Assembly and Method for Microbiological Analysis

FIELD OF THE INVENTION

The present invention relates to the microbiological analysis of a liquid sample in a pressurized flow.

BACKGROUND OF THE INVENTION

Units for the microbiological testing of pressurized liquid samples comprising a microporous membrane through which the liquid is filtered under pressure are already known, particularly from French patent 2 802 942.

Such units comprise a body for admitting a liquid to be filtered and a body for draining this liquid away, the admission and drainage bodies of these units being locked together on each side of the filter membrane, thereby sandwiching this membrane over an annular area with the interposition of a seal.

Locking is achieved by means of frangible latching tabs, which are broken after filtration in order to disconnect the two bodies and thus gain access to the membrane; subsequently this membrane can be gripped with forceps via its edge to be set down on the top surface of gel growth medium, which was poured beforehand into a growing cassette such as a petri dish, for example.

SUMMARY OF THE INVENTION

PROBLEMS THAT THE INVENTION IS TO SOLVE

The invention aims to provide a microbiological analysis assembly which is similar but at the same time simpler and more reliable to handle (reducing the risks of detecting false positives) and at the same time optimize performance for growing micro-organisms that may have been collected on the membrane (reducing the risks of detecting false negatives).

MEANS OF SOLVING THE PROBLEMS

To this end, the invention provides a microbiological analysis assembly comprising a filtration unit and a gel

growth medium cassette, the said filtration unit comprising a filter membrane and a body provided with the said membrane, and the said cassette comprising a body containing the said gel growth medium, the latter having a surface designed to be covered by the said membrane, wherein this microbiological analysis assembly is characterized in that the body of the filtration unit and the body of the cassette are configured in such a way as to cooperate in order to occupy a nested position in which the membrane covers the said surface of the said gel growth medium, the body of the said unit and the body of the said cassette each being equipped with an intermediate stop, wherein when the said stops are in contact with one another, the filtration unit and the gel growth medium cassette are each in an intermediate position in which the said membrane is away from the said gel growth medium, and it is possible that at least one of the two stops is removed so as to allow the said filtration unit to move from the said intermediate position into the said nested position.

Placing the filtration unit on the cassette in an intermediate position increases the repeatability of actions performed by an operator, thereby ensuring that the unit is positioned in advance and centered on the cassette before the membrane is added to the gel growth medium, which in turn makes the operator's work simpler and more reliable.

The presence of a removable stop ensures that the membrane is placed in uniform contact with the gel growth medium after the stop was removed, thus significantly minimizing the risks that air pockets may form between the membrane and the gel growth medium, since such pockets can locally inhibit the growth of micro-organisms present on the membrane and thus cause false negatives.

In addition, such an assembly ensures that there is no need to separate the membrane from the filtration unit. After filtration, an operator simply comes into contact with the body of the filtration unit without ever having to handle the membrane with forceps, for example, as was done in the assembly of the aforementioned prior art, and thus

this assembly significantly minimizes the risks of contamination.

By virtue of the assembly according to the invention, a combination of optimization and simplification of operations involved in transferring the membrane above the gel growth medium cassette and then bringing this membrane into contact with the gel growth medium enables to reduce the risks of incorrect microbiological analysis in terms of both the detection of false positives and the detection of false negatives.

According to some preferred features, for reasons of simplicity and convenience in terms of both production and use:

- the said removable stop is configured in such a way as to be removed when the force with which the unit and the cassette are brought closer together exceeds a predetermined threshold;
- the said removable stop belongs to the said cassette;
- the said removable stop is connected to a wall of the said body of the cassette by at least one frangible portion;
- the said removable stop is an annular ring;
- the said unit comprises a flexible wall for closing a chamber, which is further defined by a wall of the body of the filtration unit and the said membrane;
- the said flexible wall belongs to a lid nested into the body of the said unit;
- the said body of the filtration unit also comprises a retaining means of holding the said unit in a position in which the unit can be nested in the said cassette;
- the intermediate stop of the body of the said unit is a tubular wall that the said body comprises;
- the body of the unit and the body of the cassette are also each equipped with an end-of-travel stop, the said end-of-travel stops coming into contact with one another in the said nested position;
- the end-of-travel stop of the body of the filtration

unit is an internal wall surrounded by the wall that forms the said intermediate stop;

- the said membrane is sealed against the said internal wall;

- the said end-of-travel stop of the cassette is a wall lying at the periphery of the said gel growth medium;

- the said cassette comprises a tubular wall, relative to which the said intermediate stop extends laterally from a first side face of the said wall, and the said end-of-travel stop extends laterally from a second side of the said wall; and/or

- the said gel growth medium has a domed shape, the said surface of the gel growth medium that is designed to be covered by the said membrane having a convex shape.

In the second aspect, the purpose of the invention relates to a method characterized by comprising the steps of:

- selecting an analysis assembly as explained above;

- engaging the said unit on the said cassette until the intermediate stop of the body of the said unit comes into contact with the intermediate stop of the body of the said cassette; and

- removing the said removable stop so as to allow the said unit to move from the said intermediate position to the said nested position.

According to some preferred features, for reasons of simplicity and convenience in terms of both production and use:

- a unit comprising a flexible wall for closing a chamber, which is further defined by a wall of the body of the filtration unit and the said membrane, is selected as said filtration unit, and the step of removing the said removable stop comprises a step of exerting a force that is above a predetermined threshold and can bring the said unit and the said cassette closer together by compressing the said flexible wall of the said unit;

- a wall configured in such a way as to deform under force that is smaller than the force required to remove the

said stop is selected as said flexible wall;

- the said method comprises a sampling step prior to the step of engaging the said unit on the said cassette, and a step of growing micro-organisms collected on the said membrane during the said sampling step, which comes after the step of removing the said stop; and/or
- the said sampling step comprises the steps of:
  - selecting a filtration unit which comprises a peelable film;
  - filtering a predetermined volume of liquid through the said unit; and
  - peeling the said film.

BRIEF DESCRIPTION OF DRAWINGS

- figure 1 is a perspective view of an assembly according to the invention, in which a filtration unit equipped with a filter membrane and a gel growth medium cassette in the present assembly are shown at a position where one is nested inside the other;
- figure 2 is a view similar to figure 1, separately showing the filtration unit in this assembly before a protective film protecting the filter membrane is peeled off this unit;
- figure 3 is a view similar to figure 2, showing this unit in an exploded view;
- figure 4 is a side view of this unit cross-sectioned along a central plane of symmetry;
- figure 5 is a perspective view showing a separated body of this filtration unit as viewed from the side, wherein the membrane is sealed to this body;
- figure 6 is a view similar to figure 1, showing the separated gel growth medium cassette in this assembly, wherein an additional lid covering the gel growth medium is nested;
- figure 7 is a view similar to figure 6, showing this cassette in an exploded view;
- figure 8 is a side view of this cassette cross-sectioned along a central plane of symmetry;

- figures 9 is a sectioned side view showing a step of bringing the filtration unit toward the gel growth medium cassette.

- figure 10 is a sectional view showing an intermediate step of centering this unit on the cassette.

- figure 11 is a side view showing a step of deforming a flexible wall on the lid of the filtration unit before removing a frangible ring in the cassette.

- figure 12 is a side view showing a step of covering the gel growth medium with the membrane after this ring was removed.

- figures 13 is a sectioned perspective view of this assembly at an intermediate centered position as illustrated in figure 10.

- figure 14 is a side elevation view of this assembly at an intermediate centered position as illustrated in figure 10.

DETAILED EXPLANATION OF THE INVENTION

The features and advantages of the invention will become apparent from the description which follows, based on preferred yet non-limiting examples with reference to the attached drawings.

