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COULD IRON/NITROGEN DOPING INFLUENCE THE CYTOTOXICITY OF TiO_2 NANOPARTICLES?

Ionela Cristina NICA[1,2,*], Bogdan MIU [1], Miruna S. STAN [1,2], Lucian DIAMANDESCU [3], Anca DINISCHIOTU [1]

[1] *Department of Biochemistry and Molecular Biology, Faculty of Biology, University of Bucharest, Bucharest, Romania;*
[2] *Research Institute of the University of Bucharest–ICUB, University of Bucharest, Bucharest, Romania;*
[3] *National Institute of Materials Physics, Bucharest Magurele, Romania;*
**E-mail address: cristina.nica@drd.unibuc.ro*

INTRODUCTION

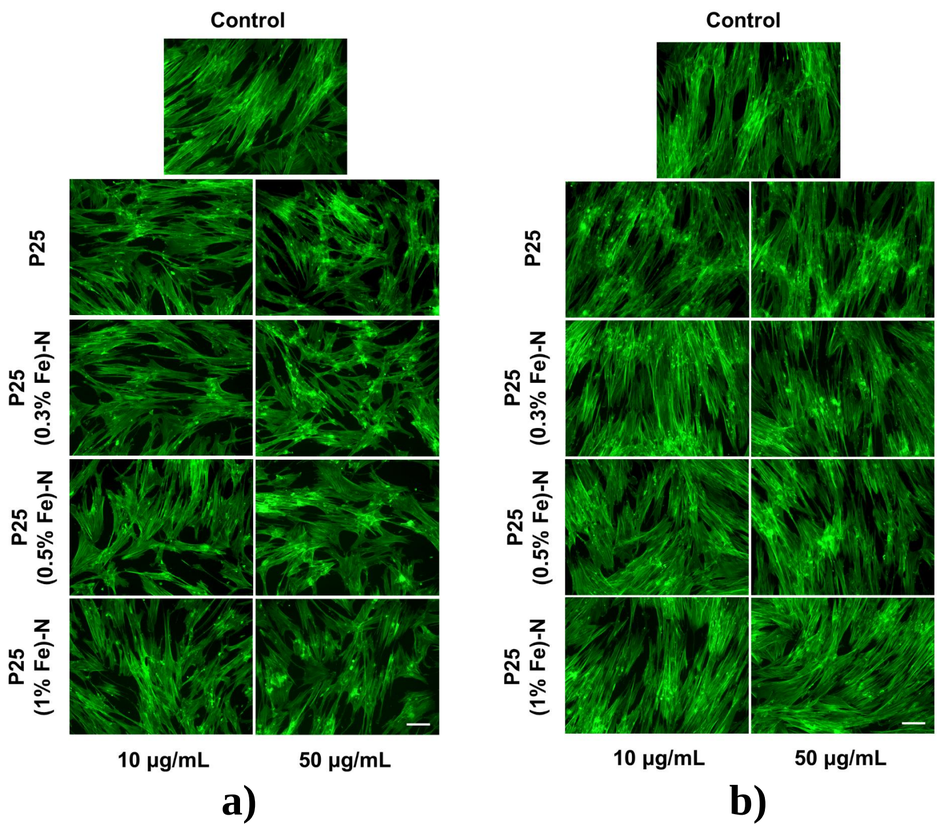
- Titanium dioxide (TiO_2) represents 70% of the total production volume of pigments worldwide, and is in the top five nanoparticles (NPs) used in consumer products.
- In the last decade, the advancement of nanotechnology has developed an abundance of novel and intriguing TiO_2-based nanomaterials that are widely used in many sectors, including industry (as a food additive and colorant in cosmetics, paints, plastics, toothpaste) and biomedicine (photoelectrochemical biosensing, implant coatings, drug delivery, new emerging antimicrobial agents).
- Since inhalation is the primary route for TiO_2 NPs exposure, our research aimed to investigate the cytotoxic effects induced by different photocatalytic TiO_2 NPs in human lung fibroblasts (MRC-5 cell line) and to establish a link between iron/nitrogen doping and toxicity.

MATERIALS AND METHODS

TiO_2 P25 Degussa and TiO_2 P25 NPs impregnated with iron (0.3, 0.5 and 1 at. %) and nitrogen under hydrothermal conditions.

