

INNOVATIVE SYSTEM FOR HEATING OF BIOCHEMICAL APPARATUS "LAB-ON-A-DISC"

Fields of use

Diagnostics, Diagnosis, Gene - DNA Therapy, Cellular and Molecular Biology, Genetic Engineering, In vitro Testing, Trials, Industrial genetic engineering applications, Gene Splicing and Manufacturing Equipment, Genetic Engineering, Diagnostic equipment

Current state of technology

Available for demonstration

Type of cooperation

License agreement

Intellectual property

Patent(s) applied for but not yet granted

Developed by

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Summary

A Slovenian research institute offers an innovative heating "lab-on-a-disc" system for use in biochemical tests and processes, developed by international cooperation. System includes a simple, accurate, fast and cost-effective heater, which provides and maintains temperatures suitable for polymerase chain reaction commonly used in bioscience and medicine. Companies engaged in biochemical testing are sought for license agreement.

Description of the invention

Diagnostics in medicine, biopharmacy, molecular biology, etc. use different types of methods for their research and analytical purposes. One of widely used procedures in laboratories is the polymerase chain reaction (PCR). Recent development of these systems and methods shows focus into integrated and low-cost devices, where systems like "lab-on-a-chip" and "lab-on-a-disc" promise potential to shorten and simplify the whole process. Both mentioned systems can even simulate several laboratory functions simultaneously and consequently provide faster analysis, lower consumption of reagents or samples, and simple use. In "lab-on-a-disc" technology, standard compact discs (CDs) are supplemented by channels and chambers for liquids and the pumping of fluids in the microfluidic system thus created is achieved by rotating the disc and thus providing a centrifugal force. While "lab-on-a-disc" is frequently used for biochemical tests, there are some obstacles that need to be overcome to ensure appropriate conditions.

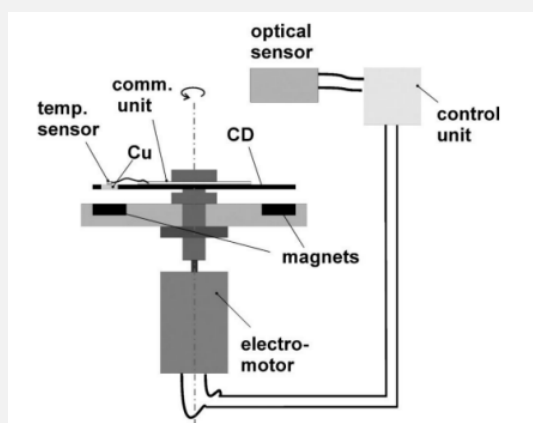
Heater and temperature control are essential to guarantee all necessary requirements for normal and planned procedure. As an example, PCR requires between 15 and 50 thermal cycles, while reaction chamber temperature needs to be precisely controlled. Additionally, temperature has to be alternated between three different temperature levels, in general between 53°C and 95°C. Systems typically use solutions like hot-air blowers, infrared light emitters, laser devices, microwave emitters, or Peltier heater, where thermoelectric effect converts electrical current into heat.

Combined research efforts and knowledge from fields of energy physics, engineering and technology of scientists from Slovenia and Sweden resulted in a new system for "lab-on-a-disc", where temperature is precisely controlled and adjusted by speed of disc rotation, with very short responsive times. Compared to other solutions on a market, this system provides greater functionality and more closely accommodates to the needs in laboratories.

New system is a combination of a "lab-on-a-disc" and biochemical testing apparatus, communication disc, attached heater, motor, temperature sensors, conducting element, controllers and other parts. Reagents and/or samples are inserted in a reaction chamber (or some other form of biochemical testing apparatus) and according to requirements,

disc is rotated at the specified velocity. In general, system allows adjustability of many parts. A reaction chamber can be used for amplification and detection of nucleic acids (e.g. PCR, loop-mediated amplification protocols), to induce endothermic reactions or biological processes, where elevated temperature is required.

The temperature is controlled and maintained by (1) rotational frequency or by (2) adjusting the distance between specific parts of the system. There is no need for any additional heaters for thermal cycling. Sensed temperature is transmitted to external controller with contactless method. Highest temperature required for polymerase chain reaction is attained within a few seconds (1 – 5 s). System allows higher temperatures to be attained also (over 120°C).



Cross-sectional schematic view of a heater "lab-on-a-disc"

Main Advantages

- System provides simple, accurate, fast and cost-effective heating, which is inevitable for application of most commonly used biochemical reaction – polymerase chain reaction – on 'lab-on-a-disc'.
- System has integrated temperature sensors and regulators which enable accurate regulation of the temperature.
- The heater can be used for different types of biochemical tests and procedures.
- The heater can be used alone or as an 'add on' in existing products.

Partner Sought

Research institute from Slovenia is looking for companies that are engaged in diagnostics in medicine, biopharmacy, microfluidics and other fields of natural science, where biochemical analysis is applied on a regular basis. New system can be utilized for polymerase chain reaction and many other biochemical processes, where "lab-on-a-chip" with specified rotations and controlled heat is required. The partners are expected to enter licensing agreements with the aim of implementing the invention into the existing or emerging products.