# EVALUATION OF THE ANTI INFRA-RED PROTECTION OF COSMETIC PRODUCTS, *IN VIVO*

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## INTRODUCTION

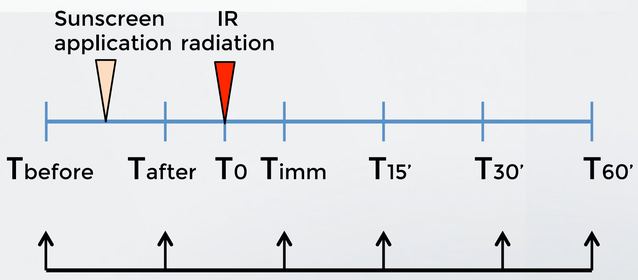
If sunscreens protect against UV radiations, several studies point now the deleterious impact of infra-red (IR) and the fact that an IR protection should also be added to the products [1-3]. Indeed, IR is involved in cutaneous ageing and probably in carcinogenesis [4]; it is mainly responsible for the increase in skin temperature and leads to free radicals and matrix metalloproteinase-1 (MMP-1) production deep in the dermis [5-7].
An efficient protection against IR should be obtained via the presence of optical absorbers in the IR range, reflection of photons and scattering and/or free radical scavengers [8].
**The aim of this study was to propose simple methodologies in order to evaluate the IR protection enabled by cosmetic products.**

## MATERIAL AND METHODS

These two tests were open and intra-individual studies. They took place at Laboratoire Dermscan (France) and were conducted in accordance with the applicable regulations.

### 1. BLOCKING EVALUATION OF TWO SUNSCREEN PRODUCTS

| Subjects | Studied zones: *forearms* | Studied products |
|---|---|---|
| 11 women<br>33 years mean age [21-57 years]<br>with untanned, dry and sensible skin on forearms<br>6 phototype II + 5 phototype IV | A_non-treated, non-irradiated zone<br>C_non-treated, irradiated zone<br>D_treated, irradiated zone | Sunscreen X (SPF 50+) applied on 7 subjects<br>Sunscreen Y (SPF 30) applied on 4 subjects |



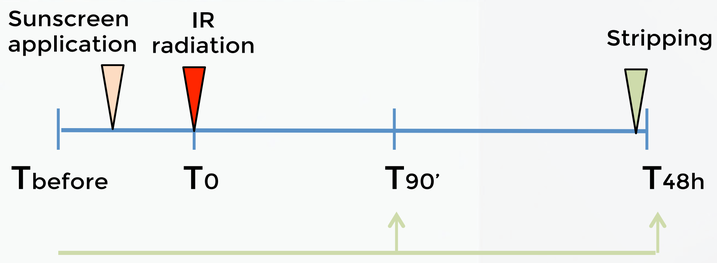

**Cutaneous measures of:**

- **Temperature** (Periflux system – Perimed)
- **Color** (spectrocolorimeter CM700d – Konica Minolta)
- **Red Blood Cell** (RBC) **concentration** (TiVi 600 – Wheelsbridge AB)

*Sunscreens were bought on the French market and contained some ingredients supposed to protect from cellular damages.*

### 2. EVALUATION OF THE CELLULAR PROTECTION AGAINST IR OF A SUNSCREEN PRODUCT

| Subjects | Studied zones: *forearms* | Studied product |
|---|---|---|
| 10 women<br>34 years mean age [20-59 years]<br>with untanned skin on forearms<br>phototype IV | A_non-treated, non-irradiated zone<br>B_treated, non-irradiated zone<br>C_non-treated, irradiated zone<br>D_treated, irradiated zone | Sunscreen Y (SPF 30) |




**Cutaneous swabs for:**

- **PCA/UCA** (LC/MS method)
- **MDA** (GC/MS method)
- **CAT, SOD** (colorimetric kits)

***PCA/UCA**: pyrrolidone carboxylic acid/urocanic acid ; **MDA**: malondialdehyde ; **CAT**: catalase ; **SOD**: superoxide dismutase*

## RESULTS & DISCUSSION

### 1. BLOCKING EVALUATION OF TWO SUNSCREEN PRODUCTS

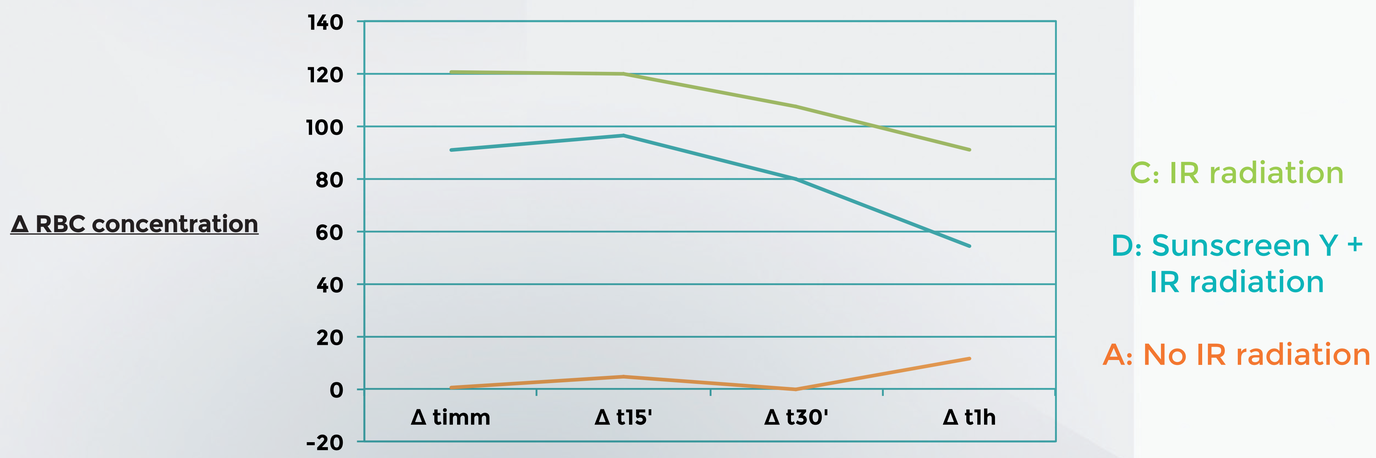
**Effects of IR radiations on cutaneous parameters**
Immediately after the end of IR radiation, significant increases in RBC concentration (+73.4%), redness (+77.6%) and temperature (8.7%) were recorded ($p<0.05$; student t test). During time, a mottled redness appeared on the zones under IR radiation (zones C and D). This sign evidences the deep penetration into dermis (and even the subcutis) of IR, heat generation and vasodilatation of vessels from the deep vascular plexus. This effect lasted up to 60 min.