A microbiological test unit 1 depicted in figures 1 to 4 comprises a body 2, a membrane 3, a porous frit 4, a disk-shaped sponge 5, a peelable plastic film 6 and a lid 7.

The unit also comprises two duckbill check valves 8 and 9 and a female insert 10.

The body 2 is made of polycarbonate and produced by molding as a single piece. This body shown separately in figure 5 comprises an external wall 15, interrupted at indentations 47, 48, a frustoconical internal wall 16 converging toward the membrane 3, an annular transverse wall 17 and an intermediate wall 26 positioned between the walls 15 and 16, the walls 16 and 26 meeting at the wall 17.

The walls 15 and 16 are connected to one another by the wall 17.

The wall 16 has an aperture 19 formed between a

larger-diameter portion 41 of this wall 16 and a smaller-diameter portion 40 of this wall 16 (figure 4).

The aperture 19 is positioned at the end of a duct 22 (figure 3), this duct opening to the outside of the unit at the opposite end of the aperture 19, via an aperture 20 formed in the wall 15.

Diametrically opposite this aperture 20, a second aperture 21 (figure 4) is also formed in the wall 15, this second aperture provided at the end of a duct 23. The duct 23 has an elbowed portion which means that it emerges to the aperture 21 at the opposite end in the space between the walls 16 and 26 via an aperture 25.

The valve 8 is nested inside the duct 22 at the wall 16, which is centered around its flange 28 and joins up against the body 2 via its flange 28′.

In the same way, the valve 9 is nested in the duct 23, the valve being centered about its flange 29, and the flange 29′ of this valve joining up against the wall portion that surrounds the aperture 25.

The valves 8 and 9 are calibrated to open only when the pressure is above a certain pressure threshold at a time when fluid is placed under pressure in the direction of flow from the inlet aperture 20 toward the outlet aperture 21 and to remain closed otherwise.

Once the valve 8 has been inserted, the insert 10 is also nested into the length of duct 22 on the aperture 20 side and centered about its flange 27, wherein the annular flange 27′ of this insert joins up against the external surface of the cylindrical wall 15 such that the aperture 12 of this insert lies near the aperture 20 of the body 2 at the opposite end of the valve 8.

The insert 10 in this instance is a female Luer tip, wherein sealing between this tip and the body 2 is achieved by ultrasound welding performed around the periphery of this insert.

As in the case of the insert 10, the duct 23 and the walls surrounding it also form a female Luer tip.

The apertures 12 and 21 are each covered by a peelable

strip made of flexible plastic (not shown here) so as to ensure the integrity of the ducts 22 and 23 by protecting them from the air, which is a potential source of microbiological contamination.

A flexible plastic lid 7 is forcibly nested on the same side as the portion 41 of the frustoconical wall 16.

The body 2 also comprises a pointed annular rib 46 on the edge face of a frustoconical portion 41 that faces the outside of the unit and is configured in such a way as to seal this lid, while the wall 26 has eight facets to hold the filtration unit and the gel growth medium cassette in their nested position as shown below.

The lid 7 is made of polypropylene and has a sealed wall 30, an annular hinge 31, a cylindrical nesting band 32 and an annular flange 33.

The sealed wall 30 is connected to the cylindrical nesting band 32 and the flange 33 by the annular hinge 31.

When it is nested within the frustoconical wall 41, the cylindrical band 32 supports the external surface of this portion via an annular sealing rib 34.

The annular hinge 31 has thin portions configured to make it easier to deform the lid.

The membrane 3 having a diameter of 55 mm is made of cellulose ester (it may equally be made of polycarbonate or PVDF). This material in particular makes it possible to obtain microporosity that allows liquid to pass through and at the same time retain various micro-organisms contained in the liquid.

This membrane is sealed at its periphery against the surface 44 of the wall portion 40 forming an annular rim.

