Introduction and aim of the project

Hair bleaching causes undesirable chemical and structural changes to the cortex, the most prominent process being the oxidation of the disulphide bonds of the amino acid cystine and the creation of cysteic acid [1]. It is known that this process affects mostly the Keratin Associated Proteins (KAP) which are amorphous and sulphur-rich. A major secondary effect is the overall destabilisation of the cortex structure within which the crystalline Intermediate Filaments (IF) are supported by KAP. An overall decrease in the proportion of ordered protein structure [2], reduction of mechanical strength [3] and the denaturation temperature of hair [4] have been used to quantify the degree of damage. The cuticle also undergoes oxidative damage during bleaching which causes reduced thickness and increased surface roughness [5].

Mitigating and countering these changes in the hair surface and internal structure have been a prime objective of the hair care industry. Such action would be expected to deliver immediate sensory benefits perceivable by the consumer.

The aim of this project was to compare the impact of three actives said to deliver structural benefits to bleached hair. Their impact was evaluated in two conditions: when applied with the bleaching cream (WB) and after bleaching (AT).

Materials and methods

K: Hydrolysed keratin (Aver. Mw=18000)
C: Cystine/silanol copolymer (Aver. Mw = approx. 230000)
VP: Hydrolysed vegetable protein/silanol copolymer (Aver. Mw=10000)
DB: Double bleached hair (control)

Virgin Caucasian hair tresses

Wet and dry tensile strength/combing tests, wet DSC

Bleach for 60 Min @ 37°C

Bleach, including 0.75%w/w active for 60 Min @ 37°C

Bleach for 30 Min @ 37°C

Soak in active solution 0.75%w/w for 60 min @ 37°C

Wash (using basic shampoo)

With bleach

AT

All active treatments were applied at 0.75%w/w

Wet and dry tensile strength tests

Wet and dry combing tests

Colour analysis (after gentle blow dry)

Sensory evaluation by naïve panel (after gentle blow dry)

Results and discussion

Tensile strength (Texture Analyser, N/µm²)

% Tensile strength change active treatments vs double bleached hair

Combing data:
- WB results: C-treatment conditioned the hair (wet and dry), reducing the work of combing. This impact is partly mirrored by the K-treatment (dry).
- AT wet combing implies that the actives were not present on the hair surface in quantities sufficient to modify the profile of the wet (swollen) cuticle.
- AT dry combing work increased notably. This effect could be attributable to an overall increased roughness and stiffness of the hair fibres, rather than a surface effect.
- The VP-treatment caused the highest level of dry roughness and stiffness, possibly due to the nature of its protein sub-units.

Sensory data: all WB and AT treated hair samples were statistically smoother than the DB hair when tested sensorially.

Conclusions

In summary, the C-activated presented some potential to enhance the tensile and surface properties of hair when added to the bleaching cream and as an after treatment. Under the test conditions, the K and VP treatments showed undesirable effects, reducing strength and increasing combing work, but offered sensorial benefits. Their use levels require adjustment to ensure a balanced outcome. The colour and DCS tests also imply that such actives might influence the oxidative process, either directly or via trapping the bleaching agents in the cortex, and that they have strong intermolecular interactions with bleached hair. Hence, the use of such actives would require a complex formulation approach.

References: