In a first aspect of the present invention, a drug product filling device for filling at least one drug product into containers is disclosed. The drug product filling device comprises at least one drug product preparation device, the drug product preparation device being configured for preparing the liquid drug product. The drug product filling device further comprises at least one filling station for filling the liquid drug product into the containers, the filling station being fluidically coupled to the drug product preparation device. The drug product filling device furthermore comprises at least one degassing device, the degassing device being fluidically interposed in between the drug product preparation device and the filling station and the degassing device comprising at least one membrane for at least partially separating off at least one gas from the liquid drug product and at least one in-line filtering device fluidically interposed in between the drug product preparation device and the filling station, wherein the drug preparation device comprises at least one mixing vessel for mixing at least two components of the drug product; wherein the membrane is a non-porous membrane; wherein the degassing device comprises at least one hollow fiber membrane module comprising a plurality of hollow fibers, wherein the hollow fibers are at least partially formed by the membrane and wherein the hollow fibers are sterilizable; and wherein the in-line filtering device comprises a sterile filter.

The term “drug product” as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a solution, a liquid or a suspension that may be usable as a medication or that may be used or prepared in the process of producing a medication or a preparation or that may be used or prepared as an interstage, a precursor or a compound of a medication or a preparation. Thus, the drug product may for example be used as part of or in connection with a treatment of a disease, a prevention, a prophylaxis or a diagnostic analysis. The drug product may specifically comprise at least one gas, such as at least one gas that is dissolved in the solution, the liquid or the suspension of the drug product.

The term “filling device” as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to a device configured for dispensing, releasing or conducting an arbitrary solution, liquid or suspension into receptacles or containers.

The term “container” as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to an arbitrary

container or receptacle configured for holding at least one liquid, such as, for example, a vial, in particular, a glass vial, a syringe or an ampoule.

The term “drug product preparation device” as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be

the degassing device. In particular the holder may be configured to removably receive the degassing device.

In a second aspect of the current invention a method of filling at least one drug product into containers is disclosed. The method comprises the steps disclosed in the following. The steps may specifically be performed in the given order. Still, a different order is possible. The method may comprise additional steps which are not mentioned. It is further possible to perform one or more of the method steps repeatedly. Further, two or more of the method steps may be performed in a timely overlapping fashion or simultaneously.

The method comprises the following steps:

A) providing at least one drug product filling device configured for filling at least one liquid drug product into containers, wherein providing the drug product filling device comprises:
- providing at least one drug product preparation device, the drug product preparation device being configured for preparing a liquid drug product;
- providing at least one filling station for filling the liquid drug product into the containers, the filling station being fluidically coupled to the drug product preparation device;
- providing at least one degassing device being fluidically interposed in between the drug product preparation device and the filling station and the degassing device comprising at least one membrane for separating off at least one gas from the liquid drug product;
- providing at least one in-line filtering device fluidically interposed in between the drug product preparation device and the filling station;

wherein the drug preparation device comprises at least one mixing vessel for mixing at least two components of the drug product;
wherein the membrane is a non-porous membrane;
wherein the degassing device comprises at least one hollow fiber membrane module comprising a plurality of hollow fibers, wherein the hollow fibers are at least partially formed by the membrane and wherein the hollow fibers are sterilizable; and
wherein the in-line filtering device comprises a sterile filter;

B) conducting the drug product from the drug product preparation device to the filling station, wherein the liquid drug product is at least partially degassed upon passing through the degassing device; and

C) filling the at least partially degassed liquid drug product into the containers by means of the filling station.

In particular, step B) of the method may further comprise:

- applying a pressure difference over the membrane using the degassing device, with the liquid drug product being in contact with the membrane on a first side and with an opposing second side of the membrane being exposed to a lower pressure than the first side.

In particular, the degassing device provided in method step A) may be configured for applying the pressure difference over the membrane by comprising at least one of a vacuum source or a vacuum port for applying a vacuum to the second side. The degassing device may further

Claims

1. A drug product filling device for filling at least one liquid drug product into containers, comprising:
   a) at least one drug product preparation device, the drug product preparation device being configured for preparing the liquid drug product;
   b) at least one filling station for filling the liquid drug product into the containers, the filling station being fluidically coupled to the drug product preparation device;
   c) at least one degassing device, the degassing device being fluidically interposed in between the drug product preparation device and the filling station and the degassing device comprising at least one membrane for at least partially separating off at least one gas from the liquid drug product; and
   d) at least one in-line filtering device fluidically interposed in between the drug product preparation device and the filling station;
   wherein the drug preparation device comprises at least one mixing vessel for mixing at least two components of the drug product;
   wherein the membrane is a non-porous membrane;
   wherein the degassing device comprises at least one hollow fiber membrane module comprising a plurality of hollow fibers, wherein the hollow fibers are at least partially formed by the membrane and wherein the hollow fibers are sterilizable; and
   wherein the in-line filtering device comprises a sterile filter.

