Enhanced Detection of HIV-1 Antigen by Quartz Crystal Microbalance Using Gold Nanoparticles

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In this study, a quartz crystal microbalance (QCM) technique was explored to detect human immunodeficiency virus (HIV-1) antigen at very low concentration using gold nanoparticles (Au NPs) as signal enhancer. Firstly, colloidal Au NPs were synthesized by a reduction method and functionalized with streptavidin. A QCM sensor surface was treated with 11-mercaptoundecanoic acid (MUA) solution and followed by immobilization of streptavidin. Thereafter, polyclonal antibody was applied to capture the antigen from the buffer solution and the streptavidin-Au was applied to enhance the signal. The QCM signal could be amplified by using streptavidin-Au NPs and the HIV-1 antigen could be easily detected even at a low concentration of 1 ng/mL due to high mass of Au NPs. In addition, different sizes of Au NPs were also tested and the Au NPs with the size of 30 nm yielded the highest signal due to its mass effect and conjugate efficiency with streptavidin. The results imply that this method of using Au NPs as signal enhancer can be a promising technique to detect HIV-1 antigen in early stage of infection.