Label-free sensor for the near real-time detection of prostate cancer

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Cancer is a disease that occurs when a group of cells in our body start growing in a non-controlled way. There are more than 200 types of cancer, depending on their origin. Among these, prostate cancer was reported to have the most cases in Spain in 2021 [1]. To date, the gold standard non-invasive test for the detection of prostate cancer is the prostate-specific antigen (PSA) test which unfortunately has a high false positive rate (75%). Therefore, this study was aimed to fabricate a proof-of-concept (POC) device that can overcome the disadvantages of the current PSA test for the early detection of prostate cancer. To fabricate this POC device, the optical and geometric properties of nanoporous anodic alumina (NAA) [2] [3] [4] were combined with the optical properties of gold nanoclusters (AuNCs). In addition, endoglin (ENG-105) was used as the target protein for the early detection of prostate cancer [5]. The POC device was optimized at various conditions: a) NAA pore size- 35 and 75 nm [6] [7] (Figure 1), b) immobilization of gold nanoclusters- with and without the addition of NHS and EDC, c) the incubation time for both gold nanoclusters and endoglin protein, d) adding different blocking buffers- Ethanolamine and Bovine Serum Albumin (BSA). NAA samples with larger pores (75 nm) showed a higher photoluminescence (PL) signal for biomarker detection than NAA samples with small pores (35 nm) [8] [9]. The POC device showed sensitivity for the endoglin detection range in fg/ml to ug/ml (Figure 2). However, non-specific binding was observed in the case of the control antibody. Although this pilot study demonstrates the potential of the proposed POC device, further optimization is required to overcome the non-specific binding.

References

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Figures

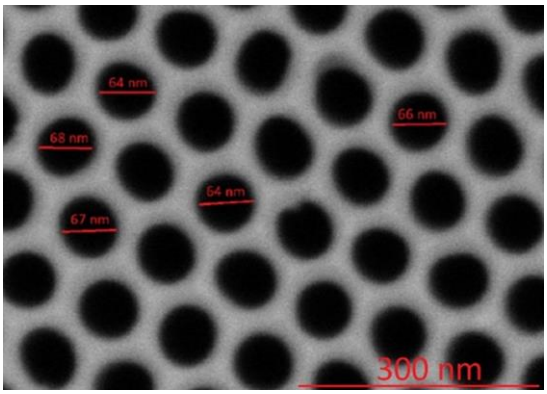

Figure 1. NAA sample anodized with 0.3M oxalic acid after a pore widening treatment.

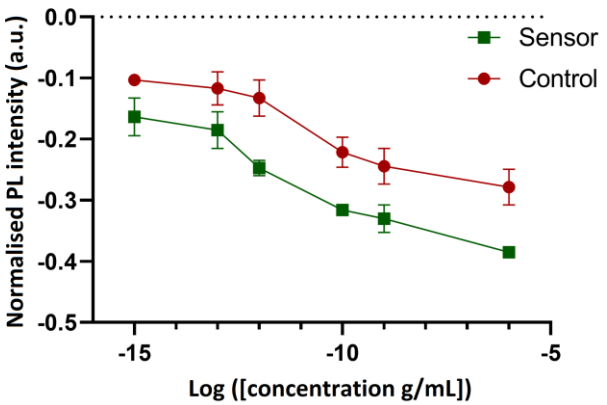

Figure 2. Photoluminescence response of the sensor for different endoglin concentrations.