Optimization of Microfluidic Chip Design for The Enhancement of Radioimmunoassay Performance

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The use of radioisotopes for the radioimmunoassay (RIA) brings out the generation of radioactive wastes and worker's radiation exposure. This is why the use of RIA has been restricted although the RIA is a highly sensitive immunoassay technique. The microfluidic chip, which is composed of micrometer-scale channels, has a short diffusion distance and high surface area to volume ratio. Thses characteristics can reduce the reaction time and amount of reagents consumption. There has been a rapid growth of interest in the application of microfluidic chips for the bioassay, and the collaboration of microfluidic technology and RIA is expected to expand the utilization of RIA. We named this advanced RIA platform "μ-RIA" and designed the microfluidic chips for the RIA. The experimental results showed that 5 minutes were enough for the analysis on the μ-RIA platform and the amount of reagent consumption was significantly reduced compared with conventional RIA. The μ-RIA could determine the amount of analytes with the standard curve (Fig. 1), and the test of quality control (QC) sample satisfied the accredited criteria. The performances of μ-RIA could be improved by optimizing the design of microfluidic chip; co-flowing of air and liquid improved the attachment of biomolecules by occuring turbulance in the channel; the multi-layer structure of microfluidic chip amplified the radiation signal from the radioactive tracer. In addition, the microfluidic chip with the optimized design for the test tubes could be easily applied to the gamma counter. Therfore, the μ-RIA is expected to be a novel radioimmunoassay platform for the diagnostics of various biomolecules with furthure studies.

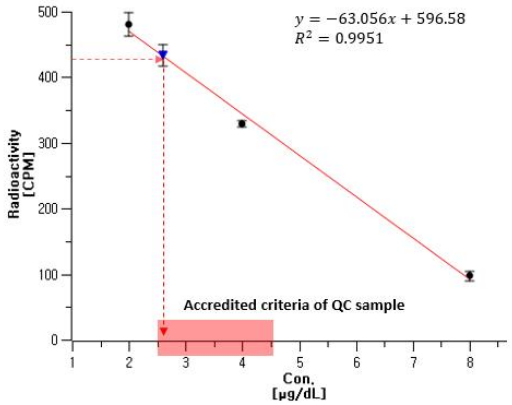

Fig. 1. Application of the μ-RIA platform for the anlaysis of T4.

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