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Simultaneous competitive and sandwich formats multiplexed immunoassays based on ICP-MS detection

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Abstract

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) based immunoassay method has been proposed in multiple immunoassays but has not been used in competitive and sandwich formats immunoassay simultaneously. The two immunoassays were usually conducted separately in clinical field depending on the size and the amount of binding sites of targets. We proposed an immunoassay method based on magnetic beads and ICP-MS detection that could be suitable for both small and large molecules. The functionalized magnetic beads were added to capture the immune complex after immune reaction. In this way, thyrotropin and free thyroid hormone can be captured, separated and then detected according to the elemental tags by ICP-MS simultaneously. The new method was evaluated by comparing the results with time resolved fluorescence immunoassays (TRFIA). The dynamic ranges of TSH and FT₄ were 0.16-105 mU/L and 3.5-65 pmol/L, respectively. The limits of detections were 0.06 mU/L for TSH and 1.59 pmol/L for FT₄. And the relative standard deviations (RSD) of TSH and FT₄ were 4.64% at 2.5 mU/L and 1.87% at 5.85 pmol/L. This immunoassay method enables the determination of small and large biomolecules simultaneously via competitive and sandwich immunoassay formats.

Keywords

ICP-MS; magnetic immunoassay; thyrotropin; free thyroid hormone

1. Introduction

One of the obvious problems for multiplexed immunoassay is that analytes may require different immunoassay formats depending on the size and the amount of binding sites of targets [2]. Normally, large molecules with more than one antibody-antigen binding sites were measured in sandwich-capture immunoassay format [10-13, 19], while some small ones with only one binding site were quantified by the competitive immunoassay [18-21]. The difference in procedures prevents the combination of the two immunoassay formats in a single detection system. To develop rapid detection of new index combinations for practical application such as clinical diagnosis and environmental monitoring, the two formats of immunoassays would need to be combined to detect both large and small

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