Stability of gold nanoparticles coated with detection antibody used in immunoassays

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In many immunodiagnostic technologies, the antibodies are coupled to micro- or nanoparticles. The bio-functionalized particles are used for specific capture of biomarkers and can also be used as labels in a subsequent detection step. One example is the use of gold nanoparticles due to their plasmonic properties. The process of anchoring antibody molecules to the surface of gold nanoparticles is complex and involves a balance between the need to bind the antibodies to the nanoparticle surface, and the need to maintain the biologically active molecular conformation of the antibodies to that antigen capture can occur [1]. In addition, the stability of immunoassay reagents is a requerement for validating immunoassay performance [2]. Therefore, the stability of these antibody-coated nanoparticles is essential, i.e. they must have the ability to retain their original behavior and properties over a period of time when stored under defined conditions.

In order to study this validation requirement, accelerated tests were performed, which consisted of storing the antibody-coated nanoparticles at 37°C. Through this study, it has been determined that the storage buffer is essential for the stability of these nanoparticles, observing poor stability when Bovine Serum Albumin (BSA) is used as storage, and great stability when mPEG-SH is used as storage. Additionally, it has been observed that storage can affect the variability of the immunoassay (Figure 1). Therefore, these accelerated stability assays are essential to study the immobilization protocol of antibodies on gold nanoparticles.

References

[1] Saha B., Everfs T.H., Prins M.W. How antibody surface coverage on nanoparticles determines the activity and kinetics of antigen capturing for biosensing. Anal Chem. 2014 Aug 19, 86(16), 8158-66.

[2] Vashist S. K. and Luong J. H. T. Handbook of Immunoassay Technologies: Approaches, performances, and applications. Academic Press. 2018.

Figures

Figure 1:
Signal/ /background ratios at 100 pg/mL biomarker in an immunoassay performed with antibody-coated gold nanoparticles stored at different times at 37ºC with different buffers:

- BSA 2 mg/ml – PBS Tween 0,05%.
- mPEG-SH 0,33 mg/ml – Tris 50 mM.
- Arginine 200 mM + histidine 50 mM + NaCl 100 mM (pH = 6).