Under this membrane, a disk-shaped porous frit 4 is disposed, which has a diameter larger than that of the membrane so that it can be positioned next to the portion 40, extends beyond this portion and supports the membrane over its entire surface (figures 3 and 4).

Under this frit, the disk-shaped sponge 5 is disposed, which is centered relative to the frit.

The porous frit 4 is supported, via the sponge 5, by a

polyethylene film 6 sealed against the surface 50 of the cylindrical wall 26 so that this film hermetically and completely covers the sponge 5, the porous frit 4 and the membrane 3 and at the same time ensures that the frit 4 is held at a predetermined position in contact with the membrane 3 and the wall portion 40 via the sponge 5.

This film is sealed to the frit 4 along several bands (not shown here) so as to ensure that this film, this frit and the sponge positioned between them are held together.

The test unit ready for use (with the lid 7 nested into the body 2 and the film 6 sealed to this body) therefore has two flexible and detachable transverse walls (the wall 30 provided with a hinge 31 and a film 6) which are parallel to each other on the whole and close the top and the bottom of the filtration chamber defined by the body 2, the wall 30 (or the film 6) having a face 38 (or 39) facing the outside of the unit.

The wall 30 and the film 6 are held at a predetermined place by simple adhesion phenomena (by friction caused by forcible engagement with the wall 30 by the band 32 and the rib 34, or by sealing or hermetic bonding in the case of the film 6).

More specifically, and as shown below, a lid 7 closes a reception volume 43 for liquid, which lies between the membrane 3, the frustoconical wall 16 and this lid, while the plastic film 6, together with the membrane 3, partially defines a drainage volume 45 for draining this liquid, which lies under the membrane and includes the space between this membrane and the film 6. This volume communicates with the annular volume 49 located between the wall portion 40 and the wall 26; through this volume, as shown below, the liquid passes (after having been received in the reception volume 43 then drained into the drainage volume 45) so that this liquid is guided toward the outlet aperture 21 via the duct 23.

This unit, pre-sterilized using gamma radiation, is packaged in a plastic sachet (not shown here) consisting of two thermoplastic sheets joined together by a weld bead.

The entire length of this weld bead is peelable by hand.

The gel growth medium cassette 80 will now be described below with reference to figures 6 to 8.

The gel growth medium cassette 80 has a cassette body 81 and two identical lids 82. The body 81 has an overall cylindrical shape and comprises a first cylindrical wall 83, a second cylindrical wall 84, a meshed plate 85, a balcony 86 and several teeth 87.

The wall 84 surrounds the wall 83 and is connected to it by a transverse wall 99.

A ring 100 connected to this wall by four uniformly spaced frangible tabs 101 extends transversely from the wall 84 on the opposite side of the wall 99.

The mesh 85 is made up of a series of bars 94, which extend from the surface of the wall 83 facing the inside of the cassette toward the geometric center of this cylindrical wall, these rods being connected to one another by circular ribs (not shown here) so as to form this mesh.

The balcony 86 is connected to the wall 84 on the opposite side of the wall 99. This balcony has a series of uniformly spaced teeth 87 projecting parallel to the wall 84.

The lids 82 each have a domed wall 90 connected to a flange 92 by a cylindrical band 91.

The flange 92 has an annular rib 93 projecting on the same side as the band 91.

An agar-based gel growth medium 88 is poured onto the mesh 85 of the cassette 60 (which at that point is in an inverted position by comparison with the position shown in figure 8, the stopper 82 located near the teeth 87 having been removed beforehand) so as to cover this mesh and show a convex surface 89 designed to be covered by the membrane 3 in the direction of the lid 82 that has not yet been removed.

Each lid 82 of a ready-to-use gel growth medium cassette (figure 12) is nested within respective free edges of the wall 84 (these edges are subsequently positioned between the band 91 and the rib 93 of the corresponding lid

82) in such a manner as to protect the medium from air by having the concave surfaces 97 of the lids face toward the meshed support 85 and making the domed wall 90 of the lid 82 closest to the gel growth medium hold the concave surface 97 and the convex surface 89 of the gel growth medium together.

