IVD_18 - Gold nanoparticles for diagnostic use: Evaluation of accelerated stability and lifetime

Gabriel Mustafá Misirli[1]; Keila Gisele Azevedo Figueiredo dos Santos[1]; Jeanne Dopazo Fernandes[1]; Maria Amelia das Virgens de Lima[1]; Ana Beatriz Teixeira Frederico[1]; Ingrid Silva Correia[1]; Danielle Regina de Almeida de Brito e Cunha[1]; Lisia Maria Gobbo dos Santos[2]; Ana Paula Dinis Ano Bom[1]; Edimilson Domingos da Silva[1].
[1]Fiocruz/Bio-Manguinhos
[2]Fiocruz/INCQS

Introduction: Gold nanoparticles (AuNPs) are often used as biosensors in biological markers and also in diagnostic kits. Spherical shaped AuNPs are red. These nanoparticles have high binding affinity with proteins, antibodies and antigens forming stable bioconjugates. Are widely used in lateral flow immunochromatography platform. Therefore, AuNPs are currently one of the main raw materials used to produce various diagnostic kits, including Sars-CoV-2. The assessment of their correct stability directly affects the customized production and quality of the diagnostics kits.

Objectives: Evaluate the stability of *in-house* prepared gold nanoparticle solutions used in the manufacture of diagnostic tests using statistical methods for determining the appropriate shelf life under established storage conditions.

Methodology: *In-house* based on adapted Turkevish method (1951), a gold nanoparticle (AuNP) solution was synthesized and characterized by ultraviolet-visible spectroscopy, inductively coupled plasma mass spectrometry (ICP-MS), dynamic scattering (DLS) and laser Doppler electrophoresis (LDE). The solution was analyzed at the time of manufacture (T0) and every 15 days for 90 days, under thermal stress conditions. The evaluation of the stability of the AuNP solution was based on the ISO Guide 35, which statistically evaluates the time that significant change occurs of the evaluation parameters, indicating the end of shelf life at a significance level of 0.05.

Results: Statistical analysis shows that at T90 days, one of the evaluated parameters showed a significant change at a significance level of 0.05. $|b1| > t95\%, n-2 * s(b1)$ and, therefore, there is statistical evidence that proves that the final solution lost stability in this time. Arrhenius equation was used to determine the shelf life. Where, Storage=25°C, Stress=40°C, Activation Energy (Ea)=3, and then: Thermal Kinetic Ratio (Qt) = 5.2. That is, 2.5 months at 40°C is equivalent to 13 months at 25°C.

Conclusion: AuNPs produced *in-house* have a shelf life of 1 month at room temperature. Based on the analysis of the main control parameters and statistical application, the validity attributable to the AuNP solution under study is 13 months at 25°C, bringing great savings to the production process, without loss of quality. New strategies for evaluating the stability of solutions should be considered in the future.

Keywords: Gold Nanoparticles, Stability based on the ISO Guide 35, diagnostics kits