



# Adaptogen Properties of Indian Sandalwood Oil in Skin Protection

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## Introduction:

- Indian Sandalwood oil is the essential oil distilled from the heartwood of *Santalum album* tree.
- This essential oil consists of over 125 constituents, among them  $\alpha$ -santalol and  $\beta$ -santalol are the two main constituents responsible for the bioactivities and aroma unique to sandalwood.
- Indian sandalwood oil has been used as a treatment for skin for over thousands of years as described in Ayurveda system of medicine.
- Human skin is constantly expose to external stress causing skin damage leading to premature aging
- These exposures produce reactive oxygen species in the keratinocytes causing a cascade of reactions leading to inflammation, pigmentation and collagen damage
- Pollution and blue light from sun and digital screens have been identified to have detrimental effects on skin by generating ROS in keratinocyte
- Current study identifies the antioxidant capacity of Indian sandalwood oil by reducing the ROS in human keratinocyte cells exposed to pollution and blue light simulation.
- Skin protection from the above said exposures by sandalwood oil was further studies through clinical assessment of skin protection through antioxidant action.
- Aim of the investigation is to establish Indian sandalwood oil as a adaptogen in protecting skin from exposome, to recognise as a multifaceted ingredient in personal care applications.



## Materials & Methods:

### Intracellular antioxidant study

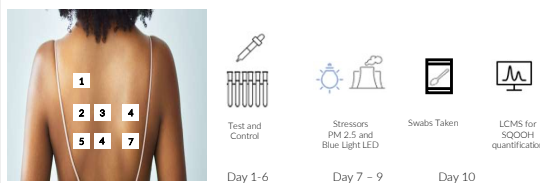
Cell viability of HaCaT cells was tested for Indian sandalwood oil (0.001-0.2% w/v)

Intracellular antioxidant capacity was tested on Indian sandalwood oil (0.2, 0.1 and 0.05%) and the positive control alpha tocopherol (2, 1, 0.5%)



### Clinical Study

- Monocentric, controlled, randomized, double-blinded, intraindividual comparative trial at the clinical facility at the CIDP Mauritius.
- 22 healthy subjects between 18 and 65 years old were recruited as subjects for this study.
- Seven location on the back were treated for six days; non treated /non exposed, treated non exposed, placebo exposed, Indian sandalwood oil 0.1%, 1% and 10%,  $\alpha$ -tocopherol 0.5%
- Six sites were exposed to stressors for 3 days with treatment, on the tenth day swabs were taken and sent for liquid chromatography mass spectroscopy analysis of squalene monohydroperoxide



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## Results & Discussion:

- Cells treated with 0.2% of ISO or less showed cell count results showing more than 70% cell viability
- A significant reduction in the oxidative stress induced by either blue light 412 nm ( $p < 0.0001$ ) or 450 nm ( $p = 0.0002$ ) or cigarette smoke ( $p = 0.001$ ) could be observed ( Figure 1).
- Positive control alpha-tocopherol did not show a significant protective effect against the levels of ROS induced by stressors.

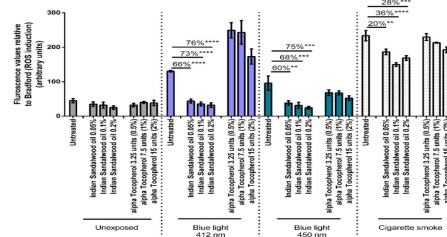


Figure 1: ROS induction by Blue light 412nm, 450nm and cigarette smoke in HaCaT cells treated with three concentrations of ISO and three concentrations of  $\alpha$ -tocopherol.

- A dose-dependent decrease in the levels of SQQOH was reported on the zones treated with the ISO formulations. The zones treated with the positive control, 0.5%  $\alpha$ -tocopherol, and exposed showed a significant lowering of SQQOH ( $p < 0.001$ ) when compared to the exposed zones that were either left untreated or treated with the vehicle control (Figure 2).

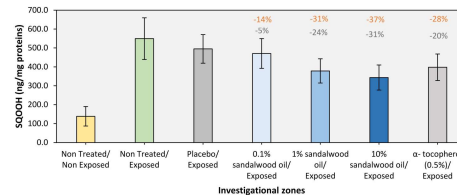


Figure 2: Concentration of SQQOH (ng/mg of protein) collected on each zone subjected to ambient dust and blue light stress. Percentage variation from untreated exposed zones denoted in orange, exposed zones are denoted in grey.

## Conclusions:

- Skin oxidation due to external stressors are identified as the main cause for aging, pigmentation and other ailments of skin.
- Indian sandalwood oil has significantly reduced ROS generated in keratinocyte cells when exposed to blue light and pollution simulation.
- Protection of cells by exposome is notably high from Indian sandalwood oil compared to  $\alpha$ -tocopherol.
- Cells treated with solar blue light range showed the highest level of protection when treated with Indian sandalwood oil.
- Human skin treated with Indian sandalwood oil showed a dose dependant protection as measured as reduced oxygenated squalene of sebum.
- Indian sandalwood oil showed a similar efficacy and when compared to the established skin antioxidant  $\alpha$ -tocopherol.
- Indian sandalwood oil can be a first line active cosmetic agent in protection skin from solar and digital blue light as well as pollution.

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