

Portable device for controlling an alcoholic beverage through a container, a system and a method associated thereto

The present invention relates to the field of the authentication of a content
5 such as a beverage, in particular an alcoholic beverage. More specifically, the invention concerns a device and a method allowing to authenticate a beverage through the walls of a container, more particularly when this container is a bottle.

The production and marketing costs of the high-end alcoholic beverages, such as vintage wines and spirits, lead to high selling prices. These high prices generate,
10 as often for the luxury products, fraud as well as acts of counterfeiting. Thus, there is regularly observed the appearance on the market of counterfeit bottles, that is to say having the external appearance of a genuine bottle, but filled with a beverage of much lower quality than the quality of the original product. This phenomenon of counterfeiting is particularly significant for high-end wines and spirits, such as
15 cognac.

For economic, safety and brand image reasons, the concerned producers are vigorously fighting against these acts of fraud and counterfeiting. This struggle is reflected in particular in the manufacture of bottles including increasingly advanced anti-counterfeiting devices, aiming at preventing the exact reproduction of a bottle
20 and/or its reuse.

However, counterfeiters also make constant efforts and are able to reproduce genuine bottles with such faithfulness that it becomes very difficult to distinguish a counterfeit bottle from a genuine bottle. In other cases, counterfeiters recover used genuine bottles, which are then filled with a non-genuine product.

25 Therefore, there is a need to remove any doubts about the authenticity of a bottle, by directly authenticating the content itself. Of course, since it is not possible to open each bottle whose authenticity would be doubtful, such authentication should be possible to make through the walls of the bottle.

In addition, this question of authentication arises in various places related to
30 different actors in the distribution chain (resellers, distributors, etc.). The diversity of these actors and their potential remoteness from the places of production mean that there is a need for an authentication device to be portable, easy to use and inexpensive, as well as for an authentication method to be reliable and efficient, in particular in terms of timeliness.

35 The present invention aims to meet these needs.

It concerns to this end a portable device for controlling an alcoholic beverage in an at least partially transparent container, including:

- a single light source emitting a monochromatic excitation light beam having a wavelength comprised between 350 and 650 nanometers;

- a beam splitter oriented at 45° with respect to the direction of emission of the light source to reflect the excitation light beam;

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- a focus and collection lens;

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- a positioning device allowing to orient the light beam coming from the light source along a direction substantially normal to the outer surface of the container, the positioning device also allowing to position the outer surface of the container at a predetermined distance from the focus lens, the predetermined distance between the focus lens and the container is chosen so that the light beam is focused inside the container, at a distance from the wall of the container less than 1 millimeter and preferably less than 500 micrometers, the positioning device including a through opening for the passage of the light beam coming from the light source;

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- a filtering device for filtering the fluorescence radiation captured by the focus lens and transmitted by the beam splitter, so as to eliminate the wavelengths which are shorter than or equal to the wavelength of the light beam emitted by the light source;

- a spectrometer module for producing a signal corresponding to the measured spectrum of the fluorescence radiation of the beverage;

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- an analysis module for comparing the measured spectrum with a reference spectrum.

By using the fluorescence phenomenon, the device in accordance with the invention allows reducing the power of the excitation light source with respect to known devices, particularly those using the Raman effect (the intensity of the light emitted in the fluorescence process is indeed about a million times more intense than the Raman scattering). The device in accordance with the invention includes a single light source, which contributes to the simplicity and portability of the system. In addition, by being limited to wavelengths greater than 350 nanometers, the influence of water and ethanol molecules (very much predominating in concentration in an alcoholic beverage such as a wine or a spirit) is limited. Indeed, water and ethanol molecules do not absorb the light radiation for wavelengths which are greater than 200 nanometers. Furthermore, by providing an assembly called "reflection" assembly, the attenuation of the fluorescence radiation is limited. Moreover, the 180° angle of incidence between the emitted ray and the reflected fluorescence ray allows minimizing the undesirable effects due to the wall of the container, since the traversed thickness will be minimal. Finally, by providing a positioning device, it is ensured that the focus of the emitted beam will be at the desired location, without any

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adjustment being necessary. The repeatability and reproducibility of the measurements are thus optimized.

In one embodiment, the beam splitter is a dichroic filter, in particular a high-pass dichroic filter (relative to the wavelengths).

5 In one embodiment, the filtering device includes a Notch-type band-stop filter and/or a high-pass filter (relative to the wavelengths).

In one embodiment, the spectrometer module is linked to the filtering device via an optical fiber.

10 In one embodiment, the positioning device includes a contact surface configured to be complementary to the outer surface of the container.

In one embodiment, the device includes a display device allowing in particular to display the result of the comparison between the measured spectrum and the reference spectrum.

15 In one embodiment, the device includes a casing which is secured to the positioning device.

In one embodiment, the casing includes all the components of the device.

20 In one embodiment, the positioning device is connected to the casing by means of a flexible connection, the focus lens being integrated to the positioning device, the flexible connection including an optical fiber for transmitting the light beams passing through the focus lens.

In one embodiment, the analysis module and the display device are included in an appended portable device, such as a tablet computer or a mobile phone.

In one embodiment, the device includes connection means to a remote database.

25 The invention also concerns a system for controlling an alcoholic beverage, the system including a device as defined above and a database stored in a remote server of the device.

In one embodiment, the database includes one or more reference spectrum/spectra that can be downloaded by the device.

30 The invention further concerns a method for controlling an alcoholic beverage through an at least partially transparent container, the method including the steps of:

- acquiring a fluorescence spectrum of the beverage through the wall of the container;

35 - normalizing the profile of the spectrum measured with respect to the maximum intensity of the reference spectrum;

- calculating a resemblance factor between the measured spectrum and the reference spectrum;

- determining, according to the obtained value of the resemblance factor, whether the beverage is genuine.

The control method in accordance with the invention has many advantages. Thanks to the step of normalizing the measured spectrum, for example with respect
5 to the maximum intensity of the reference spectrum, the dispersions due to the temperature of the controlled content and to the variations in the characteristics of the container (in particular the dimensional characteristics) are avoided. This normalization step also allows collecting, with a low-power excitation source, a signal of sufficient quality to be correctly analyzed. In addition, the step of comparing the
10 measured spectrum with the reference spectrum, which involves the calculation of a resemblance factor, requires very limited calculation capacity, which capacity is now available on a "smartphone" type mobile phone.

In one embodiment, the fluorescence spectrum is acquired by using a source emitting a monochromatic beam of a wavelength comprised between 350 and 650
15 nanometers.

In one embodiment, the resemblance factor is calculated over a predetermined wavelength range, for example a wavelength range comprised between 550 and 650 nanometers.

In one embodiment, the resemblance factor is calculated by the method called
20 least squares method or by an algorithm of the Hausdorff algorithm type.

In one embodiment, the beverage is determined to be non-genuine if the resemblance factor is greater than 20.

In one embodiment, the reference spectrum is obtained from the measurement of the fluorescence spectrum measured on a sample of a plurality of
25 genuine bottles.

In one embodiment, the method includes a step of downloading the reference spectrum from a remote database.

In one embodiment, the method is implemented using a device or a system as defined above.

30 The invention will be better understood upon reading the description below, made with reference to the appended drawings, among which:

- Figures 1 and 2 show a device in accordance with the invention in use, respectively from a side and a top view;
- Figure 3 shows the device of Figure 1, from a front view;
- 35 - Figure 4a is a block diagram of a device in accordance with the invention;
- Figure 4b is a detail of Figure. 4a;
- Figure 5 shows a variant of the device of Figure 4a;

- Figure 6 and 7 are curves corresponding respectively to a reference spectrum and to a measured spectrum;

- Figure 8 is a diagram detailing the steps of the method in accordance with the invention.

Figure 1 shows a portable device 1 in accordance with the invention, and a container whose content must be authenticated, for example a bottle 2 containing an alcoholic beverage. The device includes a casing 10, for example in a parallelepiped shape. The device 1 includes a device for positioning the bottle 2, or a positioning wedge 12. The wedge 12 forms a projection from one of the faces of the casing.

As seen in Figure 2, which is a top view of the device 1 and of the bottle 2, the wedge 12 has a contact surface 14 of complementary shape to the container. For example, the contact surface 14 thus has a concave shape adapted to the convex shape of the bottle 2.

