

Skin Microcirculation System

Noninvasive, less painful, continuous measurement equivalent to drawing blood

Overview

In order to grasp the state of health, biological components (blood sugar, lactic acid, etc.) are measured by blood sampling. However, since continuous measurement is difficult and invasive, the burden on the user is large. Therefore, the present invention provides a biological component measuring sensor which can measure biological components in real time for a long time and does not cause pain to the user.

Specifically, a probe for measuring biological components has been developed which collects subcutaneous tissue fluid like dialysis by applying special processing to an ultra-fine needle inserted into the skin. A micro reflux needle with a channel covered with a perforated membrane on the surface of the metal needle is inserted and placed in the skin, and reflux fluid (physiological saline) is circulated through the channel. Since a substance in the skin tissue enters the reflux fluid through the hole in the channel due to concentration diffusion (osmotic pressure), the substance is flowed outside the body and the blood concentration is estimated from the concentration in the reflux fluid measured by a sensor installed outside the body.

The present invention enables non-invasive, low-pain continuous measurement equivalent to blood sampling simply by attaching a micro-needle to the skin.

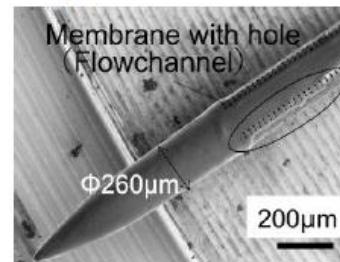
Product Application

- Lactic acid concentration measurement (sports)
- Glucose concentration measurement
- Therapeutic drug monitoring Stress, mental health assessment, etc.

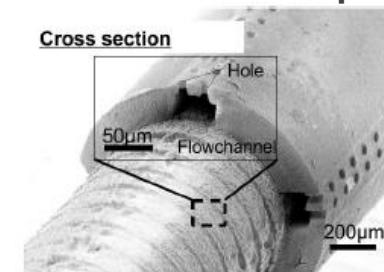
IP Data

IP No.	: JP6120257
Inventor	: HAGA Yoichi, MATSUNAGA Tadao, NAGATOMI Ryoichi ISHII Kenji, TSURUOKA Noriko
Admin No.	: T11-045

Top view

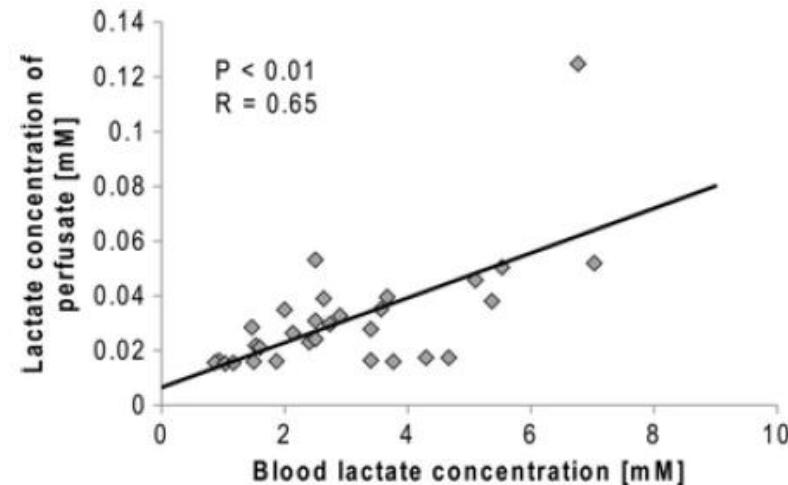


Cross section



Measurement of lactate concentration in mice

Relationship between the refusion solution of the invention and the lactic acid concentration in the blood



Related Works

[1] N. Tsuruoka, K. Ishii, T. Matsunaga, R. Nagatomi, Y. Haga, Lactate and glucose measurement in subepidermal tissue using minimally invasive microperfusion needle, *Biomed Microdevices*, Vol.18, No.19 (2016)

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Constant Flow Valve · Powerless Liquid Delivery System

Compact, low-cost, long-running non-power supply system

Overview

In drug delivery systems, POCT (Point of Care Testing) devices, and microdialysis, it is important to deliver fluid at a constant flow rate in order to maintain an appropriate dose and improve the recovery rate and sensitivity of biological materials. In the skin microreflux system developed in Japanese Patent No. 6120257 (related patent 1/2), a constant flow rate and slow flow rate of reflux fluid are required in order to improve the recovery rate and sensor sensitivity of biological materials. In addition, small size, low cost, and low power are required for practical application of microreflux systems.

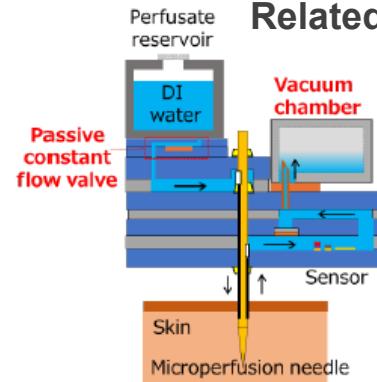
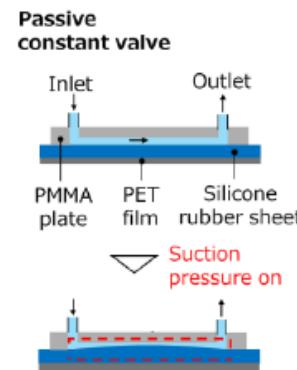
The present invention is a non-power supply fluid delivery system using a passive constant flow valve driven by negative pressure using a vacuum housing and expansion of a silicone resin membrane. In this system, when suction pressure from the outlet increases, the silicone resin membrane expands accordingly, and the flow rate is controlled at a constant level of 5 $\mu\text{m}/\text{min}$ or less by narrowing the cross-sectional area of the flow path. The system can be driven for more than 2 hours.

Product Application

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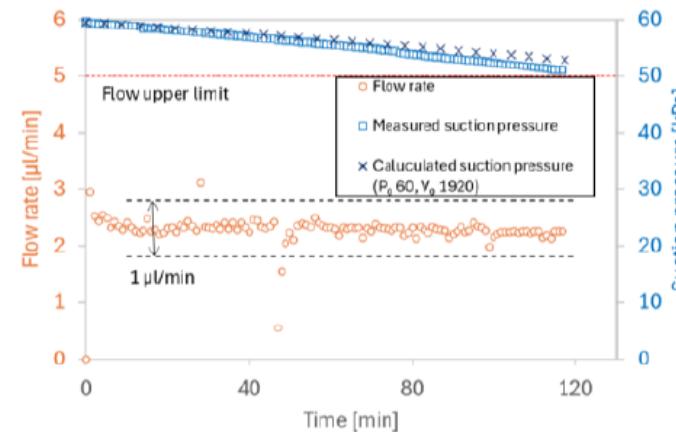
IP Data

IP No. : JP2025-084086
 Inventor : TSURUOKA Noriko, HAGA Yoichi, KAYABA Koyo
 Admin No. : T25-009



Flow rate and pressure measurement of this system

Achieved constant flow rate and 2-hour operation



Related Works

[1] KAYABA Koyo, HAGA Yoichi, and TSURUOKA Noriko, "Non-power supply liquid feeding system using laminate structure constant flow valve of PMMA plate and PDMS membrane and vacuum housing," Journal of the Institute of Electrical Engineers of Japan, E. vol. 145, No. 5, pp. 69-74, 2025 (in Japanese).

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