2. The drug product filling device according to the preceding claim, wherein the degassing device is configured for applying a pressure difference over the membrane, with the liquid drug product being in contact with the membrane on a first side and with an opposing second side of the membrane being exposed to a lower pressure than the first side.

3. The drug product filling device according to the preceding claim, wherein the degassing device comprises at least one of a vacuum source or a vacuum port for applying a vacuum to the second side.

~~4. The drug product filling device according to any one of the preceding claims, wherein the degassing device comprises at least one hollow fiber membrane module comprising a plurality of hollow fibers, wherein the hollow fibers are at least partially formed by the membrane.~~

~~5~~4. The drug product filling device according to the preceding claim, wherein the hollow fibers form fiber bundles.

~~6~~5. The drug product filling device according to the preceding claim, wherein the fiber bundles, on both ends, are embedded in a sealing.

~~7~~6. The drug product filling device according to any one of the two preceding claims, wherein ends of the fiber bundles are connected to connection ports.

~~8~~7. The drug product filling device according to any one of the four preceding claims, wherein the hollow fiber membrane module comprises at least one housing, the housing having the hollow fibers disposed therein.

~~9~~8. The drug product filling device according to the preceding claim, wherein the hollow fiber membrane module comprises at least one fiber entry port connected to a first end of the hollow fibers, at least one fiber exit port connected to a second end of the hollow fibers, and at least one housing entry port and at least one housing exit port, both the housing entry port and the housing exit port being connected to at least one inner space inside the housing between the hollow fibers and a wall of the housing.

~~10~~9. The drug product filling device according to the preceding claim, wherein the hollow fiber membrane module is fluidically interposed in between the drug product preparation device and the filling station in a way selected from the group consisting of:

i) the fiber entry port is fluidically connected to the drug product preparation device, and the fiber exit port is fluidically connected to the filling station; or

ii) the housing entry port is fluidically connected to the drug product preparation device, and the housing exit port is fluidically connected to the filling station.

~~11~~10. The drug product filling device according to the preceding claim, wherein option i) is selected, wherein one or both of the housing entry port and the housing exit port are connected to a suction device.

~~12~~11. The drug product filling device according to claim 10, wherein option ii) is chosen, wherein one or both of the fiber entry port and the fiber exit port are connected to a suction device.

~~13~~12. The drug product filling device according to any one of the preceding claims, wherein the degassing device has at least one entry port connected to the drug product preparation device and at least one exit port connected to the filling station.

~~14~~13. A method of filling at least one liquid drug product into containers, comprising:

A) providing at least one drug product filling device configured for filling at least one liquid drug product into containers, wherein providing the drug product filling device comprises:

- providing at least one drug product preparation device, the drug product preparation device being configured for preparing the liquid drug product;
- providing at least one filling station for filling the liquid drug product into the containers, the filling station being fluidically coupled to the drug product preparation device;
- providing at least one degassing device being fluidically interposed in between the drug product preparation device and the filling station and the degassing device comprising at least one membrane for separating off at least one gas from the liquid drug product;
- providing at least one in-line filtering device fluidically interposed in between the drug product preparation device and the filling station;

wherein the drug preparation device comprises at least one mixing vessel for mixing at least two components of the drug product;
wherein the membrane is a non-porous membrane;
wherein the degassing device comprises at least one hollow fiber membrane module comprising a plurality of hollow fibers, wherein the hollow fibers are at least partially formed by the membrane and wherein the hollow fibers are sterilizable; and
wherein the in-line filtering device comprises a sterile filter;

B) conducting the liquid drug product from the drug product preparation device to the filling station, wherein the liquid drug product is at least partially degassed upon passing through the degassing device; and

C) filling the at least partially degassed liquid drug product into the containers by means of the filling station.

~~15~~14. The method according to claim ~~14~~13, wherein the drug product filling device according to any of claims 1-~~13~~ 12 is used.

~~16~~15. The method according to any one of the two preceding claims, wherein the accuracy of the filling weight of the liquid drug product in the container is increased.

~~17~~16. The method according to any one of the three preceding claims, wherein the stability of at least one oxygen-sensitive active pharmaceutical ingredient in the liquid drug product is increased.

~~18~~17. The method according to any one of the four preceding claims, wherein polysorbate aggregate formation in the liquid drug product is reduced.