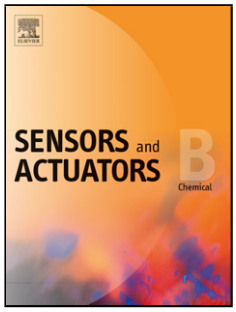

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Gold Colloid-Nanostructured Surfaces for Enhanced Piezoelectric Immunosensing of Staphylococcal Enterotoxin A

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Highlights

- Gold- and silicon-coated quartz sensors were nanostructured with gold nanoparticles
- A capture layer comprising an anti-SEA antibody was built up on the sensor surface
- Nanostructuration improved sensor response owing to better accessibility of antibodies
- With a sandwich-type assay, the limit of detection was 1 ng SEA/mL in 25 min

Abstract

We describe the use of gold nanoparticles (AuNP) as a nanostructuring agent on quartz crystal sensor chips to engineer staphylococcal enterotoxin A (SEA) piezoelectric biosensors with amplified response. AuNPs were assembled on gold- or silicon-coated quartz crystal sensor chips by a wet chemistry process involving their chemisorption to preformed thiol and amine terminated Self-Assembled Monolayers (SAMs). The purpose of this nanostructuration was to modify the topography of the surface and improve the accessibility of the binding sites on the surface of the sensor chips. Biointerfaces, comprising a polyclonal antibody against staphylococcal enterotoxin A (SEA), were further built up on these gold nanoparticle-coated sensors and their ability to capture SEA was monitored in real time with a quartz crystal microbalance with dissipation monitoring. It was found out that, although the surface density in capture antibody was similar on both nanostructured and planar sensors, the sensor response, expressed as frequency shift recorded during the binding of SEA to the antibody, was significantly higher for the nanostructured sensors as compared to the planar ones. All the same, the limit of detection was lower for the nanostructured sensors: 8 ng/mL *vs* 20 ng/mL for the planar sensors. This was rationalized by a possibly better accessibility of the antigen binding sites rather than a consequence of specific surface increase. Using a sandwich type assay, gold nanoparticles coated silicon quartz sensor chips provided the lowest limit of detection of ca. 1 ng/mL in a total assay time of 25 min.