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GOLD NANOPARTICLES: AN OPTICAL BIOSENSOR FOR THE DIRECT RNA QUANTIFICATION FOR CANCER, NEUROLOGICAL DISORDERS AND HEPATITIS C VIRUS DIAGNOSIS

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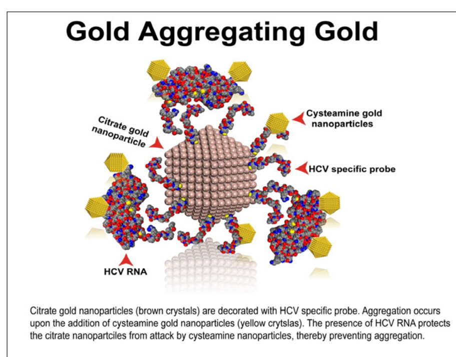
Introduction: The unique physicochemical properties of gold nanoparticles (AuNPs) have been exploited to develop gold aggregating gold (GAG) approach. Quantification of HCV RNA is a cornerstone in the infection management. On the other hand, topoisomerase 1 (TOP and tyrosyl DNA phosphodiesterase 2 (TDP2) were among the transcripts of choice due to their role as genomic stability biomarkers and their implication in various cancers and neurological disorders. The existing technologies are expensive, labour intensive and time consuming, posing significant limitations to their wide scale exploitation, particularly in economically deprived populations. We have developed for the first time; cationic AuNPs to induce aggregation of citrate capped AuNPs decorated with RNA of interest specific probe (nanoprobe).

Methods: TOP1, TDP2 and HCV RNA were first captured specifically using magnetic nanoparticles that were functionalized with a TOP, TDP2 and HCV specific probes in serum specimens, respectively. The captured unamplified mRNA was then directly detected and quantified using GAG assay. Solution color was developed immediately. RNA quantification was done by recording the spectral absorbance ratio of non-aggregated AuNPs to the aggregated nanoparticles (530/650) against a standard curve of serial diluted RNA of interest.

Results: In positive samples, the AuNPs solution retained its red color, while in negative samples the color changed to blue. A linear correlation exists between the GAG assay and the qPCR for the quantification of the RNAs (101 to 104 copies), with detection limit of up to 10 copies per reaction. Wild-type and TDP2 deficient cell lines confirmed the assay specificity and reproducibility in distinguishing between different transcripts.

Conclusion: The novel GAG assay can be utilized as an inexpensive, rapid, simple and sensitive tool for the absolute quantification of RNA from different origins and for different applications, instead of the laborious, expensive and sophisticated real-time PCR. Moreover, it could readily be adopted for full automation.



Citrate gold nanoparticles (brown crystals) are decorated with HCV specific probe. Aggregation occurs upon the addition of cysteamine gold nanoparticles (yellow crytslas). The presence of HCV RNA protects the citrate nanopartciles from attack by cysteamine nanoparticles, thereby preventing aggregation.

Biography

Sherif M Shawky has completed his Bachelor of Pharmacy and has obtained his Masters' degree in Molecular cell Biology from Vrije University, Amsterdam. Furthermore, he has completed his PhD in NanoBiotechnology in 2014 from Erasmus University, Rotterdam, Netherlands. Currently he is Postdoctoral Fellow at Center for Genomics, Zewail city of science and Technology and an Assistant Professor of Clinical Biochemistry in MUST University, Faculty of Pharmacy, Department of Biochemistry. He is the Co-founder of a spinoff company Nano-Genomics Diagnostics (NG-Diagnostics), Cairo, Egypt. He has published more than 14 papers in reputed journals with h-index 5, in addition to two USA granted Patents, and two US/World pending patents and has been serving as a Reviewer of repute journals.

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