INNOVATIVE IN-HOUSE MODELS TO EVALUATE THE EFFECT OF ENVIRONMENTAL STRESSORS (PHYSICAL, CHEMICAL & POLLUTION) ON HAIR FIBERS.

N.ANDRE, C.CLAVE, I.THUILLIER, J.GINESTAR

C.F.E.B SISLEY, 3-5 avenue de Friedland, 75008 Paris; nada.andre@sisley.fr

Quality of hair is very important for self-confidence as well as a very important part of appearance and self-esteem. Hair reflects the personality and hair damage is considered as aesthetic imperfections.

Hair cuticle is the hair's first line of defence against environmental stressors. Alteration causes penetration of stressors, such as pollution or chemical molecules into the fibers and promotes damaged, brittle and weak hair. An Intact cuticle is therefore crucial for healthy hair.

Our nowadays lifestyles involve constant exposure to stressors (pollutants, chemicals, physical and mechanical stresses…) that weaken our hair fibers; This results in damaged hair that looks dull and seems asphyxiated.

Unlike in skin investigation, the effect of environmental stressors on hair fibers has not often been studied and published in scientific papers. Precise evaluation methods to track modulations of the stressors on hair fibers are necessary.

This explains the interest in developing several and complementary models to provide experimental conditions that mimic the harmful effects of environmental stressors on hair fibers. The aim of this study is to identify the damage of stressors on hair fibers and then measure the performance of appropriate hair care products.

The following stressors were studied:

1. Air-pollution: Carbon micro-particles (5-50 µm) were used to simulate air pollution. These particles were made fluorescent with fluorescent ink of a yellow highlighter. 5mg of the above prepared fluorescent carbon particles were then mixed with 25mg of hair under a stable flux of compressed air for 3 minutes. Microscopic observation was then realized and particles on hair were quantified by specific software (figure-1).

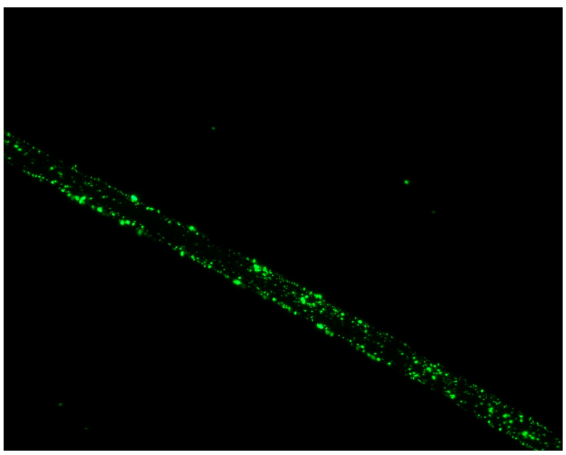

Figure 1 : Fluorescent carbone particules on hair fiber

2. Chemical-stress: Chlorine (swimming-pool water modeling); Hair tresses were placed in a bath of chlorine at 5mg/L (mean concentration in swimming pools in France). In order to measure the integrity of the hair cuticles, the penetrating capacities of a fluorescent probe into the hair was studied. Hair were then sectioned and analyzed. The fluorescent intensity in the hair cortex is directly proportional to the degree of hair damage (Figure-2).

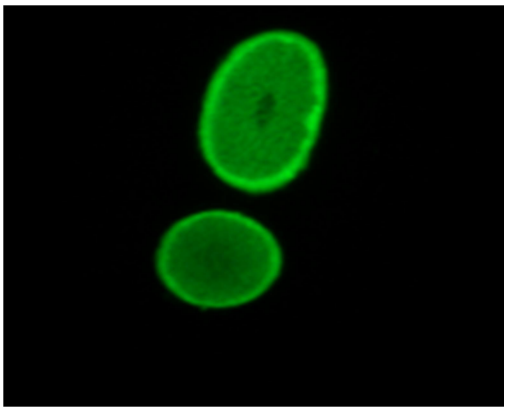

Figure 2 : Sectioned porous hair with fluorescence in the cortex

3. Physical-stressors. Two stressors were studied.

UV-irradiation: Hair pieces were cut from tresses and spread in a homogeneous manner in petri dishes. UVA & B irradiations were realised. ROS determination (DCFH-probe) was evaluated to quantify the deleterious effect of UV light on hair.

Heat and mechanical damage: Hair tresses underwent several cycles on hairstyling (heating and hair brushing) and the damage on hair cuticles was observed by Scanning Electron Microscopy (SEM). (Figure-3)

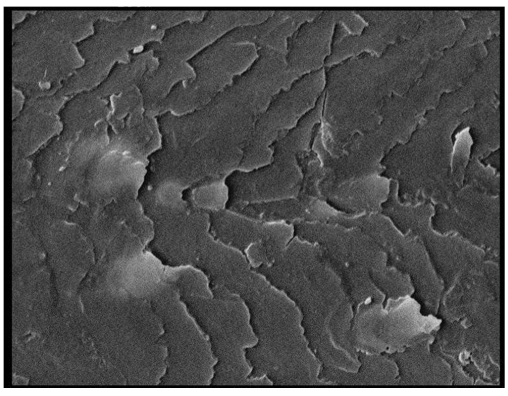

Figure 3 : SEM imaging showing altered cuticles

SUMMARY OF RESULTS /CONCLUSIONS

The in-house developed methods for the evaluation of pollution deposition on hair are suitable to evaluate the “detoxifying” potential of hair care products.

Chemical stress, making hair porous, can be evaluated by the rate of penetration of the fluorescent probe into hair cortex.

As expected, UV irradiations increase the production of ROS on hair fiber.

Heat and mechanical damage can be observed on the hair surface by SEM.

The above described conditions appear to be suitable for the evaluation of the effects of environmental stressors on hair fibers permitting the development of appropriate hair care products.