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Using EpiDerm™ to evaluate the toxic effects of P25 Degussa nanoparticles on skin barrier

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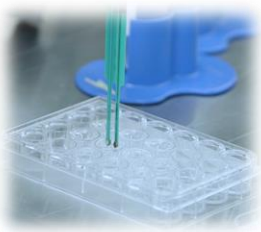
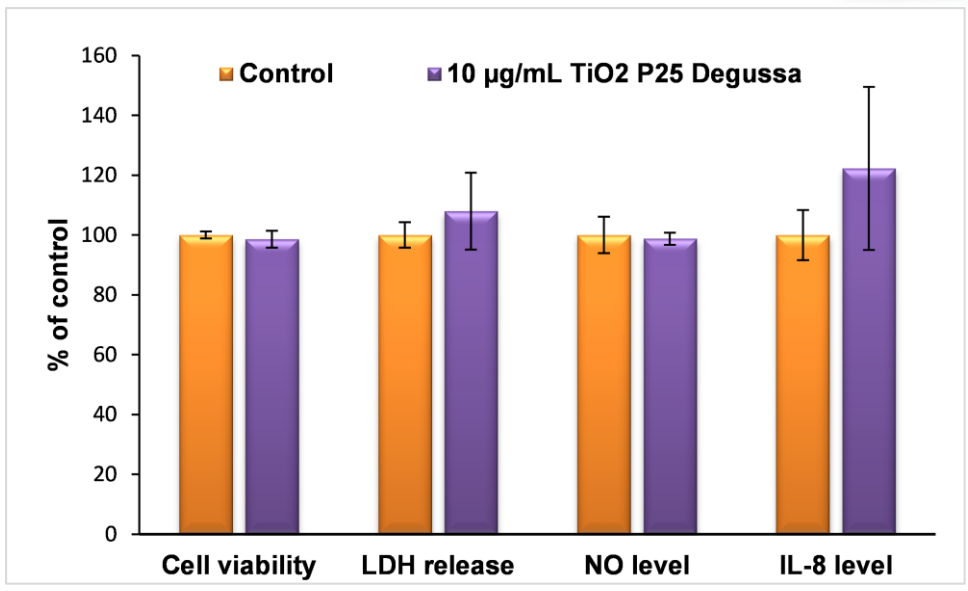
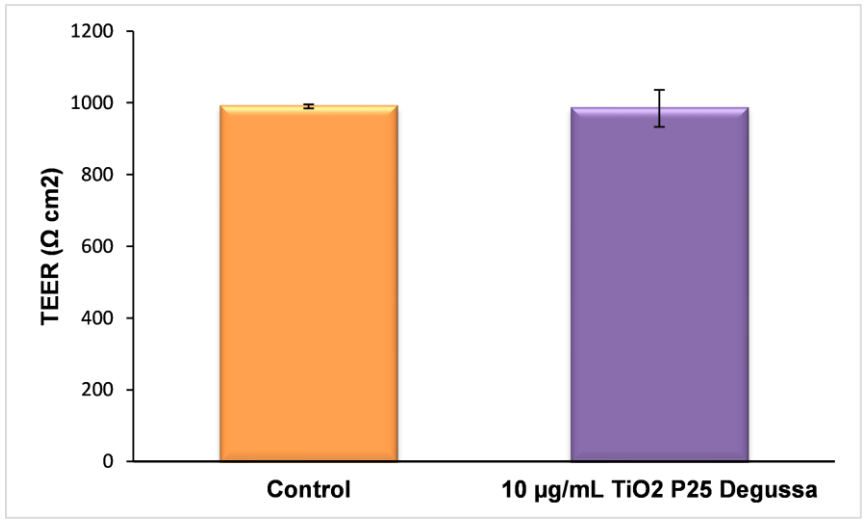
INTRODUCTION

- P25 Degussa represents a type of titanium dioxide (TiO_2) used as a white pigment in various applications, including coatings, plastics, paper, inks and cosmetics. It is generally considered to be non-toxic, but there have been concerns about the potential skin and inhalation toxicity of TiO_2 nanoparticles, as they can cause oxidative stress and other cellular damage in high quantities.



RESULTS AND DISCUSSION





▼ Trans-epithelial electrical resistance (TEER) measurement showed that cell barrier integrity was not altered by exposure to TiO_2 P25 Degussa particles, the tight junctions and normal cell permeability being maintained.

