

Structural control of nanofiber membranes and development of filtration system aiming at colorimetric DNA biosensor

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The detection of harmful microorganisms that threaten our health will become even more important in the future. Previously, we have developed a technique to collect and detect MRSA (methicillin-resistant *Staphylococcus aureus*) DNA using probe-modified gold nanoparticles (AuNPs). However, the conventional method requires expensive equipment for detection, making it difficult to apply to practical use. In this study, we have constructed a colorimetric biosensor based on AuNPs using freeze dried

Ca²⁺ crosslinking TEMPO-oxidized cellulose nanofiber (TOCN) film. DNA-probe modified AuNP complex (DNA-AuNP probe) is too large to be pass through in the film and exhibit AuNP-based color (Fig. 1). TOCN is expected to be used in industrial applications as a material in the form of ultra-fine fibers with a diameter of about 4 nm. Freeze dried TOCN-Ca²⁺ film was used as a filter to separate DNA-AuNP probe by size.

The color intensity increased in a dose-dependent manner with increase in the amount of DNA (Fig. 2). Our DNA sensing system with probe-modified nanoparticles was capable of detecting 10PM genomic DNA from MRSA without PCR amplification. Signaling was linearly correlated to the amount of genomic DNA tested in the range of 10-100PM.

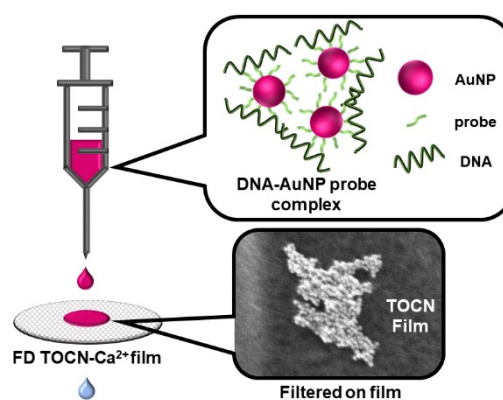


Fig.1 Schematic illustration of colorimetric DNA sensing system using Freeze dried (FD) TOCN-Ca²⁺ film



Fig.2 Photograph of the FD TOCN-Ca²⁺ film surface after passing through the samples (A) 0 pM (B) 10 pM (C) 100 pM (D) 1000 pM