Image-based quantification of erythrocyte morphological abnormalities to measure CuO nanoparticle-induced apoptosis

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Abstract

Copper nanoparticles (CuO NPs) are used widely as industrial catalyst, gas sensors or in biomedicines, due to their flexible properties such as large surface área to volume ratio. Their exponentially increased usage has exposed humans to a potential risk of toxicity. However, little is known about the adverse effects of CuO NPs on nontarget organisms. Here, a multiparametric cytotoxicity approach it is used, where CuO nanoparticle posible toxic effects to the crucian carp fish, *Carassius carassius*, were evaluated. The results revealed that both environmentally realistic doses of CuO, 0.5 and 1 mg/L used were toxic to erythrocytes and caused serious cell morphological abnormalities. 96hLC50 value of CuO NPs of 124.9 mg/L provoked generation of oxidative stress. Furthermore, light microscopy image-based quantification of erythrocyte cell and nucleus abnormalities was used to measure the CuO nanoparticle-induced apoptosis. Direct interaction of CuO NPs with erythrocyte membrane was suggested as a possible mechanism of cytotoxicity. The computational method we used here is straightforward, entails only light microscopy field images whose processing can be realised without expensive reagents or specialized instruments, making it applicable by a broad range of researchers and in laboratories where other approaches would be costly.

References

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Figures

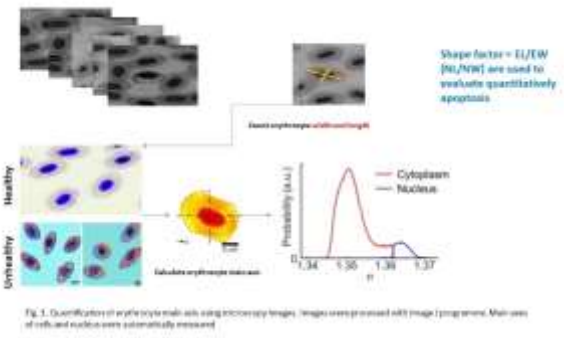

Fig. 1. Quantification of erythrocyte main axis using microscopy images. Images were processed with Image J programme. Main axes of cells and nucleus were automatically measured.