CONCLUSIONS

✓ Our results showed that the toxicity of TiO_2 P25 Degussa particles in small concentration was minimal on the in vitro 3D model of the human skin, not penetrating this biological barrier.

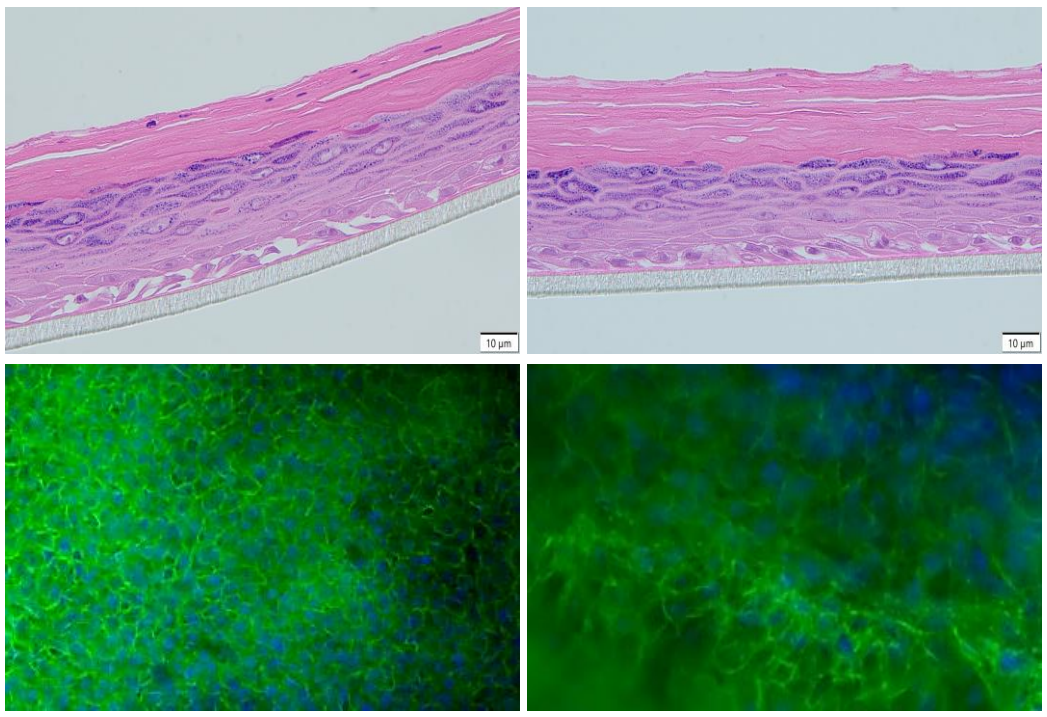
MATERIALS AND METHODS

- A 3D skin barrier system represented by human epidermis reconstructed from highly differentiated keratinocytes cultured at the air-liquid interface (EpiDerm™) was used in our study to test the cytotoxicity of TiO_2 P25 Degussa particles.
- After 24 h of exposure to a concentration of 10 µg/mL TiO_2 P25 Degussa, their influence on cellular viability (MTT assay), membrane integrity (LDH release) and potential to generate an inflammatory response (NO and IL-8 level) were evaluated.

⚡In addition, the transepithelial electrical resistance (TEER) was monitored using the Millipore® Millicell Electrical Resistance (ERS) system as an indicator of the integrity of the 3D cellular barriers.

► A 24 h exposure of cell culture to a concentration of 10 µg/mL TiO_2 P25 Degussa did not significantly alter cell viability compared to the control as measured by the MTT assay. It also did not induce the release of an appreciable amount of nitric oxide or lactate dehydrogenase in the extracellular environment, the values being close to those of the control.

► Instead, an increase in the level of the cytokine IL-8 was observed, being suggestive for the initiation of an inflammatory process.



Control **10 µg/mL TiO_2 P25 Degussa**

▼ Microscopy analysis of cell morphology (through hematoxylin-eosin staining and fluorescent actin labeling) revealed slight changes, especially at the apical surface of the tissue, noting some TiO_2 P25 Degussa particles remained attached to this surface and were not internalized by cells (Scale = 10µm and 60X magnification for H&E staining; 20X magnification for actin and nuclei staining).

ACKNOWLEDGEMENTS
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