

# Proposal of a novel microchannel structure for more accurate measurements of zeta potential by Electrophoretic Coulter Method systems

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We have proposed Electrophoretic Coulter method (ECM), which combines electrophoresis method and Coulter method in micro-channel systems [1]. Accordingly, it can simultaneously analyze the zeta potential  $\zeta$  as well as the size, and the number of individual specimens, while resistive pulse sensing (RPS) method [2] can estimate the size, and the number.

The observed velocity  $v_{total}$  of a particle in a microchannel consists of four elements:

$$v_{total} = v_{EP} + v_{EO} + v_P + v_D \quad (1)$$

where  $v_{EP}$  is the electrophoretic velocity,  $v_{EO}$  is the electroosmotic velocity,  $v_P$  is the velocity caused by a pressure gradient, and  $v_D$  is the diffusion velocity [3]. In electrophoresis method, zeta potential  $\zeta$  is estimated from  $v_{EP}$ . Consequently, to obtain accurate  $\zeta$ , the influence of  $v_{EO}$ ,  $v_P$ , and  $v_D$  should be suppressed. Firstly,  $v_D$  is usually negligible, and secondly,  $v_{EO}$  is found to be reduced effectively by coating of surfaces of micro channels. We have optimized the condition of coating material, 2 methacryloyloxyethyl phosphorylcholine (MPC) polymer [4]. However, how the influence of  $v_P$ , and its suppression have not been discussed yet in detail.

Therefore, in this study, we attempt to suppress the influence of  $v_P$  to improve the accuracy of electrophoresis systems. We propose a novel structure of a microchannel system, which has an additional wide U-shaped microchannel as well as a narrow channel for electrophoresis measurement, as shown Fig. 1. The additional U-shaped microchannel equalizes the flow rates of the solution at both ends of the narrow channel, As a result, based on Bernoulli's principle, the pressures of the solution at both ends of the narrow channel become equal, and then,  $v_P$  vanishes. Experimental confirmation will be reported on the poster session.

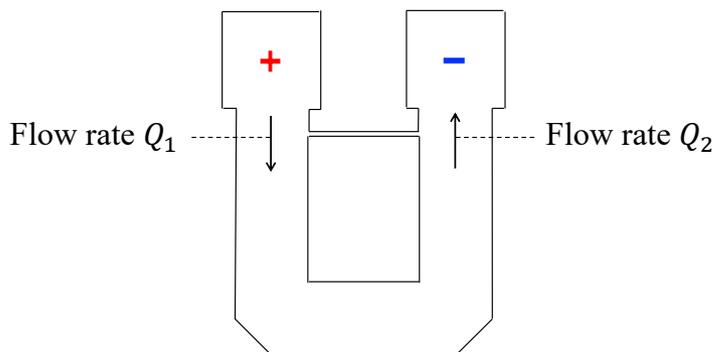


Fig. 1 Electrophoresis system with an additional U shaped microchannel .  
DC electric field is applied for electrophoresis measurements.

## References:

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