Abstract

One-third of Australians are at risk of developing chronic kidney disease (CKD). Clinical practice guidelines have recommended that the test for urine albumin should be used to screen for CKD. A healthy kidney does not allow albumin to pass into the urine, but a damaged kidney allows, so early detection of CKD can reduce the kidney failure by up to 50 percent. People normally use micro-albuminuria, which means the protein concentration is 30-300 mg/L, to detect CKD in the early stage. A few in-vitro diagnostic devices are based on fluorescent emission to assay the chronic kidney disease, such as the strip test, also known as the lateral flow assay which always combines a device for quantitative analysis. A strip is composed of four parts and when the sample drops on it, the sample will flow and pass through the various parts to separate into individual components. This is called lateral flow assay and there is a test line in the reaction part. The antibody is labelled with fluorogen, e.g., quantum dot (QD), when the sample passes through, the analyte, which is the antigen will have reaction with antibody in the test line. The fluorogen will be lighted on. We can use the light intensity to quantify the analyte concentration.

The aggregation-induced emission (AIE) effect is a group of fluorogen materials become highly luminescent when they are aggregated in solid state or in poor solvents, which is opposite to the aggregation cased quenching (ACQ) effect, i.e., the effect will cause the QD labelled antibody quench when they aggregate together in the test strip. The AIEgens are successfully used as various bioprobes, such as they can be used as biological probes to detect human serum albumin in urine. Compared with conventional fluorogen systems, the AIEgen based sensing systems have better stability, higher signal-to-noise ratio and lower detection limits, which provides a new opportunity to look into the redevelopment of urine test strip.

In this feasibility study, we try to use a specified designed AIEgen to substitute the expensive, tedious-prepared and ACQ effecting QD fluorogen labelled

antibody and the corresponding antigen in the current test strip, and redevelop the test strip to achieve more cost-effective and acceptable detection ability for the in-vitro diagnostic system. The individual parts of the strip, such as sample pad, conjugate pad, NC membrane, and the assembled strip using the optimized individuals have been evaluated with different incubation times and AIEgen concentrations in this research.