Abstract

This work investigates blood separation based on high gradient magnetophoresis. Separation is performed based on native magnetic susceptibility of red blood cells on microfluidic device. Much research already shows the magnetic properties of red blood cells. Main reason of this magnetic property is Fe^{2+} ion in haemoglobin. [MEL75, TAY38, CHE16]

Microfluidic system was designed and developed to perform high gradient magnetic separation. A dipole magnet used to generate external magnetic field is custom assembled. A ferromagnetic wire is lay down on the surface of the microchannel to create a high gradient magnetic field. A syringe is fitted with one-way stopcocks. Human whole blood sample was collected and prepared as paramagnetic after treatment with 20mM sodium nitrite solution.

Experiment under microscope shows that blood sample rapidly move toward the high gradient magnetic field under a control flow. It was observed that as long as a magnetic field is applied, blood cells remain at the edge of the ferromagnetic wire. With a proper design of the microfluidic device, it is possible to collect clear plasma from the edge of the microchannel. This work demonstrates that 80% to 85% (average 83%) blood cell separation is possible with a volumetric flow rate of 0.4 mm/min.

High gradient magnetophoresis in micro device can be used to separate blood components continuously without any magnetic tagging. High gradient magnetic separation in micro-devices is simple and highly efficient method compare to conventional approaches. A proper microfluidic system is required to apply high gradient magnetophoresis and with it blood components can be separate successfully and efficiently.

Key words: Magnetophoresis, blood cell separation, blood plasma separation, Microfluidics.