the origin of the sample and the indications of the field technician who took the sample, establishes a high dilution of the sample, which is placed under the olfactory threshold of the observers. The olfactometer mixes pure air with the sample and gradually offers lesser dilutions of the sample. For each dilution of the sample that is offered to the observer, the olfactometer presents a reference blank IR. The observer must distinguish which of the two offers, corresponds to the sample and which to the reference blank. The olfactometer also randomly offers blanks, interspersing with the series of dilutions that the observer must identify. Analysis of the sample concludes when the four observers have detected two consecutive dilutions offered by the olfactometer.

The olfactometer is controlled by a computer programme designed especially to carry out this function. The samples collected and transported inside isothermal containers are connected to the olfactometer. So that the samples can be diluted for being presented to the observers, the olfactometer is connected to a system that generates odourless compressed air, using an adapted compressor.

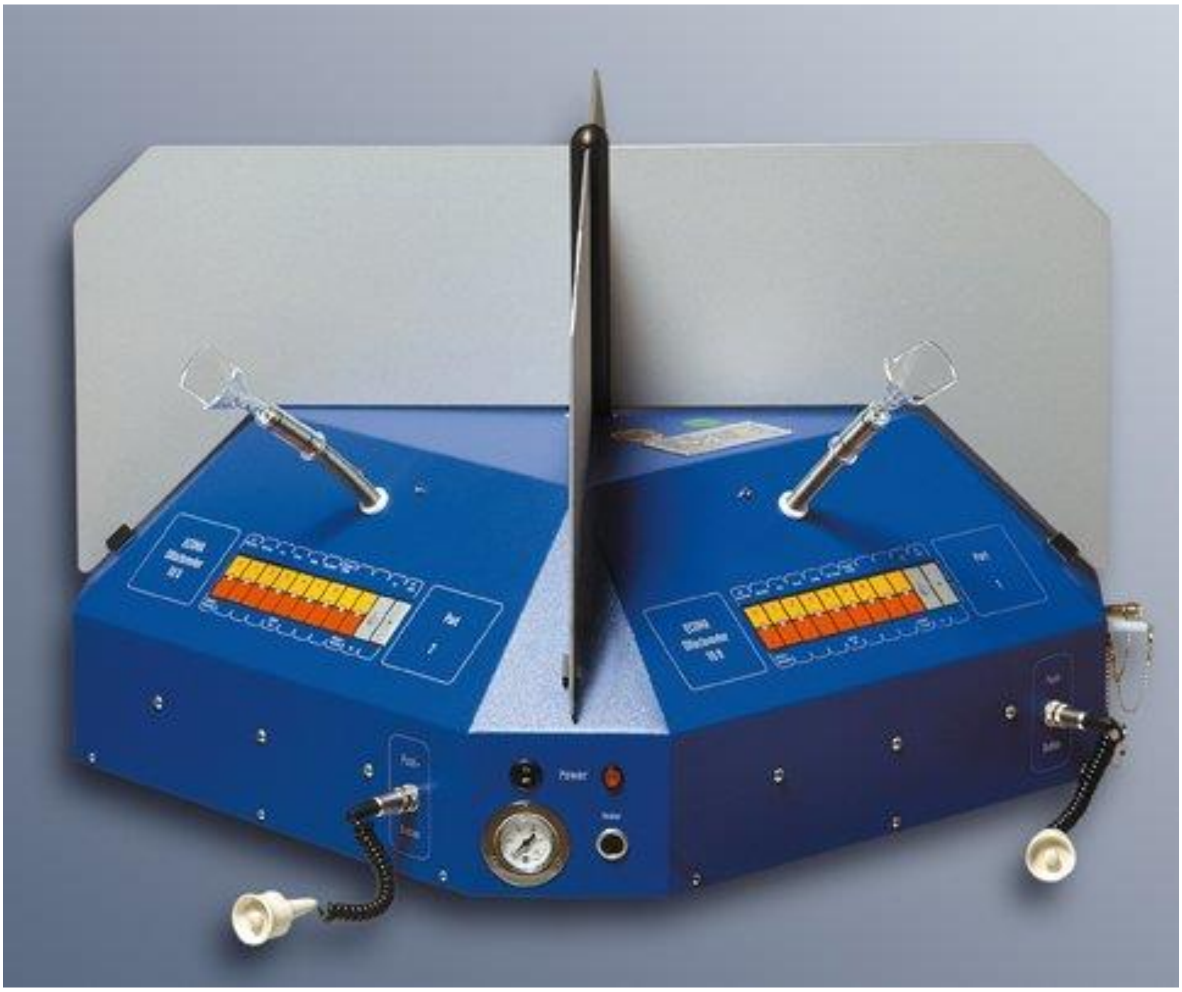


Fig. II.1. Olfactometer Ecoma T08.