As shown in Figure 3, the wedge 12 has an opening 16 forming a passage allowing the light rays emitted by the device 1 to pass through the wedge 12. The wedge 12 is secured to the casing 10 via a support 18, this support 18 also having a through passage for the light rays emitted or received by the device 1.

Figure 4a is a block diagram of the components of an exemplary device in accordance with the invention. In this figure, for the sake of clarity, a bottle 2 is shown, and the casing 10 of the device 1 is shown in dotted lines. The device 1 represented in Figure 4a includes a single excitation light source 32 emitting a monochromatic beam of a wavelength λ_0 . For example, the light source 32 is a laser diode.

The wavelength λ_0 of the light source 32 is comprised between 350 nanometers and 650 nanometers. This range allows obtaining that the emitted light beam generates a strong fluorescence emission of the molecules allowing to characterize the alcoholic beverage (that is to say the molecules other than those of water and ethanol). Moreover, in this range, the beam emitted by the light source 32 is only slightly attenuated by the glass of the bottle 2. Still in this range, the fluorescence emission of the content of the bottle 2 is only very weakly attenuated by the glass of the bottle 2.

The light beam 34 coming from the light source 32 is directed toward a beam splitter 36. The beam splitter 36, for example a dichroic filter, is oriented according to a 45° angle with respect to the direction of the light beam 34 emitted by the source 32. Thus, the beam emitted by the source 32 is reflected by the beam splitter 36 and the reflected beam 38 is directed toward a focus lens 40, for example an achromatic doublet lens. The focus lens 40 is located at a distance A from the bottle 2.

As seen in Figure 4b, which represents a detail of Figure 4a, the bottle 2, for example of a circular cross section, includes a wall delimited by an outer surface 22 and an inner surface 24. The bottle 2 contains a beverage 26 to be authenticated. The wedge 12 is in contact with the outer surface 22 of the bottle 2. As mentioned above, the wedge allows positioning the bottle 2 in such a way that the focus lens 40 is at a determined distance A from the outer surface 22 of the bottle. In addition, the wedge 12, by the shape of its contact surface 14, adapted to cooperate with the shape of the outer surface 22 of the bottle, allows positioning the bottle 2 in such a way that the light beam passing through the focus lens will be directed toward the outer surface 22 of the bottle 2 along a direction normal to this surface. For example, the contact surface 14 of the wedge 12 is of a concave shape and adapted to cooperate with the outer convex shape of the bottle 2. It should be noted in this respect that the wedge 12, and particularly the shape of the contact surface 14, will be adapted in the case where the container is not of a circular shape. Whatever the shape of the considered container, it will be ensured that the shape of the contact surface 14 allows positioning the wedge 12 on the container so that the light beam passing through the focus lens 40 is directed toward the outer surface of the container along a direction normal to that surface. In order to easily adapt the positioning wedge 12 to each type of container, it will be of course possible to provide that the wedge 12 is removably attached to the casing 10. It may be further considered that the wedge 12 is connected to the casing via a flexible connection to facilitate the positioning of the wedge 12 on a container. In this case, the focus lens will be offset from the casing and secured to the positioning wedge 12. To this end, the flexible connection between the casing and the set formed by the positioning wedge 12 and by the focus lens will include an optical fiber to transmit the light beams from the casing to the focus lens and vice versa.

The spacing ensured by the wedge 12 between the focus lens 40 and the bottle 2 will be determined so that the reflected beam 38 is focused inside the bottle 2, within the beverage 26, but as close as possible to the inner surface 24. Figure 4b thus shows the focal point 28 located within the beverage 26 at a distance B from the wall of the bottle 2 (more precisely: at a distance B from the inner surface 24 of the wall of the bottle 2). The shorter the distance B, the more the path of the emitted beam and that of the fluorescence radiation is minimized, and the more the attenuation of these two signals is limited. The distance B will be advantageously less than 1 millimeter, and its value will be preferably in the order of a few hundred micrometers or less.

The fluorescence signal 42 induced in the content of the bottle 2 by the light beam is collected by the focus lens 40, by retro-emission, and is directed toward the

beam splitter 36. The beam splitter 36 allows the fluorescence signal, which is directed toward a spectrometer module 50, to pass.

