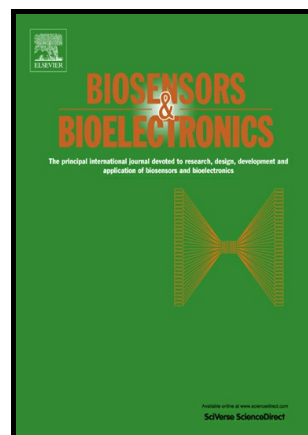


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White Blood Cell Counting on Smartphone Paper Electrochemical Sensor

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Abstract

White blood cell (WBC) analysis provides rich information in rapid diagnosis of acute bacterial and viral infections as well as chronic disease management. For patients with immune deficiency or leukemia WBC should be persistently monitored. Current WBC counting method relies on bulky instrument and trained personnel and is time consuming. Rapid, low-cost and portable solution is in highly demand for point of care test. Here we demonstrate a label-free smartphone based electrochemical WBC counting device on microporous paper with patterned gold microelectrodes. WBC separated from whole blood was trapped by the paper with microelectrodes. WBC trapped on the paper leads to the ion diffusion blockage on microelectrodes, therefore cell concentration is determined by peak current on the microelectrodes measured by a differential pulse voltammeter and the quantitative results are collected by a smartphone wirelessly within 1 minute. We are able to rapidly quantify WBC concentrations covering the common physiological and pathological range ($200 \sim 20000 \mu\text{L}^{-1}$) with only $10\mu\text{L}$ sample and high repeatability as low as 10% in CoV (Coefficient of Variantion). The unique smartphone paper electrochemical sensor ensures fast cell quantification to achieve rapid and low-cost WBC analysis at the point-of-care under resource limited conditions.

Keywords: label-free; smartphone; paper electrochemical; white blood cell; diffusion impedance; point-of-care

1. Introduction

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