Terms and definitions

Below, the methods and procedures that have to be followed to carry out an olfactometric analysis of substances or mixtures of substances are described. Such methods and procedures are based on the Spanish regulation UNE-EN 13725 “Air quality - Determination of concentration of smells using dynamic olfactometry"

At the time of analysing the concentration of smell of a substance or mixture of substances, the first thing to determine is the threshold of its smell. By threshold of smell, we understand the concentration of that substance or mixture of substances in pure air that can be distinguished from a sample of odourless air by half a group of observers (panel). For definition, the threshold of smell of a substance corresponds to a concentration of smell of 1 unit of smell per cubic metre (1 uo_E/m^3).

The unit of smell (ou_E) is defined as the quantity of a gaseous substance or gaseous mixture of substances that, distributed in 1 m^3 of odourless pure air, is distinguished from completely odourless air by half the panel of observers.

Once the threshold of smell of the substance or mixture of substances has been determined, its concentration of smell can be calculated, this is defined as the number of units of smell per cubic meter (ou_E/m^3). The numerical value of the concentration of smell is equal to the number of times the sample of smelly air has to be diluted with odourless air to reach its threshold of smell.

Selecting the panel

When a sample is to be analyzed using the olfactometer, the first thing that has to be done is to form a panel of observers (panelists), which is no more than a group of people who have been selected as qualified individuals to do some smell measuring.

The object of this observer selection is to achieve that the results of the measuring does not depend on the group of observers chosen and that the results obtained are the same if we do the analysis with another different group of observers that also have the selection criteria. The panel of observers has to be made up of at least 4 people and its members must be over the age of 16.

To obtain a panel of observers the selection process described below is used.

Firstly the future members of the panel are instructed about the use of the olfactometer and about how they are to act and behave when a sample analysis is carried out. To do the selecting, a certified reference gas is used (gas pattern). The reference gas in regulation UNE-EN 13725 is n-butanol with concentrations of nitrogen of 60 mmol/mol respectively.

For each of the observer candidates, the individual smell threshold for said candidate is determined at least 10 times, using the reference gas. By individual smell threshold, we mean the concentration of gas that is found in the concentration, in which the observer can distinguish the sample of smelly air from odourless air perfectly, and the concentration which the observer cannot distinguish one from the other.
To determine the individual smell threshold of each candidate, the olfactometer offers him diluted samples of n-butanol, in such a way that the dilution of each offer lessens, or what is the same, increases their concentration. The candidate must choose from the offerings, qualitatively detecting the different concentrations of n-butanol.

The individual smell threshold is determined by finding the geometric average of the following two values:

The dilution in which the result is correct and the candidate indicated it as being so, and the previous dilution to the latter.

Next, 10 calculated individual thresholds, as well as their dispersion determine the geometrical average of the natural logarytms. According to regulation UNE-EN 13725, the candidate for panel member is accepted if he fulfills the following selecting criteria:

- The number of tests carried out must be at least 10.
- The average value of the decimal logarithms of the 10 calculated individual thresholds is found between the values 1,30 and 1,90 (between 20 and 80 ppb of a sample of n-butanol).
- The typical deviation of the results should be < 0,36.

Also, each time a member of the panel carries out a sample analysis, before said analysis, a test with n-butanol is done on him to determine that the panel member is still qualified to carry out the olfactometric analysis (following specifications of the UNE-EN-13725).

