

# PEO coated CdS nanoparticles for toxicity testing

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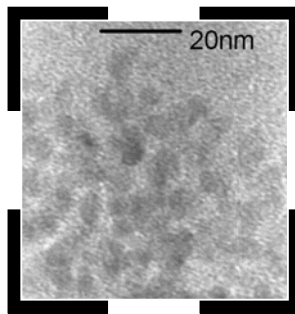
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## Introduction

There has been a massive growth in the interest and development of nanoparticulate materials for a range of applications. However, there have been very few systematic studies relating to their toxicity in the natural environment. We have developed a method for preparing PEO capped CdS nanoparticles which form stable suspensions in water and are not destabilised by variations in ionic strength. We have then exposed sticklebacks to these nanoparticles in controlled experiments in order to understand their toxicity.

## Experimental & Results

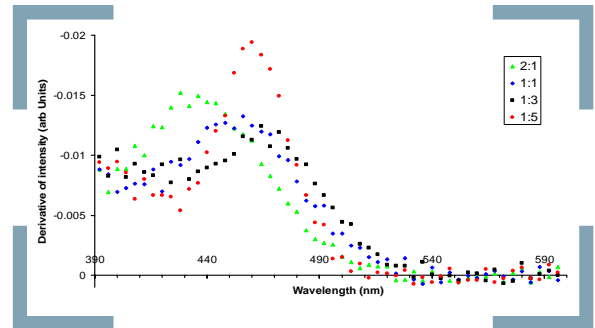
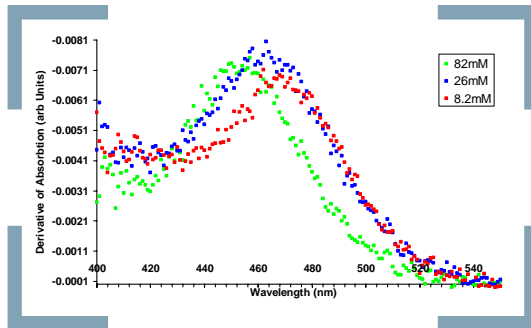


The particles were readily prepared by addition of a solution of sodium sulfide to a solution of cadmium chloride and the MPEGSH capping agent. The reaction resulted in the formation of a deep orange yellow solution. The unreacted ions were removed from solution by using an ion exchange resin.



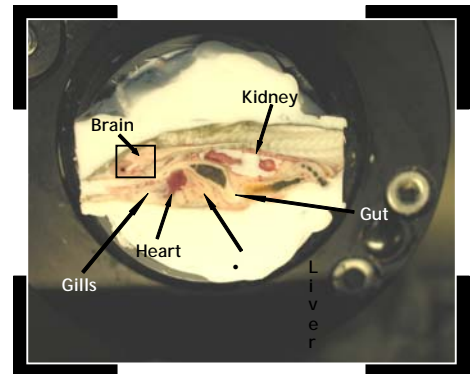
The three-spined stickleback, *Gasterosteus aculeatus*

It was found that the formation of the CdS nanoparticles generally resulted in the formation of particles of approximately 4.5nm (TEM). UV Absorption spectra were recorded for a series of particles prepared at different ratios of capping agent to cadmium ion. The data shows that there was only slight variations in particle size depending on capping agent: Cd<sup>2+</sup> ratio. In particular it was observed that slightly smaller particles were formed when the capping agent to ion ratio was greater than 1:1. A similar persistence in particle size with variation of total concentration can also be seen. There is a seemingly small shift in particle size which can be attributed to the respective variation in the concentration of the capping agent which absorbs strongly at about 350nm. Similar data have also been observed for silver nanoparticles by our group and we therefore propose a diffusion limited model to explain these results.



## Fish Studies

The three-spined stickleback, *Gasterosteus aculeatus* is endemic throughout Britain & northern hemisphere it is easy to keep in the lab and is a freshwater, estuarine, and marine fish. Its well-documented biology and complete genome sequence make it an excellent model for studying toxicology. Furthermore it is also recognised by OECD for toxicity testing. The fish were exposed to between 5ppm and 500ppm of nanoparticles (based on Cd) for 21 days. Oxidative stress is commonly observed during toxic responses to nanoparticle exposures. However there was neither a variation in stress markers or protein synthesis as a result of exposure. However there did appear to be a reduction in the number of males exhibiting normal nest building behaviour and hepatocellular nuclear hypertrophy was observed (4/6) in the fish exposed to the highest concentration. We are now expanding this work to further understand the relationship between the nanoparticle form and its toxicity.



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