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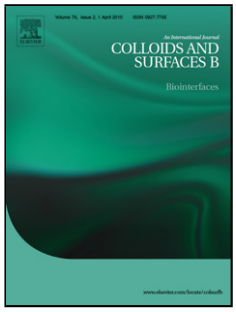

Title: The influence of mineral particles on fibroblast behaviour: a comparative study

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The influence of mineral particles on fibroblast behaviour: a comparative study

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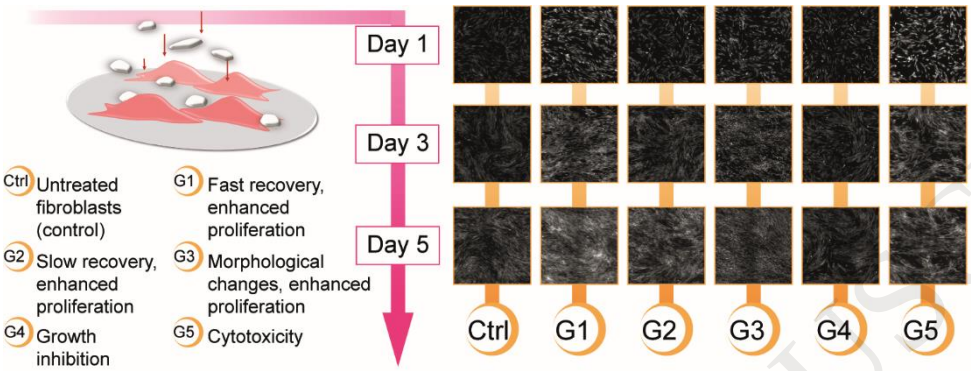
Graphical abstract



Highlights

- Minerals were characterised and the influence on fibroblasts behaviour was assessed.
- FTIR and zeta potential show protein adsorption on the minerals from the serum.
- Minerals can be grouped according to the time-dependent cellular response.
- Calcium sulphates induced a significant change in the fibroblast morphology.

ABSTRACT

Minerals are versatile tools utilised to modify and control the physical-chemical and functional properties of substrates. Those properties include ones directing cell fate; thus, minerals can potentially provide a direct and inexpensive method to manipulate cell behaviour. This paper shows how different minerals influence human dermal fibroblast behaviour depending on their properties. Different calcium carbonates, calcium sulphates, silica, silicates, and titanium dioxide were characterised using TEM, ATR-FTIR, and zeta potential measurements. Mineral-cell interactions were analysed through MTT assay, LDH assay, calcein AM staining, live cell imaging, immunofluorescence staining, western blot, and extra/intracellular calcium measurements. Results show that the interaction of the fibroblasts with the minerals was governed by a shared period of adaptation, followed by increased proliferation, growth inhibition, or increased toxicity. Properties such as size, ion release and chemical composition had a direct influence on the cells leading to cell agglomeration, morphological changes, and the possible formation of protein-mineral complexes. In addition, zeta potential and FTIR measurements of the minerals showed adsorption of the cell culture media onto the particles. This article provides fundamental insight into the mineral-fibroblast interactions, and makes it possible to arrange the minerals according to the time-dependent cellular response.