On the other hand, the members of the panel are always asked to follow a series of rules so that the results of the measurements will not be distorted. Basically, the general rules are as follows:

- Do not smoke half an hour before the start of the analyses.
- Do not eat or drink (except water) immediately before or during an olfatometrical analysis.
- Do not use cosmetics, perfumes, etc. that may distort your olfactory capability.
- Do not take part in the analyses if you have a cold or similar complaint that may affect the olfactory capability of the panelist.
- Do not communicate with other members of the panel about the development and results of the analysis.
- Be motivated and pay attention, etc. when doing the analyses.

Sample analysis

Analysis of collected samples has to be done during the following 30 hours after their collection, to avoid changes in the smell occurring due to their storing.

Three series of smell measuring/analyses are offered, presenting sample dilutions in descending order, that is to say, first the most diluted sample is offered, progressively increasing the concentration of the sample to be analyzed. The minimal number of panelists that must do the analysis is 4. Each dilution presentation of the sample is always accompanied by a reference blank (reference air), the panelists must indicate if they can smell the diluted samples or not and not mark the reference blank as positive. Randomly interspersing in a presentation series, blanks, samples composed of purified air are offered. The panelists must not identify these offerings as positive samples. A presentation series finishes when the four members of the panel have correctly identified at least the last two offerings. From here the ITE (individual threshold estimate) is calculated. The dilution factor used for diluting the samples is 2. The dilution series must be distributed symmetrically around the expected smell threshold for each sample.

Each panel member is assigned a certain number and must register it before beginning each analysis. For each presentation, the computer software that controls the olfactometer decides, if it begins with the reference blank or the diluted sample.

The deciding time for the panel member is 2.2 seconds. The interval that passes between two presentations for the same panel member must be at least 20 seconds.

Each one of the decisions made by each panel member is registered by computer, in the form of a table, below the number corresponding to the panel member in question.

Calculation of odour concentrations

We must remember that the smell concentration of a certain sample is defined by the number of units of smell per cubic meter (uo_E/m^3). The numerical value of the smell concentration is equal to the number of times that the smelly air sample must be diluted with odourless to reach its smell threshold.

Therefore, the first step to take when calculating the smell concentration is determining the smell threshold of the sample using the results that have been obtained from the sample analysis done by the panel members.

To do this the geometric average of the ITE (individual threshold estimate) is calculated.

This can be done graphically or with the help of tables that contain pairs of values of both functions and the subsequent calculation of the straight line that fit the values obtained.

The computer software that controls the olfactometer while the sample analysis is being done by the panel members, is designed to collect and store the responses that they provide for the different concentrations of the samples that are offered to them. Also, once the sample analysis is concluded, the computer software itself takes care of determining the smell threshold of the sample, based on the stored responses and by applying algorithms.

After obtaining the smell threshold of the sample, the concentration of smell is found by determining the number of dilutions done to it to reach the smell threshold. To do this, the pre-dilutions that were done on taking the sample have to be taken into account and also, those that the olfactometer has done to reach said threshold.

ANNEX II
PICTURES OF THE ODOUR SAMPLING CAMPAIGN CARRIED OUT BY FIELD TEAM

Picture II.1. FAST CHEF Elite+ fryer.

Picture II.2. Sampling at the inlet and outlet of the deodorizing system of the fryer, with probe method.

ANNEX III
RESULTS OF THE SAMPLING CAMPAIGN AND THE ANALYSIS OF THE ODOUR CONCENTRATION BY DYNAMIC OLAFCTOMETRY ACCREDITED BY ENAC

REPORT Nº: 2.447.443
CLIENT: QUALITYFRY
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CITY: MADRID
INSTALACIÓN OBJETO DE ESTUDIO: FAST CHEF ELITE+ FRYER

Table III.1. Sample taking done by LABAQUA.

Sample name	Method [a]	Sampling procedure	Date	Time of sample
Inlet system – Product 1 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	13:34h
Outlet system – Product 1 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	13:34h
Inlet system – Product 1 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:03h
Outlet system – Product 1 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:03h
Inlet system – Product 2 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:32h
Outlet system – Product 2 (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	14:32h
Inlet system – Product 2 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	15:02h
Outlet system – Product 2 (replica 2)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	15:02h
Inlet system – Product 2 – Olive oil (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	16:08h
Outlet system – Product 2 – Olive oil (replica 1)	S	UNE-EN 13725 A-OLF-PE-003	04-10-17	16:08h

Method of sampling used:
- S: Probe for point sources

To avoid condensation phenomena, it was necessary to predilute the samples with nitrogen. The following table shows the applied predilution factors.

