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Development of A Mechanical Digital Microfluidic Immunoassay with Glass Microspheres †

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Abstract: Digital (droplet-based) microfluidic platform has become an attractive approach for biomedical applications, such as immunoassay, because it requires less sample volume and take shorter time in bio-reaction. However, the digital microfluidic immunoassay based on electrowetting technology often has dielectric breakdown problem due to biofouling and high input voltage. Here a highly reliable mechanical digital microfluidics immunoassay is reported by combining the movable-chip design and the glass microspheres as the carrier of antibody. Since the droplet movement is achieved by moving the chip in the mechanical digital microfluidic system, high voltage is not required, the biofouling won't cause any problem in droplet movement during the process of immunoassay. In addition, owing to the buoyancy, the glass microspheres can self-concentrate to the top of droplet, which helps to improve the detection sensitivity and reduce the limit of detection. The Human IL-1β is used here to demonstrate the performance of the proposed mechanical digital microfluidic immunoassay. It is shown that the limit of detection is 0.246 pg/mL, required sample volume is only 2 μL, and the time for immunoassay process is less than 30 minutes. which is similar to our previous digital microfluidics immunoassay based on electrowetting technology with much better reliability.

Keywords: glass microsphere; digital microfluidic; immunoassay.