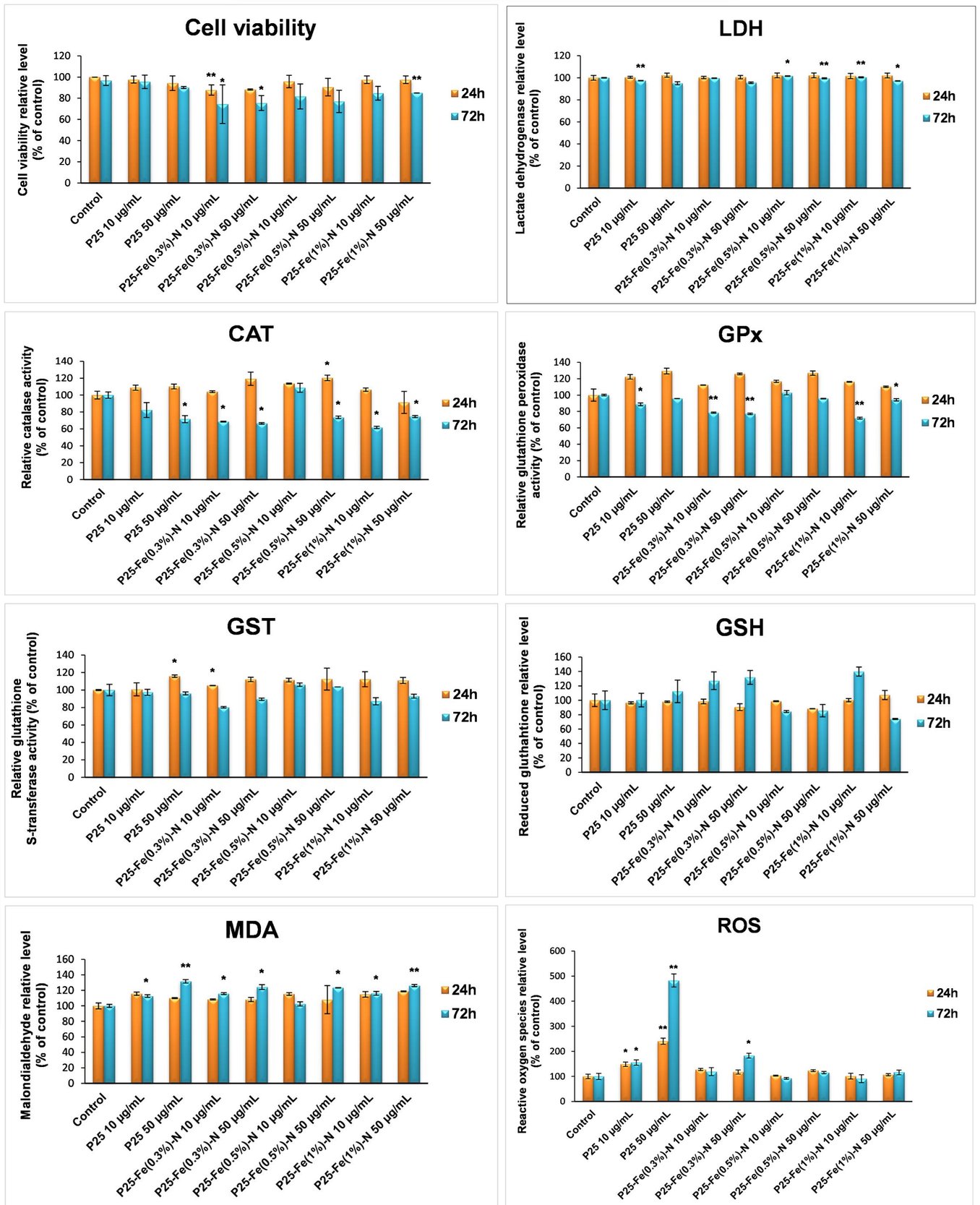
The cell viability and the cell membrane integrity as well as the oxidative stress level were evaluated by spectrophotometry and fluorimetry, after 24 and 72 hours of exposure to these TiO_2 NPs.

The cellular morphology and the actin cytoskeleton organization following exposure to functionalized TiO_2 NPs were analyzed by fluorescence microscopy.



Actin cytoskeleton organization of lung fibroblasts after 24h (a) and 72 h (b) of incubation with photocatalysts. F-actin (green) was labeled with phalloidin-FITC.

RESULTS AND DISCUSSION



- Our results showed that increasing the iron-doping of TiO_2 NPs reduced their toxic effect on human lung fibroblasts, and the oxidative stress was initiated by TiO_2 NPs in a time- and dose-dependent manner, providing information that may contribute as a reference for future studies on photocatalytic applications.
- The cells kept their elongated morphology specific to fibroblasts and established numerous focal adhesions, which confirmed that TiO_2 NPs did not affect human fibroblasts behavior.

CONCLUSIONS

✓ Our research contributes to a better understanding of the mechanisms of interaction between functionalized TiO_2 P25 NPs and *in vitro* biological systems, and can also help to obtain more biocompatible and efficient TiO_2-based nanomaterials.

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