PORTABLE WIRELESS DEVICE FOR HEMOGLOBIN LEVEL MONITORING

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***Abstract*— The wireless detection of hemoglobin from whole blood with very small volumes is a significant research topic, due to its improving impact on human health in the field. In the present paper, we have fabricated a simple and smart wireless optical device for hemoglobin level monitoring, including the simple optical modules, disposable plastic chip, and wireless near field communication module, for the first time. It has demonstrated a high accuracy performance of 95±2 % and rapid analysis time within 30 seconds using whole blood samples. We have compared with a clinical laboratory instrument and confirmed that it have worked well with a coefficients of determination (R^2) of 0.952. Finally, we implemented a near-field communication module in the device for communicating with a smart android tablet. We think that this optical assembly can show great potential as a platform for improving human health through the monitoring of human hemoglobin status in the field.**

Keywords—Portable optical device; Hemoglobin; Wireless communication

I. INTRODUCTION

Portable microdevices are beginning to be used in remote and resource-poor countries, as a result of developments in integrating the steps of fluidic control, sample preparation, and signal detection. As they stand, these devices are not yet appropriate for use in the resource-poor settings. A portable optical device with a disposable sensor seems to be the most promising approach for the platform that meets the demands. Hemoglobin measurement is a basic blood test for medical diagnostics and used for screening for anemia, as a decrease in the amount of red blood cells (RBCs) or hemoglobin in the blood [1]. Conventionally, hemoglobin is measured from automated laboratory hematology analyzers. It is very needed to develop the portable hemoglobin meter for point-of-care applications [2].

II. EXPERIMENTAL

Figure 1 shows the typical spectrum of ferryl-hemoglobin, oxy-hemoglobin, and met-hemoglobin. We employ two wavelengths of 530 nm and 880 nm as measuring wavelengths. have observed that the sectrum we confirmed that you have the correct template for your paper size. The microsensors for detecting of hemoglobin had reported before, there are strong needs to improve the accuracy and reproducibility caused by the material properties and a complex optical set-up for commercialization [3-4]. The plastic chips contain the following in dried form as a typical method; sodium deoxychrolate to hemolyze red cells, sodium nitrite to convert hemoglobin to methemoglobin and sodium azide to convert methemoglobin to azide methemoglobin [5]. The block diagram of the wireless hematocrit system with the optical module is shown in Figure 2. We have investigated the optical measurement promotion through performance comparisons in case of the separated LEDs light sources and one-body merged LEDs. In order to merge two LEDs (wavelengths; 530 nm and 880 nm), a chemical mechanical polishing (CMP) processing of two LEDs and their bonding with a UV epoxy are employed. The photograph of the fabricated portable wireless hematocrit meter is shown in Fig. 3. It shows the system profile and the case of loading the Poly(methyl methacrylate) (PMMA) plastic biochip with a 10 μL whole blood sample, which are provided from Eulji university hospital through IRB inspection. We also investigated the effects of light scattering on the performance by comparing the intensity of the optical signals between the transmission beam and the scattering beam at two wavelengths, respectively through the biochip using the human whole blood samples. The scattering intensity is only under 1.7 % of the transmission value. It looks like that the scattering light intensity is negligible comparing to the transmission light intensity in the device. We also investigated the optical transmission intensity variation as a function of measuring time, and found that the drift of signal was very small and negligible.

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