A Wearable Oxygen Sensor For Rabbit Conjunctiva

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Transcutaneous oxygen monitoring has been widely used for monitoring arterial oxygen pressure [1], [2] of baby in the purpose of maintaining adequate arterial oxygenation. This is applicable in neonatal intensive care unit for preventing oxygen poisoning in baby caused by retinopathy of prematurity or/and hypoxia. However, current transcutaneous oxygen electrode has a rigid cell and has to be fixed to the skin with adhesive plaster, resulting in common skin rashes. In addition, thermoregulation of skin surface at about 45 ºC is necessary in order to improve a gas penetration from arterial vessel. Warming a electrode for long-term may cause a skin burn [3]. The conjunctiva has been reported as a soft skin area with high gas penetration. In this study, a novel thinner and transparent wearable oxygen sensor was developed with using some functional polymers.

A novel wearable oxygen sensor based on the Clark-type electrode was developed with using a limber gas-permeable membrane. Developed sensor has three layer, a limber gas-permeable membrane (FEP, film thickness: 25 μm), a membrane filter containing electrolytic solution and a non-permeable membrane (Ionomer, film thickness: 50 μm). Au electrode and Ag/AgCl electrode were fabricated on a gas-permeable membrane by using photolithography and sputtering methods. The developed sensor is 3 mm wide and 84 μm thick. For evaluation of it, the sensor output was evaluated by measurement of standard air and 30 % oxygen gas. Then the electrode part of it was placed directly to a conjunctiva of a Japanese white rabbit which inhaled standard air and high concentration oxygen (95 %) alternately. The sensor output was monitored by an A/D converter and recorded by a PC.The sensor was evaluated with a computer-controlled potentiostat at a potential of 600 mV vs. Ag/AgCl. In purging 30% oxygen, the sensor output decreased significantly. The time constant was 55 seconds. As an rabbit experiment, the rabbit inhaled standard air and high concentration oxygen (95%) alternately. As the result, sensor output increased and decreased synchronously with high concentration oxygen and standard air inhaling respectively. This result suggests that the developed sensor can be used as a new transcutaneous oxygen sensor.

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