with the housing to cool the non-frozen slurry composition held in the disposable cartridge to a temperature sufficient to form ice crystals. The medical ice slurry production system further includes an agitator operable with the actuator of the housing to agitate the medical slurry composition such that the ice crystals are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle, and an access port structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals. In one aspect, there is provided a medical ice slurry production system comprising:

a disposable cartridge holding a non-frozen, sterile medical slurry composition;

a housing supporting the disposable cartridge, the housing including an actuator;

a cooling device operable with the housing to cool the non-frozen slurry composition held in the disposable cartridge to a temperature sufficient to form ice crystals in the disposable cartridge;

an agitator operable with the actuator of the housing to agitate the medical slurry composition such that the ice crystals are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle; and

an access port structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals;

wherein the access port is defined in the disposable cartridge.

[0007] The present disclosure also provides a medical ice slurry production system including a disposable cartridge holding a non-frozen, sterile, medical slurry composition. The disposable cartridge includes an access port.

The medical ice slurry production system further includes a housing supporting the disposable cartridge. The housing including an actuator. The medical ice slurry production system further includes a cooling device operable with the housing so as to cool the non-frozen slurry composition held in the disposable cartridge to a temperature sufficient to form ice crystals in the composition, an agitator operable with the actuator of the housing to agitate the medical slurry composition such that the ice crystals are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle, and a pump operable to pump the medical slurry composition including the reduced ice crystals out of the access port of the disposable cartridge through a disposable delivery tube, while maintaining the sterility of the medical slurry composition including the reduce ice crystals. In one example, there is provided a medical ice slurry production system comprising:

a disposable cartridge holding a non-frozen, sterile, medical slurry composition, the disposable cartridge including an access port;

a housing supporting the disposable cartridge, the housing including an actuator;

a cooling device operable with the housing to cool the non-frozen slurry composition held in the disposable cartridge to a temperature sufficient to form ice crystals in the disposable cartridge;

an agitator operable with the actuator of the housing to agitate the medical slurry composition such that the ice crystals are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle; and

a pump operable to pump the medical slurry composition including the reduced ice crystals out of the access port of the disposable cartridge through a disposable delivery tube, while maintaining the sterility of the medical slurry composition including the reduce ice crystals.

[0008] The present disclosure further provides a medical ice slurry production method including placing, in a housing, a disposable cartridge holding a non-frozen, sterile medical slurry composition, and while placed in the housing, cooling the disposable cartridge to a temperature sufficient to form ice crystals inside the disposable cartridge. The medical ice slurry production method further includes

agitating the medical slurry composition held in the disposable cartridge such that the ice crystals inside the disposable cartridge are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle. In one aspect, there is provided a medical ice slurry production method comprising:

placing, in a housing, the housing including an actuator, a disposable cartridge holding a non-frozen, sterile medical slurry composition;

while placed in the housing, cooling, using a cooling device operable with the housing, the disposable cartridge to a temperature sufficient to form ice crystals in the disposable cartridge, and

agitating, using the agitator operable with the actuator of the housing, the medical slurry composition held in the disposable cartridge such that the ice crystals inside the disposable cartridge are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle through an access port defined in the disposable cartridge,

wherein the access port is structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals.

[0009] The foregoing and other aspects and advantages of the disclosure will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof, and in which there is illustrated by way of illustration a preferred example of the disclosure. Such example does not necessarily represent the full scope of the disclosure, however, and reference is made therefore to the claims and herein for interpreting the scope of the disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0010] The invention will be better understood and features, aspects and advantages other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such detailed description makes reference to the following drawings.

[0011] Fig. 1 is a schematic illustration of a medical ice slurry production system according to one non-limiting example of the present disclosure.

[0012] Fig. 2 illustrates the medical ice slurry production system of Fig. 1 with a cover.

[0013] Fig. 3 illustrates the medical ice slurry production system of Fig. 1 with a liquid in an internal cavity defined by a housing.

[0014] Fig. 4 illustrates the medical ice slurry production system of Fig. 1 with a syringe positioned adjacent to an access port of the medical ice slurry production system.

[0015] Fig. 5 illustrates the medical ice slurry production system of Fig. 1 with an syringe holder coupled to a housing of the medical ice slurry production system.

[0016] Fig. 6 illustrates the medical ice slurry production system of Fig. 4 with one or more filters arranged within a disposable cartridge of the medical ice slurry production system.

