



Red Blood Cell Measurement System Using Polyelectrolytic Salt Bridge-based Electrodes



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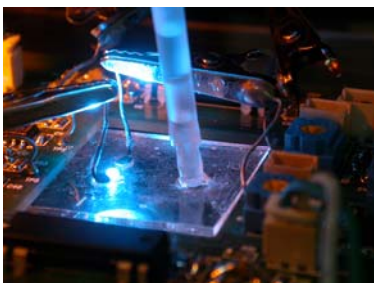
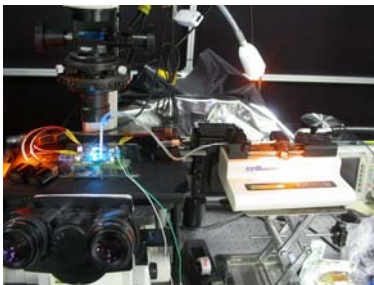
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INTRODUCTION

- Clinical application of microfluidic cytometry chip
- Detection Method
 - DC impedance measurement system using electrochemical electrode, PSBE
- Polyelectrolytic Salt Bridge-based Electrode (PSBE):
 - Conductive polymer
 - PDADMAC (poly-diallyldimethylammonium chloride)
- RBC (Red blood cells) Counting efficiency
 - about 90% compared to commercial hemacytometer

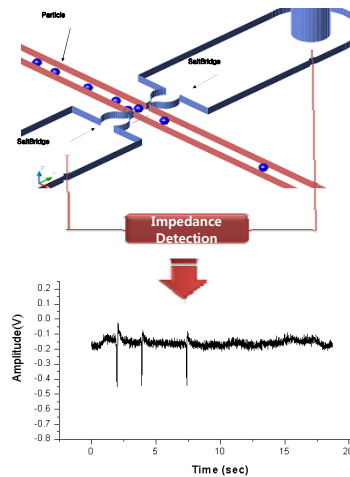
METHODOLOGY

A. PSBE system components



- Glass to glass microfluidic chip
 - width : 60 μm , height : 30 μm
- Electrode : Ag/AgCl electrode
- Data acquisition circuit and PC
- Pump : Syringe pump (KD syringe pump)
- Sample
 - Fluorescence microbead
 - Whole blood cells (RBC)
 - Diluent : PBS (Phosphate Buffered Saline)

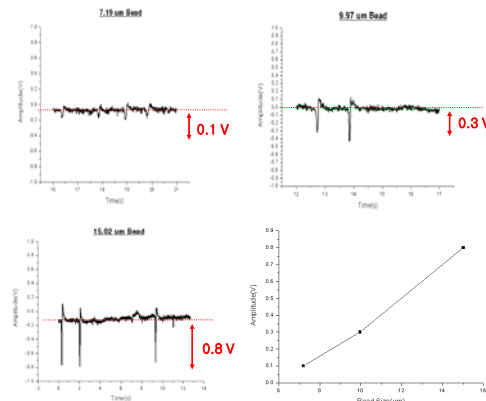
B. Working principle



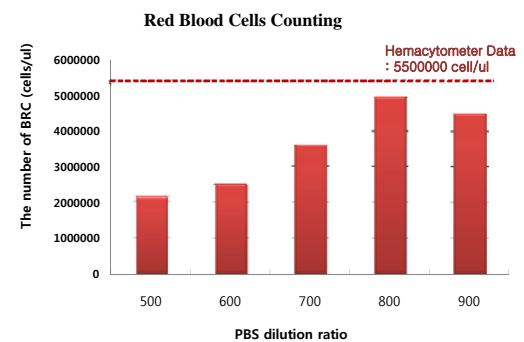
- Fluorescent microbead (or blood) solution was injected into the microchannel using a syringe pump.
- The impedance signals fluctuating when the beads or cells passed through the microchannel between the PSBE.
- The impedance was calculated from the electric current that was measured under a fixed bias voltage.
- The amplified impedance signals were acquired and stored in a PC for further analysis.

C. Experiments

- Fluorescence microbead



- Whole Blood Cells



- Calculation Method

: The number of RBC in 1 μl (PSBE) = $1/A * B/10 * C$
 (Flow rate : 1.11 X 0.001 μl / sec = A
 The number of RBC in 10 sec = B
 Dilution (x 500, 600, 700, 800, 900) = C)

RESULTS

- Impedance measurement system output of RBC
 - 0.1 ~ 0.2 V
- Optimum dilution of PBS
 - Blood : PBS = 1 : 800
- Maximum throughput
 - 6000 cell / sec
- PSBE system performance
 - about 90% compared to commercial hemacytometer

DISCUSSION

- Proposed methods showed good performances about red blood cell counting
- PSBE system reduce the hemacytometer size and cost
- This method may provide new approach that has no optical elements, laser, lens and filters
- Further research, PSBE system will propose the small-sized POCT device for patients