QUANTITATIVE DISPENSING DEVICE AND QUANTITATIVE DISPENSING METHOD FOR BIOLOGICAL AGENTS

[0001] The present application is a Continuation Application of PCT Application No. PCT/CN2023/116549, titled "Quantitative Dispensing Device and Method For Biological Agents", filed on September 1, 2023, the entire contents of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of biopharmaceutical technology, and more particularly, to a quantitative dispensing device and quantitative dispensing method for biological agents.

BACKGROUND

[0003] Dispensing of biological agents is an important component of the biomedical technology field and is crucial for cell therapy and pharmaceutical preparation. During the dispensing of the biological agents, in order to avoid contamination, electronic components such as sensors which may be in direct contact with the biological agents are not used, causing the dispensing of the biological agents to be difficult.

[0004] In related technologies, the dispensing of the biological agents is mainly achieved through weighing and manual recording. Although this method can achieve quantitative dispensing of the biological agents, the dispensing efficiency and accuracy are both relatively low.

WHAT IS CLAIMED IS:

1. A quantitative dispensing device for biological agents, comprising:

a storage container with biological agents stored therein;

a dispensing container having a liquid inlet communicating with a liquid outlet of the storage container through a delivery tube; and

a first non-contact sensor and a second non-contact sensor arranged on the delivery tube and located between the liquid inlet of the dispensing container and the liquid outlet of the storage container, and the first non-contact sensor and the second non-contact sensor being separated by a preset distance.

2. The quantitative dispensing device according to claim 1, wherein a quantifier is arranged on the delivery tube between the first non-contact sensor and the second non-contact sensor.

3. The quantitative dispensing device according to claim 2, wherein the quantifier comprises a main body; a flow guide tube is arranged inside in the quantifier, the flow guide tube extends along a preset path, and a length of the preset path is greater than a distance between an inlet and and an outlet of the flow guide tube.

4. The quantitative dispensing device according to claim 3, wherein the flow guide tube is arranged around a center line of the main body and communicates with the delivery tube.

5. The quantitative dispensing device according to claim 4, wherein a cross-sectional area of the flow guide tube is equal to a cross-sectional area of the delivery tube.

6. The quantitative dispensing device according to claim 1, wherein the delivery tube between the first non-contact sensor and the second non-contact sensor is arranged spirally for extending a circulation path of the delivery tube.

7. The quantitative dispensing device according to claim 1, further comprising a pumping member for supplying a delivery power to the delivery tube, and the pumping member is arranged on any one of the delivery tube, the storage container, and the dispensing container.

8. The quantitative dispensing device according to claim 1, wherein a plurality of the dispensing containers are provided, the dispensing containers are arranged in parallel, and a switch valve is arranged on the delivery tube between the liquid inlet of each dispensing container and the liquid outlet of the storage container.

9. A quantitative dispensing method for biological agents, comprising:

obtaining a first bubble detection signal of the biological agents in a delivery tube detected by a first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by a second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the

delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

10. The quantitative dispensing method according to claim 9, wherein in the controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents, an on-off time of a switch valve arranged at the liquid inlet of each dispensing container is controlled under a preset flow rate of a peristaltic pump.

11. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 1, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

12. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 2, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

13. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 3, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

14. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 4, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

15. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 5, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

16. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 6, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the

delivery tube between the first non-contact sensor and the second non-contact sensors; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

17. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 7, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.

18. A quantitative dispensing method for biological agents implemented using the quantitative dispensing device of claim 8, comprising:

obtaining a first bubble detection signal of the biological agents in the delivery tube detected by the first non-contact sensor;

obtaining a second bubble detection signal of the biological agents in the delivery tube detected by the second non-contact sensor;

calculating a time difference between the first bubble detection signal and the second bubble detection signal;

obtaining an actual volume flow rate of the biological agents in the delivery tube through a relationship between the time difference and a volume of the delivery tube between the first non-contact sensor and the second non-contact sensor; and

controlling a flow time of the biological agents in the delivery tube to achieve quantitative dispensing of the biological agents.