- Pump systems have been designed to pump the mixture through the different temperature zones, which have been separated in space, inside a tube made from for example PTFE.
- PCR on chip depends on moving very small amounts of mixture, i.e. droplets with no more than several nano litres through temperature zones, which have been created. Moving can be done by pumping or by magnetic fields, if the DNA has been labelled with magnetic beads.
- Yet another system changes the temperatures in purposely-constructed cuvettes by blowing gas of the correct temperature under high pressure through the cuvette.

Summary of the invention

The object of the disclosure~~invention~~ is to provide a device that can be used to change the temperature of a substance in a faster way than known from the prior art.

To that effect, the disclosure~~invention~~ provides a temperature control device as ~~claimed in claim 1~~described herein. Embodiments of this device are ~~claimed~~ defined in dependent claims 2-~~12~~20.

A system comprising such a device is claimed in claim ~~13~~. Embodiments of the system are claimed in dependent claims ~~14-18~~2-20.

Methods in accordance with the ~~invention~~ disclosure are claimed in claims ~~19-20~~21 and 22.

In one aspect, there is provided a system comprising a temperature control device and at least one bag (17(i)) containing reaction mixes, the temperature control device being arranged to control a temperature of said at least one bag to obtain a first temperature (T1) and to change to a second temperature (T2), the temperature control device comprising at least a first heating block (27(1); 34(1)) and a second heating block (29(1); 34(1)), as well as a heating device (47), the heating device (47) being arranged to heat said first heating block (27(1); 34(1)) to said first temperature (T1) and to heat said second heating block (29(1); 34(1)) to said second temperature (T2), the temperature control device having a first object comprising either a first further heating block (27(2)) or a first isolator (43(1)) arranged opposite to said first heating block (27(1)) such as to define a first space between them arranged to receive said at least one bag and define a first temperature zone (27(3)) having the first temperature (T1) and the temperature control device having a second object comprising either a second further heating block (29(2)) or a second isolator (45(1)) arranged opposite to said second heating block (29(1)) such as to define a second space between them arranged to receive said at least one bag and defining a second temperature zone (29(3)) having the second temperature (T2), the

first and second spaces being arranged such that the at least one bag can be moved from the first temperature zone (27(3)) to the second temperature zone (29(3)), said at least one bag (17(i)) having a wall thickness of 0.01 mm or thinner and a volume in the range of 5 to 100 µl, and the heating blocks (27(1), 29(1); 27(2)/29(2)) having a heat capacity which is at least 10 times higher than the heat capacity of said at least one bag (17(i)) containing reaction mixes.

In another aspect, there is provided a method of using a system as described herein, characterized by:

- Providing said at least one bag (17(i)) with a primer and an amount of double-stranded DNA,
- Moving said at least one bag (17(i)) into said first temperature zone such as to perform a denaturing action on said DNA and render said at least one bag (17(i)) with denatured DNA,
- Moving said at least one bag (17(i)) with denaturated DNA to said second temperature zone such as to perform an annealing action with said primer and render said at least one bag with (17(i)) with an annealed substance,
- Moving said at least one bag with (17(i)) with said annealed substance to said third temperature zone such as to perform an extension action.

Brief description of the drawings

The invention will be explained in detail with reference to some drawings that are only intended to show embodiments of the invention and not to limit the scope. The scope of the invention is defined in the annexed claims and by its technical equivalents.

The drawings show:

Figure 1A-1C show a method of making bags 17(i) filled with a substance to be changed in from one temperature to another;

Figures 2A, 2B, 3, 4, 5, 6, 7 show embodiments of the temperature control device according to the invention.

Detailed description of embodiments

Here a system is proposed for changing the temperature in substances, preferably reaction mixes, more preferably nucleic acid amplification reaction mixes, even more preferably PCR-reaction mixes, most preferably a liquid PCR-reaction mix ,with great speed and accuracy.

