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Microstructural and electrical properties of human blood

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Abstract. Human blood has been prepared from healthy human body. Structure, and electrical properties of human blood are studied. Scanning electron microscope (SEM) image exhibits a uniform size distribution of thrombocyte of human blood with an average size less than 15 μm. Electrical analysis of the blood sample was measured by linear sweep voltammetry in the potential range between -1 and 1 V with scan rate 50 mV/s to 200 mV/s at room temperature. At scan rate of 250 mV/s, a peak was clearly observed from 300 mV to 750 mV. The peak should be attributed to an oxidation process of occurred to blood sample.

1. Introduction
Erythrocytes of human blood contains hemoglobin which acts as oxygen-carrying from the lungs to peripheral tissues [1]. Hemoglobin form is vary depend on the organism condition and environmental characteristic [2–4]. Hemoglobin made up of four polypeptide chain subunits called globin. Each globin subunits bound to a heme prosthetic group [5]. This heme has an iron ion (Fe3+) as a core of its structure [6]. There are 1800 mg of iron ion in the erythrocytes, this was approximately 50% of total amount of the human body [7]. Iron is an important part of hemoglobin. The iron in hemoglobin of the erythrocytes provides the binding site to the oxygen [8]. Hemoglobin oxygen affinity is increased at each of the remaining sites when first Fe3+ site of heme is bound to oxygen [9]. In this paper, we have investigated microstructural and electrical properties of human blood from healthy human body. Scanning electron microscope (SEM) SEC SNE 4500 M for analyzing the structure and morphology. The electrical property of human blood was measured using linear sweep voltammetry in the potential range between -1 and 1 V and EDAQ EA163 potentiostat using stainless steel electrodes.

2. Experimental methods
Human blood of healthy human body has been prepared. Scanning electron microscope (SEM) SEC SNE 4500 M observed the microstructure of blood sample. Electrochemical characteristics of the blood sample was measured by linear sweep voltammetry in the potential range between -1 and 1 V. This
electro analytical measurement was performed using Edaq EA163 potentiostat using stainless steel electrodes. For this purpose, the blood sample was directly placed onto a glass plate without any prior treatment and additive. The I-V plots were then recorded with five different scan rate [10–12].

3. Results and discussion
Figure 1 shows the SEM image of the human blood sample from healthy human body. The micrograph exhibits a uniform size distribution of thrombocyte of human blood with an average size less than 15 μm. The micro thrombocyte was found to form cylindrical-like coin. However, a different morphological characteristic was observed in the human blood sample from healthy human body prepared at room temperature, where blood sample formed as coarse thrombocyte with irregular shapes.

![SEM image of the human blood sample](image1.png)

**Figure 1.** Scanning electron microscope (SEM) with secondary signal of the human blood sample.

![I-V plots](image2.png)

**Figure 2.** The Current-potential (I-V) characteristic of the human blood with different rate of potential at room temperature.
Figure 2 shows I-V plots of the blood sample obtained with different scan rate. From the obtained plots, it is found that the current tend to increase by the scanning toward positive potential in the measured the range of -1 to 1 V. Similar current transient characteristics were found with scan rate 50 mV/s to 200 mV/s. However, at scan rate of 250 mV/s, a peak was clearly observed from 300 mV to 750 mV. The peak should be attributed to an oxidation process of occurred to blood constituent compounds. Though, the specific compound involved in the reaction must be studied by further investigation. The results indicate that electro analytical method, in this case linear sweep voltammetry, is useful for electro active species or compounds analysis from blood sample.

4. Conclusions

Human blood of healthy human body has been prepared at room temperature. Structural and electrical properties of human blood has been investigated. The SEM image exhibits a uniform size distribution of thrombocyte of human blood with an average size less than 15 mm and forms cylindrical-like coin. The I-V plots result of the blood sample with different scan rate showed at scan rate of 250 mV/s, a peak was clearly observed from 300 mV to 750 mV. The peak should be attributed to an oxidation process of occurred to blood constituent compounds.

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