



一种低功耗无创血糖仪设计与性能测试

作者：贺银增,肖宏辉,常凌乾,刘春秀,蔡新霞

单位：中国科学院电子学研究所

基金项目：863计划项目“心血管疾病多参数监测微系统”(No. 2007AA042105)、中科院创新项目“低成本便携式生化检测仪”

摘要：

结合反离子电渗抽取原理，设计了一款基于MSP430F1611芯片的低功耗血糖仪，配合自制的三电极葡萄糖传感器，实现对组织液葡萄糖的无创抽取和低浓度葡萄糖的检测。该仪表采用MSP430F1611作为主芯片，对其它功能模块进行了低功耗设计，在3.7 V工作电压下最大工作电流降低至17.31 mA。设计了模拟实验和动物实验验证了该仪表的反离子电渗抽取和对低浓度葡萄糖的检测能力。仪表在模拟皮肤电阻抗小于80 kΩ时，可实现恒流抽取，当大于80 kΩ时，可实现恒压抽取。动物实验结果表明，可进行反离子电渗和检测。在葡萄糖浓度5~200 μM范围内，仪表的响应电流与葡萄糖浓度呈现良好的线性关系，线性相关系数为0.9979，检测灵敏度达到15.619 nAμM⁻¹。仪表为动物实验研究奠定基础。

关键词：葡萄糖生物传感器；无创血糖检测；反离子电渗；低功耗

Design of a Low-power Non-invasive Glucose Monitor and Test of It's Performance

Author's Name:

Institution:

Abstract:

Design of a low-power based non-invasive glucose monitor and the test of it's performance are introduced in this paper. Based on reverse iontophoresis, the device can extract substances from subcutaneous space outward to the skin surface on-invasively. Low-concentration glucose can be detected by a high-sensitively enzyme biosensor. In order to improve stability of the monitor and reduce the power consumption, microcontroller MSP430F1611 was used in this device. The system's maximum working current is reduced to 17.31mA at 3.7 V voltage supply. The experiments results proved that the device can extract glucose from tissue liquid through skin and detect low concentration glucose. The system works in low frequency field, so skin can be simulated by resistance. The performance test proved that if resistance is less than 80 kΩ the extracting current is constancy 100 μA, else the extracting voltage is constancy 8 V. Low concentration glucose can be obtained by reverse iontophoresis in pig experiment. In the experiment of low concentration glucose, good linearity of glucose concentration and responsible current is obtained between 5~200 μM with the linear correlation coefficient of 0.9979. The detection sensitivity of biosensor is 15.619 nAμM⁻¹.

Keywords: glucose biosensor, non-invasive glucose monitoring, reverse iontophoresis, low power consumption

投稿时间：2010-01-08

[查看pdf文件](#)