Advantageously, the device 1 includes one or more filtering device(s) allowing to filter the fluorescence signal 42 before the latter is transmitted to the spectrometer module. The purpose of this filtering is in particular to eliminate the component of the signal collected by the focus lens 40 linked to the light beam emitted by the source 32. For this purpose, there is provided for example a band-stop filter 44 or "notch" filter. The interval of frequencies not transmitted by the band-stop filter will be close to the wavelength of the monochromatic light beam emitted by the source 32. The non-transmitted band will have for example a width of about 10 nanometers, and will be centered over a wavelength greater, by a few nanometers or less (for example 1 nanometer), to the wavelength λ_0 of the laser source.

It can further be provided that an additional high-pass type filtering (with respect to the wavelengths), is performed by the beam splitter 36. In this case, the beam splitter 36 is a high-pass type dichroic filter with a high cutoff slope (in particular an "edge"-type filter) which reflects the beam 34 toward the focus lens, and transmits the radiation emitted by the beverage and its container to the spectrometer module by eliminating the wavelengths which are shorter than a threshold value corresponding to the wavelength of the monochromatic beam emitted by the source 32 increased by about 10 nm.

In the example of Figure 4a, the fluorescence signal 42, once filtered by the beam splitter 36 and by the stop-band filter 44, is directed toward a lens 46, for example an aspherical lens of a very short focal length. The beam transmitted by the lens 46 is directed toward one end of an optical fiber segment 48, the other end of this segment being linked to the spectrometer module 50. The optical fiber 48, due to its flexibility, allows optimizing placing the components within the casing 10 and thus limiting the congestion therefrom. In addition, said optical fiber plays the role of a confocal hole and thus limits the amount of information transmitted and therefore analyzed. Thus, undesirable effects, particularly those related to the shape and thickness of the bottle or those related to outdoor lighting, can be minimized. Furthermore, the optical fiber also allows overcoming the astigmatism effect, which involves focus changes at the inlet of the spectrometer module according to the different wavelengths of the fluorescence radiation.

In one variant, the lens 46 may be replaced by a magnification lens.

The spectrometer module 50 includes a diffraction grating 52 allows directing the diffracted signal toward a sensor 54, for example a CCD-type sensor which has the advantage of not requiring cooling. For example, the diffraction grating 52 is a reflective diffraction grating. The signal entering the spectrometer module 50, via an

input slot 56, is directed toward a first mirror 58, which is a convex mirror. The signal reflected by the diffraction grating 52 is directed toward a second planar-type mirror 60. The second mirror reflects the diffracted signal toward the sensor 54. In one variant, the set 52-58-60 can be replaced by a single concave diffraction grating allowing to improve the compactness of the device. In another variant, the set 52-58-60 can be replaced by a single diffraction grating operating in transmission.

The sensor 54 provides a signal corresponding to a fluorescence spectrum. This signal is transmitted from the spectrometer module 50 to an analysis module 62. The analysis module 62 includes in particular a storage unit 64, allowing to store in memory a signal coming from the spectrometer module. The storage unit 64 has a capacity allowing to store a signal obtained over a certain acquisition time, for example in the order of 150 milliseconds. The analysis module 62 further includes a calculation unit 66, allowing to determine whether the recorded signal corresponds to that of a genuine beverage. To this end, the calculation unit 66 performs in particular a comparison between the recorded signal and a reference signal, preferably according to the method in accordance with the invention, which will be described in more detail below. The reference signal may be previously stored in the storage unit 64 and/or downloaded or updated from a remote database. To this end, the analysis module 62 includes a communication unit 68, in particular of the wireless type.

The device finally includes a display device 70, allowing to display the result of the test. The display device 70 may consist of a display screen or any other means, such as a plurality of indicator lights (made for example with light-emitting diodes). For example, it is possible to provide that the result of the test is given according to one of two even three possibilities: "GOOD", "BAD" and possibly "DUBIOUS". In the case of a plurality of indicator lights, it will be thus possible to provide three different indicators (in particular of different colors), each corresponding indicator lighting up respectively according to one of the three possibilities mentioned above.