CLAIMS

We claim:

1. A medical ice slurry production system comprising:

a disposable cartridge holding a non-frozen, sterile medical slurry composition;

a housing supporting the disposable cartridge, the housing including an actuator;

a cooling device operable with the housing to cool the non-frozen slurry composition held in the disposable cartridge to a temperature sufficient to form ice crystals in the disposable cartridge;

an agitator operable with the actuator of the housing to agitate the medical slurry composition such that the ice crystals are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle; and

an access port structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals;

wherein the access port is defined in the disposable cartridge.

2. The medical ice slurry production system of claim 1, wherein the disposable cartridge includes one of a syringe or a canister.

3. The medical ice slurry production system of claim 1, wherein the access port is structured and arranged to allow a syringe to engage the access port and withdraw the slurry composition.

4. The medical ice slurry production system of claim 1, wherein the agitator includes at least one a vibrating device or a rotating device.

5. The medical ice slurry production system of claim 1, wherein the agitator includes a rotating device structured and arranged to rotate back-and forth.

6. The medical ice slurry production system of claim 1, wherein the agitator is attached to the disposable cartridge.

7. The medical ice slurry production system of claim 1, wherein the agitator is attached to the actuator supported by the housing.

8. The medical ice slurry production system of claim 1, wherein the actuator includes a motor structured and arranged to cause the agitator to agitate the medical slurry composition inside the disposable container such that ice crystals inside the disposable cartridge are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered through an end of a needle for injecting the medical slurry composition into a patient.

9. The medical ice slurry production system of claim 1, wherein the access port is defined in the disposable cartridge.

10. The medical ice slurry production system of claim 1, wherein the access port is a first access port defined in the disposable cartridge, and which includes a second access port defined in the housing, the first access port and the second access port in fluid communication so as to allow the medical ice slurry composition to be withdrawn from the disposable cartridge while maintaining the sterility of the medical slurry composition

11. The medical ice slurry production system of claim 1, wherein the cooling device includes at least one of standard refrigeration, magnetic refrigeration, electrical cooling, or chemical cooling.

12. The medical ice slurry production system of claim 1, wherein at least one of (i) a luer lock with a shut-off, (ii) a pressure valve, (iii) a quick disconnect, (iv) a one-way valve with luer lock, and (v) a sterile rubber stopper is operable with the access port to selectively allow the sterile medical slurry composition to be withdrawn from the disposable cartridge through the access port.

13. The medical ice slurry production system of claim 1, wherein the reduced ice crystals are less than approximately one millimeter.

14. The medical ice slurry production system of claim 1, wherein the actuator is operable to rotate the agitator at a rotational speed between approximately 1000 revolutions per minute and 45000 revolutions per minute.

15. The medical ice slurry production system of claim 1, wherein the agitator includes one or more blades each sized to define a length between approximately 12.5% and approximately 99% of a diameter of the disposable cartridge.

16. The medical ice slurry production system of claim 1, further comprising:

a pump operable to pump the medical slurry composition including the reduced ice crystals out of the access port of the disposable cartridge through a disposable delivery tube, while maintaining the sterility of the medical slurry composition including the reduce ice crystals.

17. A medical ice slurry production method comprising:

placing, in a housing, the housing including an actuator, a disposable cartridge holding a non-frozen, sterile medical slurry composition;

while placed in the housing, cooling, using a cooling device operable with the housing, the disposable cartridge to a temperature sufficient to form ice crystals in the disposable cartridge, and

agitating, using the agitator operable with the actuator of the housing, the medical slurry composition held in the disposable cartridge such that the ice crystals inside the disposable cartridge are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle through an access port defined in the disposable cartridge,

wherein the access port is structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals.

18. The medical slurry producing method of claim 17, which includes withdrawing the medical slurry composition including the reduced ice crystals from the disposable cartridge while maintaining the sterility of the medical slurry composition.

19. The medical slurry producing method of claim 17, which includes pumping the medical slurry composition including the reduced ice crystals from the disposable cartridge while maintaining the sterility of the medical slurry composition.

20. The medical slurry producing method of claim 17, wherein agitating includes causing an actuator to agitate the medical slurry composition such that the ice crystals inside the disposable cartridge are reduced to a size sufficient to allow the medical slurry composition including the reduced ice crystals to be delivered to a patient through an end of a needle.