

Screening of Thyroid Stimulating Hormone Using Paper-Based Lateral Flow Device

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Abstract : A paper-based lateral flow device for screening thyroid stimulating hormone (TSH) is reported. A sandwich immunoassay was performed using two mouse monoclonal TSH antibodies (anti-hTSH 5403 and 5404) as immobilized and labeled antibodies for capturing TSH samples. Test (anti-hTSH 5403) and control (goat anti-Mouse IgG) lines were fabricated on nitrocellulose membrane (NCM) using ballpoint pen printed with a speed of 3 cm/s and thickness setting of 1. The novel gold nanoparticles europium complex (AuNPs@Eu) was used as fluorescence label compared to conventional AuNPs label. The results obtained with this device can be visually assessed by the naked eyes and under UV hand lamps, and quantitative analysis can be performed using the ImageJ program. The limit of detection (LOD) under UV hand lamps (0.1 μ IU/mL) provided 50-fold greater sensitivity than AuNPs (5 μ IU/mL), which is suitable for both hypothyroidism and hyperthyroidism screening within 30 min. A linear relationship between the red intensity and the logarithmic concentrations of TSH was observed with a good correlation ($R^2=0.992$). Furthermore, the device can be effectively applied for screening TSH in the spiked human serum with recovery range of 96.80-104.45% and RSD of 2.18-3.63%. Therefore, the developed device is an alternative method for TSH screening which provides a lot of advantages including low cost, short time analysis, ease of use, disposability, portability, and on-site measurement.

Keywords : thyroid stimulating hormone, paper-based lateral flow, hypothyroidism, hyperthyroidism

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