Table III.2. Dilution ratios.

Sample name	Dilution Ratio
Outlet system – Product 1 (replica 1)	18,1
Outlet system – Product 1 (replica 2)	18,1
Outlet system – Product 2 (replica 1)	18,1
Outlet system – Product 2 (replica 2)	18,1
Inlet system – Product 2 – Olive oil (replica 1)	18,1

Table III.3. Analysis by dynamic olfactometry.

Sample code	Sample name	Date and time of arriving of samples		Date and time of start of analysis		Analysis procedure	Odour Conc (uo_E/m^3)
4.131.592	Inlet system – Product 1 (replica 1)	04-10-17	13:45	04-10-17	14:00h	A-OLF-PE-007 UNE-EN 13.725	62.148
4.131.593	Outlet system – Product 1 (replica 1)	04-10-17	13:45	04-10-17	14:00h	A-OLF-PE-007 UNE-EN 13.725	73
4.131.594	Inlet system – Product 1 (replica 2)	04-10-17	14:15h	04-10-17	14:30h	A-OLF-PE-007 UNE-EN 13.725	91.807
4.131.595	Outlet system – Product 1 (replica 2)	04-10-17	14:15h	04-10-17	14:30h	A-OLF-PE-007 UNE-EN 13.725	70
4.131.596	Inlet system – Product 2 (replica 1)	04-10-17	14:45h	04-10-17	14:45h	A-OLF-PE-007 UNE-EN 13.725	303.174
4.131.597	Outlet system – Product 2 (replica 1)	04-10-17	14:45h	04-10-17	14:45h	A-OLF-PE-007 UNE-EN 13.725	96
4.131.598	Inlet system – Product 2 (replica 2)	04-10-17	15:15h	04-10-17	16:00h	A-OLF-PE-007 UNE-EN 13.725	409.293
4.131.599	Outlet system – Product 2 (replica 2)	04-10-17	15:15h	04-10-17	16:00h	A-OLF-PE-007 UNE-EN 13.725	74
4.131.600	Inlet system – Product 2 – Olive oil (replica 1)	04-10-17	16:20	04-10-17	16:30h	A-OLF-PE-007 UNE-EN 13.725	168.593
4.131.601	Outlet system – Product 2 – Olive oil (replica 1)	04-10-17	16:20	04-10-17	16:30h	A-OLF-PE-007 UNE-EN 13.725	45

NA: Not applicable
Samples were collected in nalophan bags of 8 L

Additional information required by the UNE-EN 13725:

Measuring the sample analyses took place in the olfactometry laboratory at LABAQUA in Alicante with a temperature in the analysis room at less than 25 ºC and with temperature fluctuations during the process at less than ± 3ºC. The room is kept odourless, the panellists are not exposed to sunlight or are near any source of noise, and the air in the room is ventilated and goes through an active carbon filter before going into the room.

The presentation method of the smelly substances to the panellists, used by LABAQUA, is called the "Yes/No Mode". Each panellist is presented with three series of dilutions (in ascending order of concentration order) per sample, the pass factor (Fs) being two. The range of dilutions of the olfactometer (internal laboratory code: OLF-011), between the minimum and maximum dilution, it is 2^{16}. The presentation time to the panellists is 2,2 seconds, the time interval between dilution series is more than 45 seconds. Blanks have been included in all the dilution series.

The panel's variable accuracy test (A) during the last calibration was A= 0,152, and the precision (expressed as repetitivity) was r= 0,2116 (both parameters comply with the criteria established in regulation UNE-EN 13725).

The odour panel threshold during the day of of the sample analyses is presented below.

Analisys date	*Odour panel threshold*
04-10-17	*1.374 uo_E/m^3*

A mixture of n-butanol in nitrogen (batch no.: 4EK71T2G) was used as a reference substance, with a 54,9ppm concentration of butanol and a relative uncertainty of 2,5% (for a confidence interval of 95 %, K=2).

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Developed by	Approved by
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11 de octubre de 2017	11 de octubre de 2017