



PHOTOBIOLOGY AND PHOTOPROTECTION

## COMBINED EXPOSURE TO UV AND POLLUTION INCREASES RISK OF SKIN DAMAGE, AND PRODUCTS THAT PROTECT AGAINST BOTH ARE NEEDED FOR OPTIMUM PROTECTION

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**Introduction:** In daily life, skin is consistently exposed to various environmental stressors, like UV and pollution. It is suggested air pollutants like Polycyclic Aromatic Hydrocarbons (PAH) could penetrate and accumulate in the skin where they induce deleterious effect like carcinogenesis, pigmentation and oxidation. Both PAHs and UV can activate aryl-hydrocarbon receptor (AhR), through which they trigger similar biological responses. Therefore, exposure to UV and PAHs dual stress may result in enhanced damaging effects. A skin care product containing both SPF protection and ingredients which can mitigate the detrimental effect of pollution like antioxidants and anti-inflammatories is desirable for superior skin protection.

**Objective:** The current study aims to investigate whether exposure to both UV and pollution damages skin more than UV alone using a pigmented living skin equivalents (pLSE).

**Materials and Methods:** The pLSE model was exposed to UVB irradiation, in the presence or absence of benzo(a)pyrene (BaP). At the end of treatment, the lightness ( $L^*$ ) of pLSE was measured. The cyclobutane pyrimidine dimer (CPD) lesion and the protein expression of filaggrin and Pmel17, were investigated using immunohistochemistry (IHC).

**Results:** It was found that both UV and BaP induced dose-dependent skin darkening in pLSE. BaP alone caused around 2  $\Delta L^*$  darkening at 1  $\mu\text{M}$ , and 50  $\text{mJ}/\text{cm}^2$  UVB alone induced 3.5  $\Delta L^*$  decrease in skin tone. When combining the two stressors, the pigmentation effect increased by 200% and 75%, comparing to BaP and UV alone, respectively. IHC results revealed BaP further increased Pmel17 expression and CPD lesions, while decreased filaggrin level upon UV challenge, suggesting BaP enhanced the UV effect on pigmentation, DNA damage and barrier disruption.

**Conclusions:** The current study demonstrates the combined exposure of UV and pollution increases skin damage. Combination of SPF protection and ingredients which can mitigate





pollutant damage is preferable for superior skin protection.