The wall 99 has several apertures 95 provided with vents to prevent the gel growth medium 88 from acting like a suction cup on this lid 82 when the lid is removed.

The gel growth medium cassette is also designed, in order to simplify storage, to allow it to be nested together with other identical gel growth medium cassettes, wherein the top lid of the dish of a gel growth medium below rests on the bottom lid of the dish of a gel growth medium above, the free edges of the teeth 87 of the dish above partially surrounding these two lids to prevent any slippage of one cassette relative to another.

The way in which a microbiological test is performed using a unit and a cassette according to the invention will now be described.

First of all, an operator performs a sampling step, that is, the operator takes a sample for analysis (a membrane that may contain micro-organisms, as used herein).

To do that, the operator opens an individual sachet (by parting the two thermoplastic sheets at the peelable weld bead) in which a unit 1 is contained, in order to pull it out therefrom by grasping it at the indentations 47 and 48 of the body 2.

The unit is then engaged within a clamp (not shown here) having two jaws on which the lid 7 and the film 6 are disposed, to enable them to withstand the pressure of flowing liquid.

Once the unit is fastened at a predetermined place using the clamp, the operator peels off a plastic film (not shown here) that blocks the inlet aperture 12 of the unit and then connects the inlet female Luer tip 10 of the unit to a male Luer tip (not shown here) connected to a filling pipe communicating with a reservoir (not shown here) of pressurized liquid via a tap (not shown here).

The operator then peels off a plastic film covering the outlet aperture 21 so as to connect the outlet female Luer tip to a drain pipe (not shown here).

The operator then operates the tap to bring the filtration chamber to the same pressure as the liquid, for example 3 bar.

The liquid then passes along the duct 22 in the direction of the arrow B (figure 4) (the pressure is high enough to open the leaf of the valve 8), fills the reception volume 43 and then begins to pass through the membrane 3 over its entire thickness in the axial direction of filtration shown by the arrow A (figure 4).

Since this membrane hermetically seals the surface 44 of the wall 40, the liquid can escape from the reception volume 43 only by passing right through the entire thickness of the membrane 3.

After it was filtered through the membrane, the liquid enters the drainage volume 45 within the porous frit 4 and crosses it at least partially.

Most of the liquid crosses only part of the thickness of the frit and escapes from this frit along its edge face 4′ (figure 4).

The drainage volume is thus essentially located in the volume occupied by the frit 4 and in the volume running radially (transversely with respect to the axial direction of filtration) around this frit and situated near the edge face 4′.

The liquid then travels from the drainage volume 45 toward the transit volume 49, which lies between the wall 40 and the wall 26 and is distributed around the membrane 3 so that the liquid can reach the valve 9.

The leaf of this valve, like that of the valve 8, is designed to be opened at the operating pressure of the unit; therefore this design enables the liquid to be removed via the aperture 21 passing along the duct 23.

Should the operator mistook the inlet aperture for the outlet aperture, the check valves 8 and 9 prevent the liquid from passing through the unit by making a pressure

difference to deform the membrane 3 in such a way as to separate it or probably tear it from the support frit.

After all the liquid was filtered, the operator closes the liquid inlet tap, disconnects the filling and drain pipes from the unit 1 and pulls out the unit 1 from the clamp. The water-laden membrane 3 is supported by the frit 4 in order to prevent it from tearing when the unit is pulled out from this clamp.

The operator then purges the liquid contained in the unit from this unit by connecting its outlet aperture 21 to a vacuum pump so that this liquid can be discharged by suction through the duct 23.

When most of the liquid has been removed, the surface of the membrane comes into contact with air inside the device.

The bubble point phenomenon means that no gas bubble can leave a wetted membrane, which in turn means that this membrane is sealed against air, thus preventing any liquid or gas from flowing toward the outlet aperture 21.

