Influence of the pH on the stability of CdTe QDs investigated by fluorescence and particle size analyses

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Abstract

CdTe quantum dots are mainly used as biological markers (labels). Compared to the usual biomarkers they reveal size and composition tunable emissions, narrow emission spectra, wide excitation profiles, and long luminescence lifetimes. The environment around the tumor cells often shows decreased pH values compared to healthy cells. CdTe QDs were prepared from the mixture of two main solutions: a) $Cd(CH_3COO)_2$, mercaptosuccinic acid in slightly basic solution and b) Na_2TeO_3 + $NaBH_4$. The obtained CdTe QDs are stabilised by mercaptosuccinate ions. Their behavior and stability was tested in buffer solutions within the pH range 3-8. Their stability was tested by fluorescent spectra for each pH at different times and tracking of particle size changes through Malvern zetasizer. Shifting from the initial position of the fluorescence emission maxima were observed for the low and high pH values.
In the acidic pH range (3-3.5) the carboxyl groups are not dissociated and as a consequence their particles increase over time from 0.5 µm to 1.5 µm. The increase of particle size leads to enhancement of fluorescence intensity, peak broadening and shifting of intensity maxima toward greater wavelengths. Through maxima shifting in fluorescence spectra and particle size analysis could be proved the increase of the CdTe QDs system stability near neutral pH values. At pH values > 7 particle size increases slightly due to surface modifications, leading to slight shifting of intensity maxima toward smaller wavelengths. The increase of pH slows down the process of coagulation and sedimentation. In alkaline pHs there a slight increase of the particle size is observed.

Figures

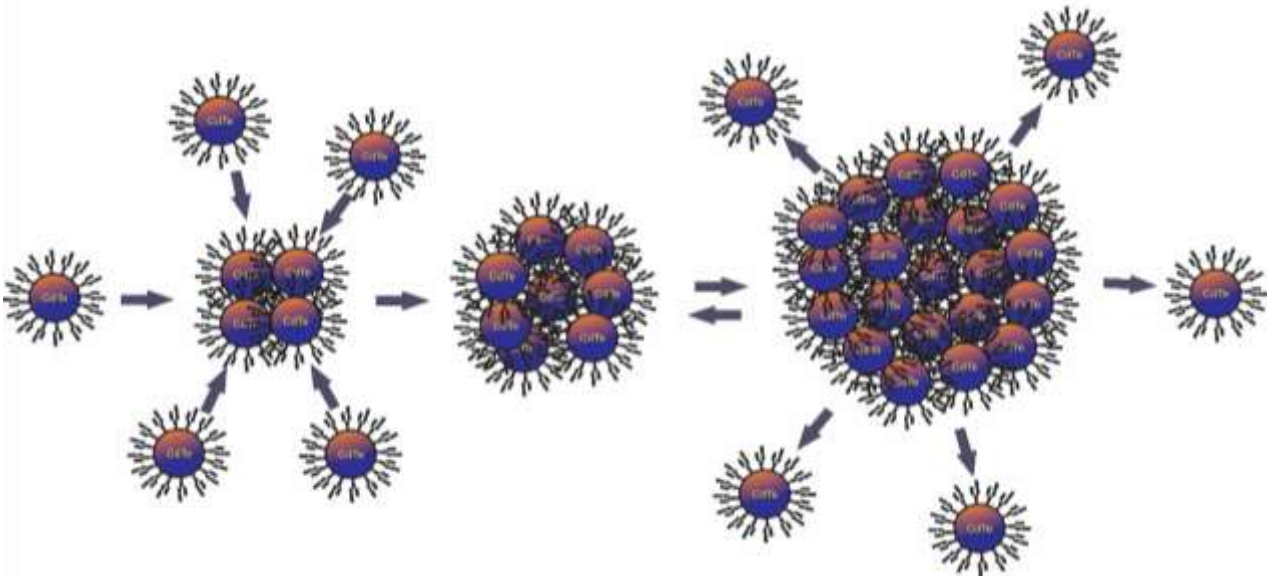

Figure 1. Dynamics of CdTe particle size particles increase at low pH values.