From WO 2011/154042 A1, apparatuses and methods for dispensing a cell or a particle in a free-flying droplet are known

The inventors have realized that current dispensing methods for individually depositing may detect and deposit cells with high efficiency, while not being 100 % reliable.

Embodiments of the present invention seek to provide apparatuses and methods which may detect cells or particles in a fluid container with high reliability.

There is disclosed an apparatus for detecting cells or particles in a fluid container, comprising:

a dispenser configured to dispense at least one cell or at least one particle into a defined sub-volume of a fluid with which the fluid container is at least partially filled;

a detection apparatus configured to, in a time-coordinated manner with dispensing the at least one cell or the at least one particle by the dispenser, perform a detection in the defined sub-volume and/or in one or several sub-volumes underneath the defined sub-volume in order to sense the at least one cell or the at least one particle when entering the fluid or immediately after entering the fluid.

An aspect of the invention provides a method for detecting cells or particles in a liquid container, comprising:

dispensing a free-flying drop in which at least one cell or at least one particle is encapsulated into a defined sub-volume of a liquid with which a liquid container is at least partially filled; and

sensing the at least one cell or the at least one particle when entering the liquid or immediately after entering the liquid no later than five seconds after entering the liquid by performing, in a time-coordinated manner with dispensing the at least one cell or the at least one particle, a detection in the defined sub-volume and/or in one or several sub-volumes underneath the defined sub-volume, wherein performing the detection comprises focusing an image capturing apparatus on the defined sub-volume and/or the one or several sub-volumes underneath the defined sub-volume and capturing an image of the defined sub-volume and/or of the one or several sub-volumes underneath the defined sub-volume; and wherein the at least one cell or the at least one particle is dispensed onto a surface of the liquid and wherein the liquid container is transparent and the image capturing apparatus is arranged underneath the liquid container.

## Claims

1. Method for detecting cells or particles in a liquid container, comprising:

dispensing a free-flying drop in which at least one cell or at least one particle is encapsulated into a defined sub-volume of a liquid with which a liquid container is at least partially filled;

sensing the at least one cell or the at least one particle when entering the liquid or immediately after entering the liquid no later than five seconds after entering the liquid by performing, in a time-coordinated manner with dispensing the at least one cell or the at least one particle, a detection in the defined sub-volume and/or in one or several sub-volumes underneath the defined sub-volume,

wherein performing the detection comprises focusing an image capturing apparatus on the defined sub-volume and/or the one or several sub-volumes underneath the defined sub-volume and capturing an image of the defined sub-volume and/or of the one or several sub-volumes underneath the defined sub-volume; and

wherein the at least one cell or the at least one particle is dispensed onto a surface of the liquid and wherein the liquid container is transparent and the image capturing apparatus is arranged underneath the liquid container.

2. Method according to claim 1, wherein sensing the at least one cell or the at least one particle occurs no later than 1 second after entering the liquid.

3. Method according to claim 1 or 2, wherein the defined sub-volume comprises an area which is smaller than the area of an entry opening of the liquid container.

4. Method according to claim 1, wherein a detection of the at least one cell or the at least one particle is performed in the defined sub-volume comprising a depth of less than 5mm from the upper surface of the liquid.

5. Method according to any one of claims 1 to 4, wherein, starting with a sub-volume in a greater depth, detections are successively performed in several sub-volumes comprising a respectively decreasing depth, or, starting with a sub-volume in a lesser depth, detections are successively performed in several sub-volumes comprising a respectively increasing depth.

6. Method according to any one of claims 1 to 5, comprising positioning a dispenser, a detection apparatus and each one of several liquid containers relative to each other in order to sense the at least one cell or the at least one particle when entering the liquid or immediately after entering the liquid of this liquid container no later than five seconds after entering the liquid.

7. Method according to any one of claims 1 to 6, comprising using the liquid container comprising a side wall with an edge, a contact angle of the liquid being adjusted with respect to the side wall such that the liquid comprises a flat surface.