

Abstract

Chronic kidney disease (CKD) is the progressive loss of kidney function over time, and it is a common disorder, which is associated with the increasing risk of kidney failure as well as cardiovascular disease. Moreover, CKD has become a critical and increasing public health issue among the world. However, due to the asymptomatic features of CKD in the early stage, most patients can only realize this disorder until it has been developed into an advanced stage.

Albumin is the preferred urinary protein for the early detection of CKD. The increased urinary excretion of albumin can be considered as the earliest manifestation of CKD. Besides, albuminuria can accompany related kidney diseases as well, and microalbuminuria can be regarded as a critical sign for the development of CKD. In this study, a novel method utilising fluorescence for measuring the levels of albumin in the range of microalbuminuria was evaluated. The biosensor with aggregation induced emission (AIE) feature called TC-426 was used. When TC-426 is in aggregation state, due to the strong π to π interaction force, the planar structure of molecule piles up together, leading to the quenching of fluorescence. However, when it interacts with albumin molecules, the hydrophobic phenyl rings of TC-426 were prompted to enter the hydrophobic cavities of albumin, inducing the emission of fluorescence. This study evaluated the optimal working conditions of TC-426 including the incubation time with albumin solution and the ratio to albumin solution. Moreover, the correlations between the concentration of albumin solution and its corresponding fluorescence intensity in different environments including deionised (DI) water, artificial urine and real urine sample were evaluated as well. Furthermore, the interference of creatinine was characterized. It was found that TC-426 is an outstanding biosensor with sensitivity and selectivity for the detection of albumin.