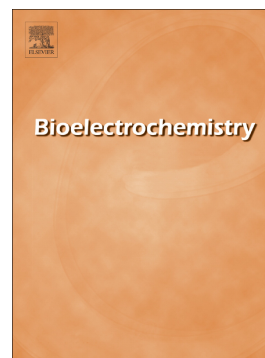


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Uddin M. Jalal, Gyeong Jun Jin, Kyu Shik Eom, Min Ho Kim, Joon S. Shim



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On-chip signal amplification of magnetic bead-based immunoassay by aviating magnetic bead chains

Uddin M. Jalal, Gyeong Jun Jin, Kyu Shik Eom, Min Ho Kim, and Joon S. Shim*

Bio IT Convergence Laboratory, Department of Electronic Convergence Engineering, Kwangwoon University, Seoul, Republic of Korea.

*Corresponding author: Joon S. Shim

Tel.: +82-10-940-8671, E-mail: shim@kw.ac.kr (J. S. Shim)

ABSTRACT

In this work, a Lab-on-a-Chip (LOC) platform is used to electromagnetically actuate magnetic bead chains for an enhanced immunoassay. Custom-made electromagnets generate a magnetic field to form, rotate, lift and lower the magnetic bead chains (MBCs). The cost-effective, disposable LOC platform was made with a polymer substrate and an on-chip electrochemical sensor patterned via the screen-printing process. The movement of the MBCs is controlled to improve the electrochemical signal up to 230 % when detecting beta-type human chorionic gonadotropin (β -hCG). Thus, the proposed on-chip MBC-based immunoassay is applicable for rapid, qualitative electrochemical point-of-care (POC) analysis.

Keywords: Magnetic bead, Lab-on-a-Chip (LOC), β -hCG, Antibody, Immunoassay.

1. Introduction

The beta-type human chorionic gonadotropin (β -hCG) hormone is released from the placenta, and it acts as an important biomarker for pregnancy [1,2]. A rapid strip-type test kit is a widely used tool to qualitatively detect β -hCG in urine which increases in the blood early in pregnancy and subsequently released in urine [1]. Functionally, β -hCG prevents the degeneration of the corpus luteum that continuously secretes progesterone to maintain the pregnancy [3-5]. Therefore, conducting a quantitative analysis of β -hCG is highly desirable to monitor the growth of the embryo to avoid risk of abortion and predict preeclampsia and trophoblastic pregnancy diseases [6,7]. Furthermore, β -hCG is widely used as a biomarker to diagnose placental trophoblastic tumors and

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