

张晓枫<sup>1,3</sup>, 刘光达<sup>1</sup>, 辛桂杰<sup>2</sup>, 焦阳<sup>1</sup>, 徐国忠<sup>3</sup>

1. 吉林大学 仪器科学与电气工程学院, 吉林 长春 130061;
2. 吉林大学 第一医院, 吉林 长春 130061;
3. 长春理工大学 生命科学技术学院, 吉林 长春 130022

**摘要:** 针对常规的色素浓度测量方法存在操作复杂、有创和非连续等问题,研究了基于色素稀释和排泄试验的脉搏光谱分析方法。通过静脉注射吲哚菁绿指示剂,选定两特定波长的近红外光作为吲哚菁绿色素吸光度测量点,并采用指夹式传感器提取人体指尖末梢血的光谱信号,通过连续记录色素浓度稀释曲线,实现了分离吲哚菁绿浓度谱和脉搏血氧吸收光谱的算法。最后分析呈指数衰减规律变化的半对数坐标色素浓度图,完成了色素血浆消失率 $K$ 和15 min滞留率 $R_{15}$ 等肝血流参数的无创测量。该方法基于Lab-VIEW平台,结合自适应差分阈值法,有效剔除了血红蛋白吸收光谱和基线漂移的干扰,各项参数检测准确率高, $K$ 值平均测量误差小于0.008。该检测理论和方法既可用于临床肝切除手术的术前、术中和术后的肝储备功能检查,也可为医学研究提供相应的中间测量过程及中间观察变量。

**关键词:** 吲哚菁绿 色素浓度谱 血红蛋白 红外吸收光谱 脉搏波 肝血流参数

## Measurement of liver blood flow parameters combined with near-infrared spectroscopy

ZHANG Xiao-feng<sup>1,3</sup>, LIU Guang-da<sup>1</sup>, XIN Gui-jie<sup>2</sup>, JIAO Yang<sup>1</sup>, XU Guo-zhong<sup>3</sup>

1. Department of Instrument Science and Electrical Engineering, Jilin University, Changchun 130061, China;
2. The First Bethune Hospital, Jilin University, Changchun 130061, China;
3. Department of Life Science and Technology, Changchun University of Science and Technology, Changchun 130022, China

**Abstract:** A pulse spectroscopic scheme based on dye dilution and an excretion test was developed to overcome the shortcomings of conventional blood dye concentration measuring method in complex operation, invasive treatment and non-continuance. Firstly, Indocyanine Green(ICG) was intravenously injected and a finger clip sensor was used to extract spectral signals of fingertips for a sufferer. Then, by recording the dye dilution curve simultaneously, the algorithm to isolate ICG absorption spectrum from the disturbance of peripheral arterial blood was implemented. Finally, the ICG plasma disappearance rate  $K$ , 15 min retention rate  $R_{15}$  and other hepatic hemodynamic parameters were deduced by analyzing the semi-logarithmic dye concentration graph. Combining a lab-VIEW software platform with an adaptive differential threshold method, proposed scheme eliminates the interference come from the hemoglobin absorption spectrum and baseline drift, improves the measuring accuracy greatly, and the average measurement error of  $K$  is less than 0.008. This method is great value to not only the assessing hepatic functional reserve at pre-operation, intra-operation, post-operation, but also providing a way to monitor some middle variables for clinical research purposes.

**Keywords:** indocyanine green dye concentration spectrum hemoglobin infrared absorption spectrum pulse wave liver blood flow parameter

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通讯作者: 张晓枫, E-mail: zhangxf@cust.edu.cn

**作者简介:** 焦阳(1970-),男,吉林长春人,博士研究生,副教授,1993年于长春地质学院获得学士学位,2006年于吉林大学获得硕士学位,主要从事光电检测技术及仪器方面的研究。E-mail: jy5276@163.com  
作者Email: zhangxf@cust.edu.cn

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