GC-FID as a complementary tool to understand fatty acids' role in cellular antioxidant activity

a pathway towards understanding iROS production in cells exposed to essential oils for cosmeceutical applications

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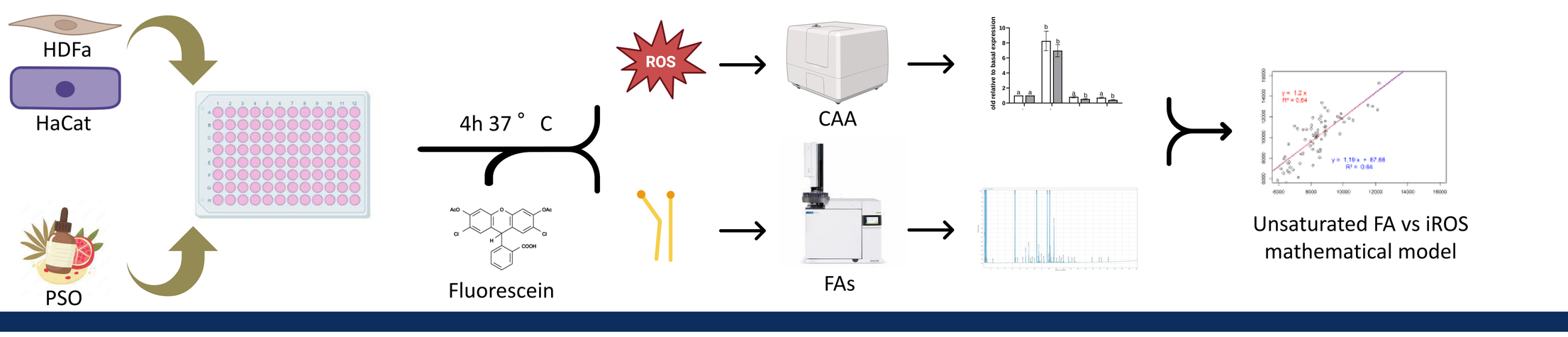
Introduction

In the cosmeceutical industry, the development of various products relies heavily upon essential oils due to two crucial reasons: first the eco-sustainability drive that demands the application of natural products in all formulations and secondly their intrinsic aromatic characteristics and the beneficial biological properties normally apported to these compounds. However, they aren't without drawbacks as they can induce various adverse reactions when in contact with the skin, namely dermal reactions and contact dermatitis, with most of these problems being associated with the essential oils' oxidation. With that in mind, most compounds are tested for their Cellular Antioxidant Capacity (CAA) to ascertain if they are involved in the formation of intracellular Reactive Oxygen Species (iROS) in the cytoplasmatic environment of skin related cells. However, while the data generated from this assay may be crucial for the cosmeceutical industry, it lacks a basal understanding of the mechanism behind the result observed. .

Objectives

1. Investigate essential oils CAA upon skin cell lines using using Pomegranate Seed Oil (PSO) as a model oil
2. Examine the relationship between essential oil composition, particularly unsaturated fatty acid (FA), and their influence on iROS formation in skin cells
3. Evaluated GC-FID data reproducibility to act as a complementary tool to CAA
4. Create a mathematical model that helps explain the relationship between CAA data and the unsaturated fatty acid content in samples

Methods



Results

Cellular Antioxidant Activity

HaCat

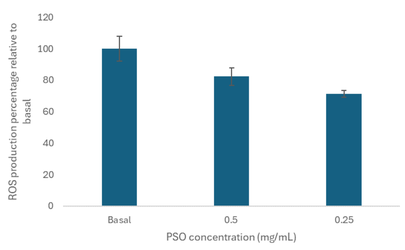


Fig. 1 – PSO cellular antioxidante activity results in HaCat cells. Results in iROS production percentage

HDFa

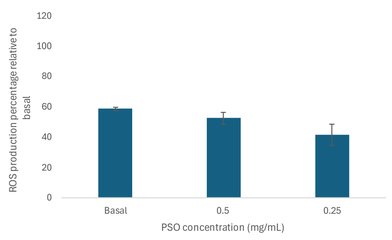


Fig. 2 – PSO cellular antioxidante activity results in HDFa cells. Results in iROS production percentagem.

