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What controls the unusual melting profiles of small AuNPs/DNA complexes

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Abstract

In this work is studied the effect of addition of low NaClconcentrations on ds-DNA and ss-DNA conformational changes induced by smalltioproningold nanoparticles (AuNPs). For this purpose, fluorescence, UV-visible, CD,AFM, DLS and zeta potential techniques were used.The high affinity of ss-DNA to AuNPs compared with ds-DNA is easily demonstrated by the results of competitive binding with SG. Additionally, it is proven that at 298 K, AuNPs/ds-DNA and AuNPs/ss-DNA complexes undergo a transition from extended-coil to more compact structures when the AuNPs concentration (C_{AuNPs}) is increased, which for the ds-DNA system is accompanied by partial denaturation.Particularly, for the AuNPs/ss-DNA system all of these techniques confirm that at a high C_{AuNPs}, the compaction process is followed by a discrete transition to aggregation and an increase in structure size. A thorough conformational changes analysis indicates that these processes are larger in low $C_{NaCl}$and at high temperature. Remarkable is the abnormal melting temperature profiles (T_m) registered at high $R = C_{AuNPs}/C_{DNA}$ ratios.At a suitable R ratio, which varies depending on C_{NaCl}, a complex melting profile for the AuNPs/ds-DNA system was registered with two characteristic transitions: $T_{m,1}$= 338 K and $T_{m,2}$ = 368 K.The AFM technique performed at 298 K and 338 K also showed a different behaviour in both DNA-based systemsSpecifically, for the AuNPs/ss-DNA system, AFM at 298 K revealed the formation of large-sized aggregates formed by AuNPs/ss-DNA compact structures linked by AuNPs, which explains the characteristic melting curves.However, when both complexes were incubated at 338 K, the formation of highly stable ordered structures was always visualized at high R.These results constitute a significant difference in the use of small gold nanoparticles in comparison fluorescence biomarkers as a detection system of DNA structures providing both challenges and opportunities for improving sensing applications.

Biography:

Elia Grueso has completed his PhD at the age of 28 years from Seville University and she has completed postdoctoral studies from Pisa University.She is Associate Professor since 2019. Her research has focused on the study of ligand-biopolymer interactions, associated conformational change, as wellas the effect of the medium on the kinetics and thermodynamics of the interactions. Currently, she works on medical applications related to the use of gold nanoparticles and biopolymers.She has published more than 35 papers in reputed journals, one international patent and has been serving as areferee of multiple research journals of repute.

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