In response to this suction, the external pressure of the device causes the peelable film 6 to be deformed, as a result, this film tends to move closer to the porous frit 4 and the membrane 3.

As a result, the peelable film 6 thus deformed compresses the disk-shaped sponge 5 against the frit 4. This means that this sponge thus compressed by the film 6 is partially emptied of the liquid it absorbed during filtration.

After this sponge was compressed, suction is stopped. A vent (not shown here) at the edge of the valve 9 of the device allows a sterile stream of air in, thus allowing the pressure inside the spaces 45 and 49 to gradually return to the state where the internal pressure and the external pressure are balanced such that the film 6 returns to its initial position and the sponge 5, which is relatively elastic and has been relieved of the force exerted by the peelable film 6 (therefore has no suction force), substantially regains its initial volume without being

saturated with water because some of the water it used to contain was removed while it was being compressed.

As a result, when it regains its volume, the sponge 5 at the same time absorbs some of the remaining liquid still contained in the device, especially the liquid still present in the pores of the membrane 3 and in the regions neighboring the preferred flow paths.

After this purging operation was performed, the operator grasps the peelable film 6 in the region of the film lying near one of the indentations 47 or 48 (figure 2) and removes this film by peeling it off. The block 5 and the porous frit 4 are then pulled away from the film 6 and removed together therewith (since the film is sealed to the frit at several points), leaving only the membrane 3 secured to the wall 40.

The operation of assembling the filtration unit 1 with the gel growth medium cassette 80 will now be described with reference to figures 9 to 14.

First of all the operator removes the lid 82 protecting the gel growth medium 88 by grasping the flange 92 of this lid to disengage it from the wall 84 (figure 13) in order to access the surface 89 of the gel growth medium.

The operator, having thus removed the surfaces 3'' of the membrane and the cover 89 of the gel growth medium that are to be brought into contact with one another, positions the filtration unit over the cassette as illustrated in figure 9 in order to engage the body of the unit on the body of the cassette.

This engagement operation is continued until the wall 26 of the body of the filtration unit abuts on the ring 100 of the cassette, and then the surface 50 of the wall 26 is brought into contact with the surface 102 of the ring 100 as illustrated in figures 10, 13 and 14.

The unit and the cassette are thus arranged in an intermediate position centered around to one another. In this state, the membrane 3 is still spaced away from the gel growth medium, wherein the surface 3'' of this membrane is facing the convex surface 89 of the gel growth medium, and

they are positioned concentrically relative to one another.

In this position, the operator then exerts a force to bring the unit and the cassette closer together, either by grasping this unit and this cassette between the thumb and other fingers of one hand or by pressing this assembly against his hand and a fixed support.

The operator exerts this force while pressing on the flexible lid 7 of the filtration unit so as to deform the wall 30, and thereby reduce the reception volume 43 as illustrated in figure 11.

Because the valve 8 and the wet membrane 3 enclose the volume 43 in a sealing manner (because of the bubble point phenomenon), pressure slightly rises in this reception volume 43.

In response to this rise in pressure, the membrane 3, held at its periphery against the surface 44, therefore is changed into a slightly domed shape (its surface 3′ becomes concave and surface 3′′ convex) toward the outside of the unit (figure 11), and thereby the centers of the surfaces 3′′ and 89 move closer to one another without touching.

The operator continues and then increases the force for bringing the unit and the cassette closer together until this force exceeds a predetermined threshold beyond which the frangible tabs 101 break.

It should be noted that the threshold at which the frangible tabs break and the flexibility of the lid are chosen in such a way as to cause enough deformation of the lid and that this deformation allows enough of a raised pressure to be created in the chamber 43 to give the membrane a desired domed shape before this breaking threshold is reached.