GC-FID

HaCat

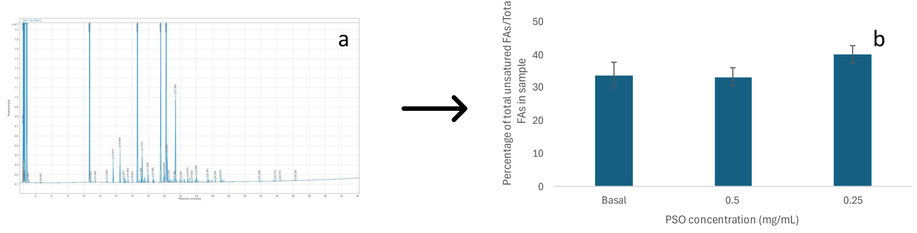


Fig. 3 – GC-FID results obtained for HaCat cells. a) Example chromatogram of FA detected in samples. B) Percentage of unsaturated FA detected in samples at different PSO concentrations relatively to total FAs

HDFa

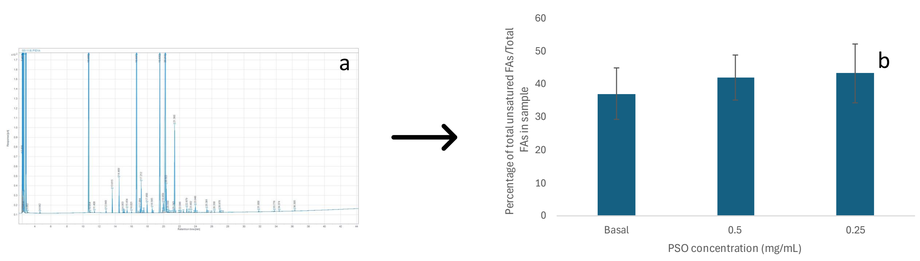
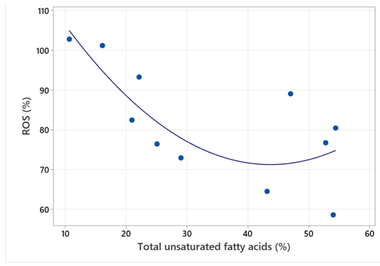


Fig. 4 – GC-FID results obtained for HDFa cells. a) Example chromatogram of FA detected in samples. B) Percentage of unsaturated FA detected in samples at different PSO concentrations relatively to total FAs.

Mathematical models

HaCat

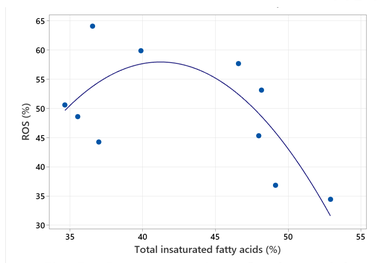


iROS = 130.2 – X + 0.03084

S 10.1462
R-Sq 58.1%

Fig, 5 – Representation of polynomial model relating unsaturated acids presence in PSO samples with iROS production in HaCat cells

HDFa



iROS = -269.6 + X – 0.1928

S 7.34510
R-Sq 54.6%

Fig, 5 – Representation of polynomial model relating unsaturated acids presence in PSO samples with iROS production in HDFa cells

Conclusions

- PSO at both concentrations tested did no cause iROS in both cell lines tested
- In HaCat PSO reduced the levels of iROS relatively to basal conditions
- PSO presence did not lead to significant increases in unsaturated FA content
- Relation between unsatured FA concentration and iROS content followed a polynomial model
- Additional assays are required to increase model fitness and strength

Acknowledgements

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