Alternatively, part or all of the analysis module 62 and/or of the display device 70 may be disposed in a casing distinct from the rest of the device. Figure 5 represents one of the possible configurations, in which the analysis module 62 and the display device 70 are grouped together in an outer device, for example in the form of a portable device 72 such as a tablet computer or a mobile phone. In such a case, a wired or wireless-type digital connection 74 is provided between the casing 10 and the portable device 72. This connection allows connecting the spectrometer module 50, disposed in the casing 10, to the analysis module 62, located in the portable device 72.

Figures 6 and 7 show spectrum examples obtained by the device in accordance with the invention, respectively before and after implementation of a normalization step in accordance with the method according to the invention.

Figure 6 shows a curve C2 corresponding to a fluorescence spectrum obtained for a genuine cognac (contained in its original genuine bottle) and a curve C1 corresponding to a spectrum obtained for a non-genuine cognac (for example a counterfeit cognac). The two curves C1, C2 correspond to the output signal of the spectrometer module 50, and were obtained with a laser diode emitting a beam of a wavelength λ_0 close to 530 nanometers. It should be noted that the two curves have a maximum, corresponding to a wavelength of λ_0+73 nanometers for genuine cognac, and λ_0+58 nanometers for non-genuine cognac. In addition, the intensity of the maximum spectrum of non-genuine cognac is greater than the intensity of the maximum spectrum of genuine cognac.

Figure 7 shows the two spectra of Figure 6, after normalization with respect to the maximum intensity of the spectrum of the genuine cognac (taking as basis 100 the maximum intensity of the spectrum of the genuine cognac). This normalization leaves significant differences between the curve C'1 corresponding to the normalized profile of the spectrum of the non-genuine cognac and the curve C'2 corresponding to the normalized profile of the spectrum of the genuine cognac. As will be seen below, these differences are used by the device and the method in accordance with the invention to allow the detection of non-genuine beverages through their container.

The control method in accordance with the invention allowing the authentication of an alcoholic beverage is described hereinafter, in the context of an example applied to a cognac. The main steps of the method in accordance with the invention are shown in Figure 8. These steps can be carried out using a device in accordance with the invention, for example the device 1 described above.

The method in accordance with the invention includes a first step consisting in acquiring a measured spectrum of the controlled beverage. This acquisition step 80 is carried out in particular by the spectrometer module 50 of the device 1.

The method then includes a comparison step 82 of the measured spectrum with a reference spectrum. This reference spectrum can be stored in a memory of the device 1, for example a memory of the storage unit 64, or can be downloaded from a remote database. Optionally, the method may include a step 84 of selecting the reference spectrum. This selection can be made among several reference spectra stored in memory, or among several reference spectra available in the remote database. This selection can be done automatically or to the user's request.

The comparison step 82 of the measured spectrum with the reference spectrum includes a sub-step consisting of a normalization of the measured spectrum, with respect to the maximum of the reference spectrum (or alternatively, with respect to the total intensity of the spectrum or with respect to the area under the spectrum). This normalization has several advantages. This allows in particular overcoming the effects of the temperature variations. The temperature is known to have a significant influence on the fluorescence phenomenon. But the inventors have found that a temperature change has a significant influence on the maximum intensity of the fluorescence spectrum, and a negligible influence in the form of the fluorescence spectrum profile. In other words, after normalization, spectra of the same beverage obtained at different temperatures are superimposable. Thus, the method in accordance with the invention allows overcoming temperature variations during the collection of the fluorescence spectrum. Particularly, this allows taking into account the difference between the temperature at which the measured spectrum is collected and the temperature at which the reference spectrum has been created. In addition, the normalization of the measured spectrum allows overcoming the effects of the dispersions observed between each bottle of the same type. It is known that the same products on the same production line, two "identical" containers (such as glass bottles) will always have dispersions, in particular dimensional dispersions (and therefore in the thickness). However, the greater the glass thickness, the more the beam emitted by the excitation source will be attenuated and also the more the emitted fluorescence radiation will be attenuated in the wall of the container. However, the inventors have found that this attenuation had a limited influence on the profile of the collected fluorescence spectrum, the attenuation having especially the effect of reducing the intensity of the spectrum. This influence on the profile of the spectrum is even more negligible if the length of the spectrum collected is less than 700 nanometers. It is therefore advantageous to limit the range of wavelengths used to implement the comparison step, for example between 550 and 650 nanometers. Thus, the method in accordance with the invention allows overcoming thickness variations for the same container model.