When the force with which the items are brought closer together exceeds this predetermined threshold, the ring 100 is then released and slides along the wall 84 until it comes into contact with the balcony 86. The stop formed by ring forms is thus removed so that the body of the filtration unit slides along the wall 84 of the cassette, and then this wall 84 is engaged between the walls 26 and 40 of the

filtration unit.

This engagement continues to the point where the unit and the cassette occupy their end-of-travel nested position in which the wall 40 of the unit joins up against the wall 99 of the cassette, and the surface 44 of the wall 40 and the surface 103 of the wall 99 then comes into contact with one another (figure 12).

During this step the surface 3'' of the membrane and the surface 89 of the gel growth medium gradually come into contact with one another, firstly via their center, then spreading out toward their peripheries in such a way as to drive air toward the periphery in order to avoid the formation of air pockets between the membrane and the gel growth medium because such pockets could locally impede the growth of the micro-organisms (figure 12).

The sliding of the filtration unit after the stop 100 was removed causes this unit to move from the intermediate position with respect to the cassette to the position where the unit is nested within this cassette, whereby the operation for covering the gel growth medium becomes by the membrane takes place quickly and effectively in a single action on the side of an operator.

In the nested position, the filtration unit is kept secured to the cassette by the facets 51 of the wall 26 which creates a local deformation of this wall, and thereby allows the wall 84 of the cassette to be nested between the wall 26 and the wall 40 of the unit so that the unit and the cassette cannot be detached from one another unless a substantial force is exerted in order to separate them.

This assembly is then incubated in an incubation chamber for a period long enough to grow the micro-organisms held in the membrane 3 until they become visible and can be counted.

Several assemblies can be stacked on top of one another in the incubation chamber to facilitate storage.

Assemblies can also be inverted in order to limit the condensation forming on the gel growth medium.

In order to count the colonies once incubation is

complete, it is possible either to remove the lid 7 and count the colonies directly or, if this lid is transparent, to count these colonies through this lid.

The use of frangible tabs 101 makes it possible to ensure, from one unit to another, good repeatability of a predetermined threshold force that has to be exerted to remove the ring 100; this ring 100 constituting constitutes a tamper indicator for the gel growth medium cassette, since the ring sits at a different heights, which are either mobile or non-mobile depending on whether or not the cassette has already been used.

In an alternative form that has not been shown here, the removable stop does not belong to a frangible ring but belongs to an elastically deformable tooth or rib. In this case, the stop may optionally act as a locking means (by latching for example) for locking the unit to the cassette in the nested position after the filtration unit is slid.

In yet another alternative form, the removable stop is not formed on the gel growth medium cassette but on the filtration unit.

In yet another alternative form, the lid 7 of the unit is replaced by a non-detachable flexible wall (designed to be domed toward the membrane) or by a peelable film similar to the film 6.

The present invention is not restricted to the embodiment described above but encompasses any alternative form of the embodiment.

CLAIMS

1. A microbiological analysis assembly comprising a filtration unit (1) and a gel growth medium cassette (80), said filtration unit (1) comprising a filter membrane (3) and a body (2) with which said membrane (3) is associated, said cassette (80) comprising a body (81) containing said gel growth medium (88), the gel growth medium (88) having a surface (89) designed to be covered by said membrane (3), wherein: the body (2) of the filtration unit (1) and the body (81) of the cassette (80) are configured in such a manner as to cooperate in order to occupy a nested position in which the membrane (3) covers said surface (89) of said gel growth medium (88), the body (2) of said unit (1) and the body (81) of said cassette (80) are each equipped with an intermediate stop (26, 100); when said stops (26, 100) are brought into contact with one another, the filtration unit (1) and the gel growth medium cassette (80) are each in an intermediate position in which said membrane (3) is spaced away from said gel growth medium (88); and it is possible for at least one of the two stops (100) to be removed so as to allow said filtration unit (1) to move from said intermediate position to said nested position.

