MEDICAL ICE SLURRY PRODUCTION AND DELIVERY SYSTEMS AND METHODS

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

[0002] Not Applicable.

BACKGROUND

[0003] The disclosure relates generally to ice slurries for medical use and, more specifically, to systems and methods for medical ice slurry production and withdrawal or injection.

[0004] Ice slurries used in medical applications typically comprise a partially frozen saline solution. Medical ice slurries are used in surgical applications to induce therapeutic hypothermia and slow organ and tissue metabolic rates thereby protecting a patient's organs during a surgical procedure. Medical ice slurries are also injected into a patient for selective or non-selective cryotherapy and/or cryolysis.

BRIEF SUMMARY

[0005] The present disclosure provides systems and method for medical ice slurry production. In particular, medical ice slurry production systems and methods are disclosed that enable an end user/clinician to produce and deliver a sterile medical ice slurry composition at the point of care.

[0006] The present disclosure provides a medical ice slurry production system including a disposable cartridge holding a non-frozen, sterile medical slurry composition. The system further includes a housing supporting the disposable cartridge. The housing includes an actuator, and 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. 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an access port structured and arranged to allow the medical slurry composition including the reduced ice crystals to be withdrawn or injected from the disposable cartridge, while maintaining the sterility of the medical slurry composition including the reduced ice crystals.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.

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

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

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.

[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 embodiment of the disclosure. Such embodiment 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.