The comparison step 82 of the measured spectrum with the reference spectrum includes a sub-step of determining a resemblance factor R between the curves corresponding respectively to a measured spectrum for a given beverage and to the reference spectrum corresponding to this beverage, for example the curves $C'2$ and $C'1$. This sub-step thus allows quantifying the resemblance between the measured spectrum and the reference spectrum. This factor R can be calculated for example by using the least squares method, according to the formula:

$$R_{1-2} = \sum_i \sqrt{(y_1(\lambda_i) - y_2(\lambda_i))^2}$$

wherein:

- $y_1(\lambda_i)$ is the intensity of the measured spectrum (for example the curve C'1 of Figure 7) for a wavelength equal to λ_i ;

- $y_2(\lambda_i)$ is the intensity of the reference spectrum (for example the curve C'2 of Figure 7) for a wavelength equal to λ_i .

A zero value is thus obtained if the two spectra are completely identical. The higher the factor R, the more the compared spectra differ.

Of course, the resemblance factor can be calculated by using any other adapted algorithm such as, for example, the Hausdorff algorithm, according to the following formula:

$$R_{1-2} = \max \left\{ \sup_{x_2 \in y_2} \inf_{x_1 \in y_1} \delta(x_1, x_2), \sup_{x_1 \in y_1} \inf_{x_2 \in y_2} \delta(x_1, x_2) \right\}$$

According to this formula, we calculate for each point $y_1(\lambda_i)$ of the spectrum $y_1(\lambda)$ its smallest distance to the points of the spectrum $y_2(\lambda)$. We then choose the greatest calculated distance noted $\delta_{\max}(y_1, y_2)$. We then perform the same calculation for each point of the spectrum $y_2(\lambda)$ compared to the spectrum $y_1(\lambda)$ by choosing the greatest calculated distance $\delta_{\max}(y_2, y_1)$. The resemblance factor or Hausdorff distance will then be the greatest value of these two maximum retained distances.

Whatever the method used, we obtain a zero R value if the two spectra are completely identical. Likewise, whatever the method used, the higher the factor R, the more the compared spectra differ.

The R value will be calculated on at least a hundred points, advantageously several hundred. For example, the number of points taken into account is in the order of 600.

The R value is used during the evaluation step 86 of the authenticity of the beverage. This step allows determining, based on the calculated value of the resemblance factor R whether the controlled bottle contains a genuine beverage or not. For example, the tested content will be declared "bad" if the resemblance factor R is greater than a predetermined value, for example equal to 20.

By implementing a comparison by calculation of a resemblance factor that requires limited calculation resources, the method in accordance with the invention leads to a low calculation time. Advantageously, the measured spectrum will be collected and/or compared to the reference spectrum only over a limited range, for example between 550 and 650 nanometers. Restricting the field of analysis allows

indeed excluding the possible residual luminescence of the glass and, as explained above, overcoming the thickness variations of the wall of the container. In addition, restricting the field of analysis allows further reducing the calculation time.

5 The device and the method in accordance with the invention allow achieving the desired objective of a portable device that is simple and quick to use. By normalizing the spectra with respect to the intensity maxima, both the dispersions related to the temperature of the content and to the shape of the container are avoided, and the required calculation capacity is reduced.

10 In addition, the architecture and operation of the device allow limiting the maximum number of components. Thus, thanks to the choice of an excitation light source emitting at a determined wavelength, the use of filters is avoided in order to select a narrow band of wavelengths. By optimizing the intensity and the quality of the fluorescence signal, in particular by the choice of the wavelength of the laser source, it is possible to use a low power laser source, for example of a few milliwatts.
15 This allows providing an autonomous device that can operate on batteries or cells, and avoiding the need for a cooling device. In this respect, it will be noted that the choice of a CCD-type sensor for the spectrometer module also avoids providing any cooling.