2. Assembly according to claim 1, characterized in that said removable stop (100) is configured in such a manner as to be removed when the force with which the unit (1) and the cassette (80) are brought closer together exceeds a predetermined threshold.

3. Assembly according to either one of claims 1 and 2, characterized in that said removable stop (100) belongs to the said cassette (80).

4. Assembly according to claim 3, characterized in that said removable stop (100) is connected to a wall (84) of the said body (81) of the cassette (80) by at least one frangible portion (101).

5. Assembly according to claim 4, characterized in that said removable stop is an annular ring (100).

6. Assembly according to any one of claims 1 to 5, characterized in that said unit (1) comprises a flexible wall (30) for closing a chamber (43), which is further defined by walls (40, 41) of the body (2) of the filtration unit (1) and said membrane (3).

7. Assembly according to claim 6, characterized in that said flexible wall (30) belongs to a lid (7) nested into the body (2) of said unit (1).

8. Assembly according to any one of claims 1 to 7, characterized in that said body (2) of the filtration unit (1) also comprises retaining means (26, 51) for holding said unit to a position in which the unit is nested in said cassette (80).

9. Assembly according to any one of claims 1 to 8, characterized in that the intermediate stop of the body (2) of said unit (1) is a tubular wall (26) that said body (2) comprises.

10. Assembly according to any one of claims 1 to 9, characterized in that the body (2) of the unit (1) and the body (81) of the cassette (80) are also each equipped with an end-of-travel stop (40, 99), said end-of-travel stops (40, 99) being in contact with one another in said nested position.

11. Assembly according to claim 10, characterized in that the end-of-travel stop of the body (2) of the filtration unit (1) is an internal wall (40) surrounded by the wall (26) that forms said intermediate stop.

12. Assembly according to claim 11, characterized in that said membrane (3) is sealed against said internal wall (40).

13. Assembly according to any one of claims 10 to 12, characterized in that said end-of-travel stop of the cassette (80) is a wall (99) provided at the periphery of said gel growth medium (88).

14. Assembly according to claim 13, characterized in that said cassette (80) comprises a tubular wall (84), relative to which said intermediate stop (100) extends

laterally from a first side of the said wall (84), and the said end-of-travel stop (99) extends laterally from a second side of the said wall.

15. Assembly according to any one of claims 1 to 14, characterized in that said gel growth medium (88) has a domed shape, said surface (89) of the gel growth medium that is designed to be covered by said membrane (3) being a convex shape.

16. A microbiological analysis method, characterized in that it comprises the steps of:

- selecting an analysis assembly according to any one of claims 1 to 15;

- engaging said unit (1) on said cassette (80) until the intermediate stop (26) of the body (2) of said unit (1) comes into contact with the intermediate stop (100) of the body (81) of said cassette (80); and

- removing said removable stop (100) so as to allow the said unit (1) to move from the said intermediate position to the said nested position.

17. The method according to claim 16, characterized in that a unit comprising a flexible wall (30) for closing a chamber (43), which is further defined by walls (40, 41) of the body (2) of the filtration unit (1) and said membrane (3) is selected as said filtration unit (1), and that the step of removing said removable stop (100) comprises a step of exerting a force, which is above a predetermined threshold and can bring the said unit (1) and the said cassette (80) closer together, by pressing on said flexible wall (30) of said unit (1).

18. The method according to claim 17, characterized in that a wall configured to deform under force that is smaller than the force required to remove said stop (100) is selected as said flexible wall (30).

19. The method according to any one of claims 16 to 18, characterized in that the method comprises a sampling step prior to the step of engaging said unit (1) on said cassette (80), and a step of growing micro-organisms

collected on said membrane (3) during said sampling step, which comes after the step of removing said stop (100).

20. The method according to claim 19, characterized in that said sampling step comprises the steps of:

- selecting a filtration unit (1) which comprises a peelable film (6);
- filtering a predetermined volume of liquid through the said unit (1); and
- peeling the said film (6).