Using 3D Reconstitution of the Different Length of Exposed to Aluminum Oxide THP-1 Cells Responses Nanoparticles

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In this study, we compared cytotoxicity induced by different length of aluminum oxide (Al\textsubscript{2}O\textsubscript{3}) nanoparticles in THP-1 cells (human acute monocytic leukemia cell line); nano sized spheres, and nano sized short and long fiber. Average sizes of each aluminum oxide nanoparticles were N- Al\textsubscript{2}O\textsubscript{3} (<30nm), S- Al\textsubscript{2}O\textsubscript{3} (2-4nm x 100-1000nm), L- Al\textsubscript{2}O\textsubscript{3} (2-4nm x 2800nm) according to the manufacturer. Aluminum oxide nanoparticle crystal form was measured using a scanning electron microscopy. Different length of aluminum oxide nanoparticles were tested for biological activity using THP-1 cells and uptake of exposed aluminum oxide nanoparticles into THP-1 cell, using the 3D structures were observed by transmission electron microscopy. By each size of the THP-1 cell Nanoparticles're located in the cytosol was confirmed again. Nanoparticles were located in the cytosol as aggregates compared to the untreated THP-1 cells. Cytotoxicity induced by different length of aluminum oxide nanoparticles was measured by WST-1 assay.

To analyze intracellular reactive oxygen species (ROS) level, the N-, S-, L- Al\textsubscript{2}O\textsubscript{3} nanoparticles treated cells were loaded with 2’,7’-difluorescencein diacetate. The fluorescence intensity of DCF florescence was immediately analyzed with FACS Calibur at an excitation/emission wavelength of 488/530 nm. The levels of IL-1beta in culture supernatants were then assessed by a commercial enzyme-linked immunosorbent assay (ELISA) kit according to the manufacturer’s instructions. Consequently, we found that aluminum oxide have length dependent cytotoxicity such as formation of ROS and release of inflammatory cytokines.

References

Fig. 1 Scanning electron microscopy of PMA-primed THP-1 cell morphology with or without presence of Al₂O₃ nanoparticles

Fig. 2 Observation of particle phagocytosis by PMA-primed THP-1 cells