Claims

1. A portable device (1) for controlling an alcoholic beverage in an at least partially transparent container (2), including

5 - a single light source (32) emitting a monochromatic excitation light beam having a wavelength comprised between 350 and 650 nanometers;

 - a beam splitter (36) oriented at 45° with respect to the direction of emission of the light source (32) to reflect the excitation light beam;

 - a focus (40) and collection lens;

10 - a positioning device (12) allowing to orient the light beam coming from the light source (32) along a direction substantially normal to the outer surface of the container (2), the positioning device (12) also allowing to position the outer surface of the container at a predetermined distance from the focus lens, the predetermined distance between the focus lens and the container being chosen so that the light
15 beam is focused within the container, at a distance from the wall of the container less than 1 millimeter and preferably less than 500 micrometers, the positioning device (12) including a through opening for the passage of the light beam coming from the light source;

 - a filtering device for filtering the fluorescence radiation captured by the focus
20 lens (40) and transmitted by the beam splitter (36), so as to eliminate the wavelengths which are shorter than or equal to the wavelength of the light beam emitted by the light source;

 - a spectrometer module (50) for producing a signal corresponding to the measured spectrum of the fluorescence radiation of the beverage;

25 - an analysis module (62) for comparing the measured spectrum with a reference spectrum.

2. The device according to claim 1, characterized in that the beam splitter (36) is a dichroic filter, in particular a high-pass dichroic filter.

3. The device according to claim 1 or 2, characterized in that the filtering
30 device includes a Notch-type band-stop filter (44) and/or a high-pass filter.

4. The device according to any of the preceding claims, characterized in that the spectrometer module (62) is linked to the filtering device via an optical fiber (48).

5. The device according to any of the preceding claims, characterized in that the positioning device (12) includes a contact surface (14) configured to be
35 complementary to the outer surface of the container.

6. The device according to any of the preceding claims, characterized in that it includes a display device (70), allowing in particular to display the result of the comparison between the measured spectrum and the reference spectrum.

7. The device according to any of the preceding claims, characterized in that it includes a casing (10) which is secured to the positioning device (12).

8. The device according to the preceding claim, characterized in that the casing (10) includes all the components of the device.

5 9. The device according to claim 7, wherein the positioning device (12) is connected to the casing (10) via a flexible connection, the focus lens (40) being integrated to the positioning device (12), the flexible connection including an optical fiber for transmitting the light beams passing through the focus lens (40).

10 10. The device according to any of claims 6 to 9, characterized in that the analysis module (62) and the display device (70) are included in an appended portable device (72), such as a tablet computer or mobile phone.

11. The device according to any of the preceding claims, characterized in that it includes connection means to a remote database.

15 12. A system for controlling an alcoholic beverage, the system being characterized in that it includes a device according to claim 11 and a database stored in a remote server of the device.

13. The system according to claim 12, wherein the database includes one or more reference spectra that can be downloaded by the device.

20 14. A method for controlling an alcoholic beverage through an at least partially transparent container, the method including the steps of:

- acquiring (80) a fluorescence spectrum of the beverage through the wall of the container;

- normalizing the profile of the measured spectrum with respect to the maximum intensity of a reference spectrum;

25 - calculating a resemblance factor between the measured spectrum and the reference spectrum;

- determining (86), according to the obtained value of the resemblance factor whether the beverage is genuine.

30 15. The method according to the preceding claim, characterized in that the fluorescence spectrum is acquired by using a source emitting a monochromatic beam of a wavelength comprised between 350 and 650 nanometers.

16. The method according to claim 14 or 15, characterized in that the resemblance factor is calculated over a predetermined wavelength range, for example a wavelength range comprised between 550 and 650 nanometers.

35 17. The method according to any of claims 14 to 16, characterized in that the resemblance factor is calculated by the method called least squares method or by an algorithm of the Hausdorff algorithm type.

18. The method according to the preceding claim, characterized in that the beverage is determined as non-genuine if the resemblance factor is greater than 20.

19. The method according to any of claims 14 to 18, characterized in that the reference spectrum is obtained from the measurement of the fluorescence spectrum
5 measured on a sample of a plurality of genuine bottles.

20. The method according to any of claims 14 to 19, including a step of downloading the reference spectrum from a remote database.

21. The method according to any of claims 14 to 20, characterized in that it is implemented using a device in accordance with any of claims 1 to 11 and/or a
10 system in accordance with any of claims 12 and 13.