Claims

1. System comprising a temperature control device and at least one bag (17(i)) containing reaction mixes,

the temperature control device being arranged to control a temperature of said at least one bag to obtain a first temperature (T1) and to change to a second temperature (T2), the temperature control device comprising at least a first heating block (27(1); 34(1)) and a second heating block (29(1); 34(1)), as well as a heating device (47), the heating device (47) being arranged to heat said first heating block (27(1); 34(1)) to said first temperature (T1) and to heat said second heating block (29(1); 34(1)) to said second temperature (T2), the temperature control device having a first object comprising either a first further heating block (27(2)) or a first isolator (43(1)) arranged opposite to said first heating block ((27(1)) such as to define a first space between them arranged to receive said at least one bag and define a first temperature zone (27(3)) having the first temperature (T1) and the temperature control device having a second object comprising either a second further heating block (29(2)) or a second isolator (45(1)) arranged opposite to said second heating block ((29(1)) such as to define a second space between them arranged to receive said at least one bag and defining a second temperature zone (29(3)) having the second temperature (T2), the first and second spaces being arranged such that the at least one bag can be moved from the first temperature zone ((27(3)) to the second temperature zone ((29(3)),

said at least one bag (17(i)) having a wall thickness of 0.01 mm or thinner and a volume in the range of 5 to 100 µl, and

the heating blocks (27(1), 29(1); 27(2)/29(2)) having a heat capacity which is at least 10 times higher than the heat capacity of said at least one bag (17(i)) containing reaction mixes.

2. The system according to claim 1, wherein the temperature control device comprises at least a first set of heating blocks (27(1)/27(2)) and a second set of heating blocks (29(1)/29(2)), the heating device (47) being arranged to heat said first set of heating blocks (27(1)/27(2)) to said first temperature (T1) and to heat said second set of heating blocks (29(1)/29(2)) to said second temperature (T2), the first set of heating blocks ((27(1)/27(2)) being separated from the second set of heating blocks ((29(1)/29(2)) by a temperature isolating material ((43(1)/43(2)).

3. The system according to claim 2, wherein the temperature isolating material ((43(1)/43(2)) is made of polyoxymethylene (POM).

4. The system according to claim 1, 2 or 3, wherein the heating blocks ((27(1)/27(2), 29(1)/29(2)) are made of one of a metal, a bag filled with a liquid, and a bag filled with gas.

5. The system according to claim 2, 3 or 4, wherein the temperature control device comprises a driving device (39) arranged to move said first heating block (27(1)) and said first object relative to one another, and to move said second heating block (29(1)) and said second object relative to one another such as to press against the at least one bag (17(i)).

6. The system according to claim 5, wherein the driving device (39) is arranged to press against said at least one bag (17(i)) with a force in a range between 1-10 N.

7. System according to claim 6, wherein said force is between 3-8 N.

8. System according to claim 6, wherein said force is between 4-6 N.

9. The system according to any of the preceding claims, comprising a scanner, the scanner comprising a light source (32) for producing light with a first wave length (λ1), a first lens (30(1)) for directing said light to said at least one bag, a detector (34) for receiving light emitted from said at least one bag at a second wavelength (λ2), and a processor (36) connected to said detector (34) to receive an output signal from said detector (34) and to analyse said reaction mixes within said at least one bag based on said received output signal.

10. The system according to claim 9, wherein said second heating block (29(1)) comprises two separate heating blocks (29(1,1)/29(1,2)), said first lens (30(1)) being arranged between said two separate heating blocks (29(1,1)/29(1,2)).

11. The system according to claim 10, wherein said second further heating block (29(2)) comprises two further separate heating blocks (29(2,1)/29(2,2)), said scanner comprising a second lens (30(2)) arranged between said two further separate heating blocks (29(2,1)/29(2,2)) in order to receive said light emitted from said at least one bag at said second wavelength (λ2) and transmit it to said detector (34).

12. The system according to any of the preceding claims, wherein at least the first heating block (27(1)) comprises a first slot (28(1)) in a first surface and the first further heating block (27(2)) comprises a second slot (28(2)) in a second surface opposing said first surface.

13. The system according to any of the preceding claims, wherein all sets of heating blocks are arranged on a circle such that all said temperature zones are located on said circle.

14. The system according to claim 1, wherein the first heating block (27(1)) and the second heating block (29(1)) are integral parts of a third heating block

(34(1)) having first and second end portions, said first heating block being formed by said first end portion and said second heating block being formed by a portion between said first and second end portions.

15. The system according to any of the preceding claims , wherein said reaction mixes comprise PCR-reaction mixes.

16. The system according to claim 15, wherein said heating device (47) is arranged to control said first heating block (27(1)) to be on said first temperature and said second heating block