Design of non-invasive skin cholesterol detection system based on absorption spectroscopy

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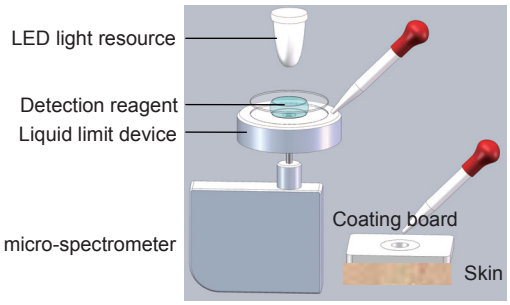

Block diagram of the measurement system

Overview: Studies have shown that the accumulation of cholesterol in human skin correlates with the risk of developing atherosclerotic disease. Skin cholesterol has a better correlation with the risk of atherosclerotic disease compared to traditional blood cholesterol. A simple, noninvasive procedure “Three Drops” for estimation of skin cholesterol was proposed as an alternative screening method. The test, which uses different concentrations of a digitonin–copolymer–horseradish peroxidase (HRP) conjugate and visual scoring, is capable of evaluating different skin cholesterol levels. According to the procedure, researchers have proposed a skin cholesterol detection method based on diffuse reflectance spectroscopy technology. This method directly detect the diffuse reflectance spectrum information of the reagent after the reaction on the skin surface. Because this method is directly measured on the palm surface, many interference factors are introduced. Using STM32 microprocessor, a non-invasive skin cholesterol detection system based on absorption spectroscopy was designed. The relative cholesterol content of human skin was indirectly obtained by absorption spectrum information of colored products which was detected by micro-spectrometer. The system was designed with a high-precision adjustable LED constant current source, and the fluctuation range of LED light intensity is controlled within ±1%. A liquid limit device with a simple structure, a small amount of reagents, and no need for an exact detection reagent volume was also designed to achieve accurate measurement of the measured liquid concentration. By detecting the concentration of $CuSO_4$ solution, the accuracy of the system for quantitative detection of different concentrations of solution was verified. Using this system to detect the skin cholesterol of patients with atherosclerotic disease and control population, the test results have statistically significant differences, which preliminarily verifies the system can be used for human skin cholesterol detection.

Citation: Xu C, Fang Z H, Dong M L, *et al*. Design of non-invasive skin cholesterol detection system based on absorption spectroscopy[J]. *Opto-Electronic Engineering*, 2018, **45**(4): 170587

Supported by National Science and Technology Support Program(2015BAI01B04), National TCM Clinical Research Base for the Second Batch of Business Research Projects (2015D05), State Administration of Traditional Chinese Medicine National Basic Public Health Service Project (20151012), Anhui Province Major Science and Technology Projects (15CZZ02019), Anhui Province Natural Science Foundation (1508085QF141) and Chinese Academy of Sciences STS project (KFJ-SW-STS-161)
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