**Influence of phototype**
Darker skin phototypes (IV) reacted greater than lighter ones (II) and recovered more slowly. They absorbed more heat, leading to higher vasodilation and redness.

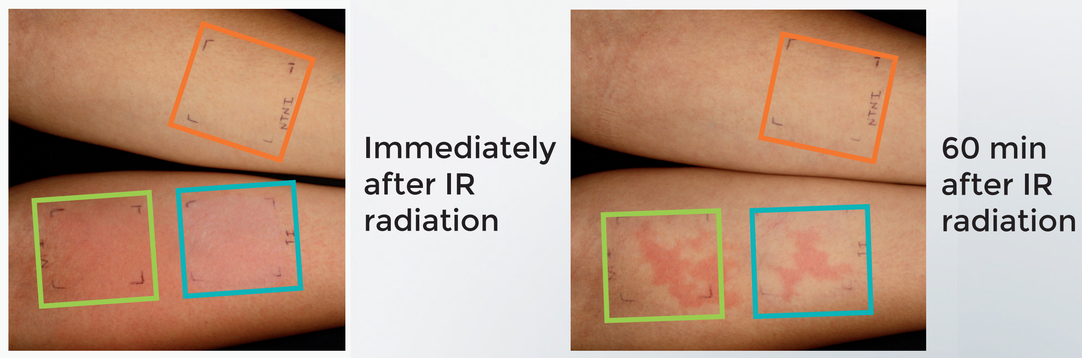
**Effect of sunscreens X or Y**

- Just after application and without any IR radiation, sunscreens did not modify any of the 3 cutaneous parameters.
- Sunscreen X had no blocking effect against IR: measures on the D zone were very similar to the unprotected C zone (data not shown).
- Sunscreen Y decreased both vasodilatation and redness at the skin surface, immediately after the end of the IR radiation. The blocking effect of sunscreen Y was still observed one hour after the end of IR radiation: all 3 parameters on D zone were reduced compared to the C zone. As an example, the variations in time obtained for RBC concentration is presented below.

**Mean variations of RBC concentration compared to before IR radiation (and after product application)**




Visualization of skin aspect on one subject (phototype IV) treated with sunscreen Y: immediately and up to 60 min after IR radiation, inflammation is reduced on the protected zone (D versus C).




### 2. EVALUATION OF THE CELLULAR PROTECTION AGAINST IR OF A SUNSCREEN PRODUCT

In the second part of this study, we decided to test the cellular protection effect of sunscreen Y and to recrut only phototype IV in order to maximize the heat reaction.

| | Effect of IR radiation (Δ% C-A zones) | Cellular protection of Sunscreen Y on IR radiation (Δ% D-C zones) | Conclusion |
|---|---|---|---|
| PCA/UCA | ↔ 11.3% (p=0.234) at t90'<br>↓ -14.0% (p=0.013) at t48h | ↑ +30.2% (p=0.005) at t90'<br>↔ -2.8% (p=0.334) at t48h | t90': Sunscreen Y had a moisturizing action<br>t48h: IR radiation dried the skin |
| MDA | ↑ +34.5% (p=0.000) at t90' | ↓ -13.5% (p=0.002) at t90' | t90': Sunscreen application limited the aggression: significant decrease of the MDA level |
| SOD | ↑ +43.4% (p=0.000) at t90'<br>↑ +7.6% (p=0.043) at t48h | ↓ -15.7% (p=0.003) at t90'<br>↔ 4.8% (p=0.178) at t48h | t90': Sunscreen application limited the aggression: significant decrease of the SOD level |
| CAT | ↑ +18.5% (p=0.000) at t48h | ↓ -7.7% (p=0.003) at t48h | t48h: Sunscreen application limited the aggression: significant decrease of the CAT level |

## CONCLUSION

- The 1st approach takes advantage of the blocking power of sunscreens. All the chosen parameters (cutaneous temperature, color and microcirculation) were increased after IR radiation. Darker skin types reacted more importantly than lighter ones: they absorbed more heat and vasodilation was more important. This approach allowed to discriminate two sunscreens: sunscreen X had no effect on skin heating under IR whereas sunscreen Y reduced the 3 parameters.
- The 2nd approach studied some cellular makers of stress: oxidation and detoxification. We were able to demonstrate that a sunscreen product that limit skin heating also limit the cellular aggression (reduced generation of MDA as well as reduced needs in SOD and CAT).

**These two approaches can be used in the future in order to test the IR protection of a cosmetic product.**

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