	Experiment title: **Fate of CdSe and InP quantum dots in primary human keratinocytes**	**Experiment number**: LS2472
Beamline: IBM30B	**Date of experiment**: from: 16 to: 22 June 2016	**Date of report**: 22 Fev 2017
Shifts: 15	**Local contact(s)**: Olivier Proux	*Received at ESRF:*

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Report:

Quantum dots (QDs) are semi-conductor nanocrystals with exceptional optical properties; for this reason they are used in a variety of high tech products, as well as for medical imaging and diagnostic. Presently, QDs that are used in the highest number of commercial products are CdSe QDs. Their intensive use poses the question of their impact on human health, which is largely dependent on their dissolution. Emerging alternative QDs which are potentially less toxic are based on InP. The aim of the present proposal is to evaluate the dissolution of CdSe and InP-based QDs in the intracellular context, as well as the speciation of released metals.
The aim of this experiment was to evaluate the biotransformation of CdSe and InP QDs and their toxicological impacts. This investigation was carried out on *in vitro* human skin models, the skin being the major route of exposure to these nanomaterials. For this purpose, we have used XAS at the Cd and In K-edges, on pellets of human primary keratinocytes exposed to pristine and aged (by a UV treatment, at high temperature) QDs. The pristine QD studies had the following composition:

- Core CdSe, shell ZnS,
- Core InPZn (called InPZn Core),
- Core InPZnS (called InPZnS Core),
- Core InPZn, shell1 ZnSe, shell2 ZnS (called InPZn Core-shell),
- Core InPZnS, shell1 ZnSe, shell2 ZnS (called InPZnS Core-shell).

For each type of QD, two caping agents were tested, penicillamine and GSH.

For the Cd K-edge, we already had a library of Cd reference compounds. Only three more references were recorded including CdSe. For the In K-edge, we had to record all reference spectra and build a new database.
All spectra were recorded at 15 K using the He cryostat, in fluorescence mode, using the 30-element Ge detector. Four to ten spectra of 40 min were averaged, based on the concentration.
High quality spectra were recorded, as shown for a few representative ones in Figure 1. The spectra were treated by linear combination fitting to determine the proportion of the Cd and In species, and by shell fitting for some of them. For InP QDs, the ageing led to the dissolution of InP and formation of In-O complexes (Fig. 1C).

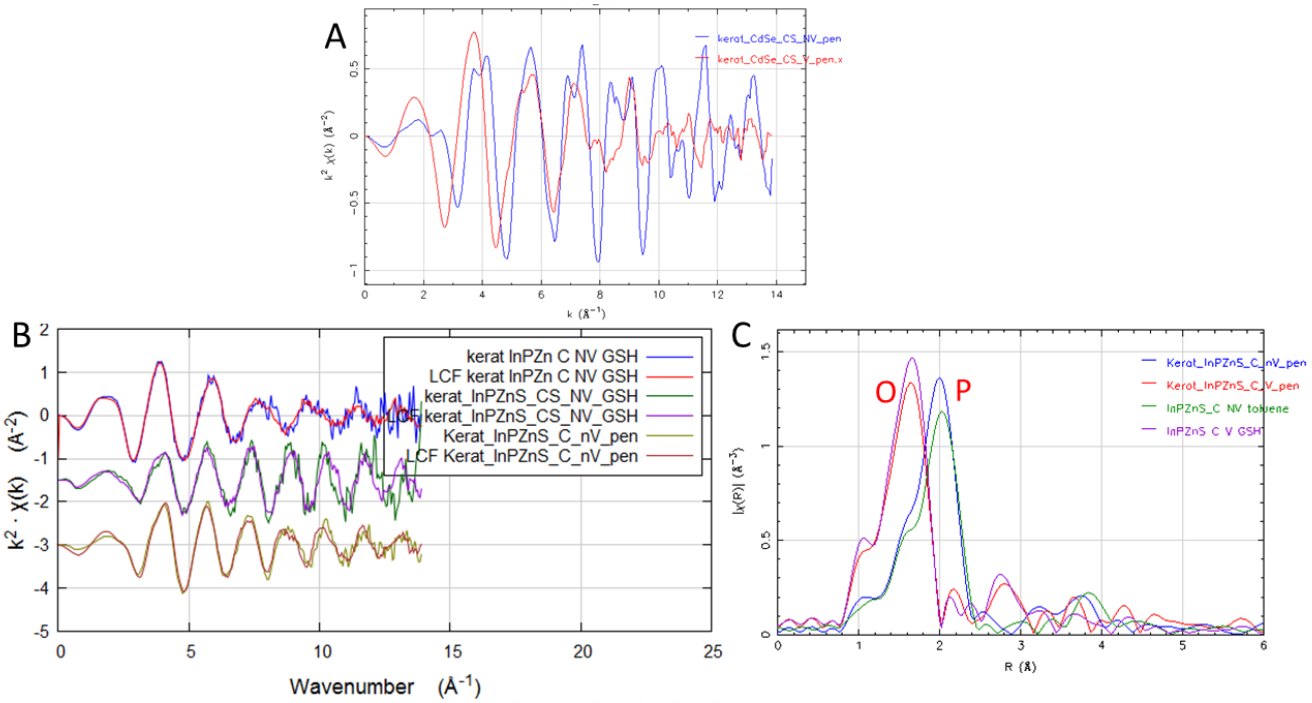

Figure 1: A: Examples of Cd K-edge EXAFS spectra for the keratinocyte cells exposed to pristine and aged CdSe QDs. B: Examples of In K-edge EXAFS spectra for the keratinocyte cells exposed to pristine InP QDs, and linear combination fits. C. Comparison of Fourier transformed spectra for the pristine and aged InP QDs.

Overall, the experiment was very successful, and the beamtime was used efficiently. We are currently finalizing the data treatment and writing the article related to this work.