DIA-STRON
DELIVERING MEASUREMENT SOLUTIONS

Complementary Hair Tress Testing - Combing and Friction

Introduction

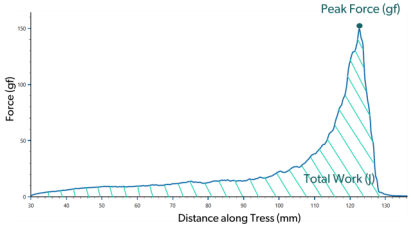
Consumers assess the condition of their hair and form an opinion of a product's performance during their daily grooming procedures. These assessments may be made when washing, brushing and styling, or when they touch or run fingers through their hair.

In-vitro instrumental tress test methods provide quantitative data that can be used to assess damage, investigate the performance of raw materials and support product claims.

Bulk hair properties are influenced by the condition of the fibre surface, the inter-fibre friction and the alignment of fibres. Healthy hair is often perceived to feel smooth, silky and easy to comb through without tangling. Combability and smoothness are therefore important attributes to measure in the development of hair care products.

Combing Experiments

Combing experiments are well established methods to characterise hair care products.

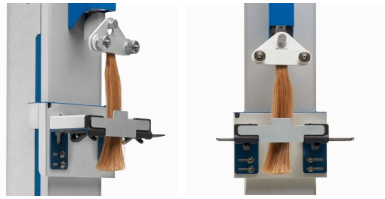


They are extremely valuable for product evaluation, as they can be used to evaluate and substantiate conditioning claims, hair damage, product build-up/ substantivity and styling product comb-out.

Measurements can be performed on both wet and dry tresses to obtain the peak force to comb the hair which is often associated with detangling as well as the force as a function of distance along the tress (total work). The Dia-Stron fibra.one with combing accessory provides an easy to use and convenient way to measure the combing forces to pass a comb through the hair.

Wet Combing study

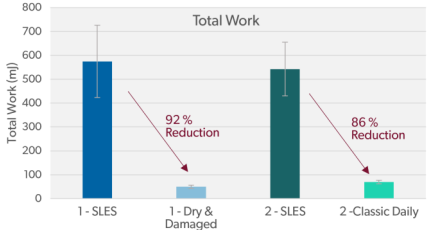
Studies were conducted on regular bleached hair tresses (IHIP) using a fibra.one fitted with comb accessory. The method used was based on a literature method.[1] Baseline measurements were conducted on hair washed with a 14% SLES solution. Following the baseline combing measurements, the tresses were treated with a shampoo and conditioner formulated for 'Dry & Damaged' hair and a 'Classic Daily' use shampoo and conditioner. The combing method was then repeated. The peak force and total work were calculated within the fibra. software.



fibra.one with combing accessory

Results

Application of both shampoo/conditioner treatments were found to significantly reduce the peak force and the total work to comb the hair compared to a SLES treatment.



Total Work (mJ) before and after treatment

Furthermore, the combing test was able to statistically discriminate between the two formulation types, with the system for 'Dry & Damaged' hair providing more of a conditioning effect than the 'Classic Daily' system.

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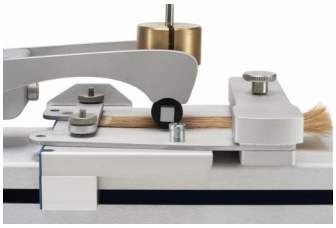
Smoothness

Frictional properties determine how the hair feels to the touch, how it combs and styles as well as its manageability. The friction of a single fibre is influenced by both the surface condition and the moisture content [2] with higher moisture containing fibre arrays being perceived as rougher and less smooth than those with a low moisture content.[3] At the tress level, the perception of smoothness is also related to fibre diameter [3] and fibre alignment.

During a friction test on the fibra.one a downward force is applied as a rubber probe is passed across the surface of a hair tress going from root tip and then tip to root. The frictional force and frictional work are measured.

The coefficient of friction (COF), μ can be calculated which describes the ratio of the force of friction between two bodies (hair and probe) and the frictional force. The COF is scalar with no units. If no friction exists between the objects, then the COF is zero. An increasing, COF indicates higher friction force and thus a rougher and/or more damaged surface. The sensory perception of damage is correlated with an increase in the COF.[4]



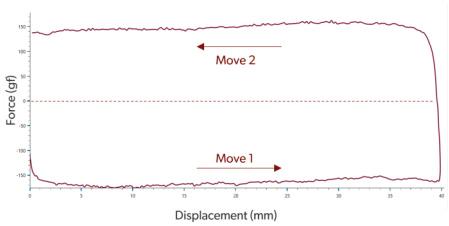
fibra.one with friction accessory

The fibra.one friction method can be used to substantiate claims such as smoothness, damage prevention and repair as well as the effect of leave on products on the surface 'feel'.

References:
1. M. L. Garcia et al., J. Soc. Cosmet. Chem., 27, 379–398 (1979)
2. A. M. Schwartz, J. Soc. Cosmet. Chem., 14, 455 (1963)
3. M. G. Davis, HairS'09, 16th International Hair Science Symposium (2009)
4. B. T. Lim et al., J.Soc.Cosmet.Sci.Korea, 46 (3), 295-305 (2020)

Dry Friction Study

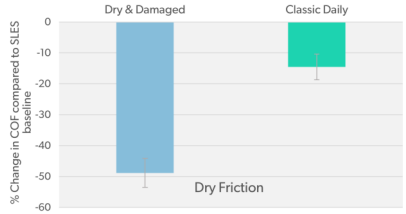
Studies were conducted on regular bleached hair tresses (IHIP) using a fibra.one fitted with the friction accessory and rubber probe. A normal load of 200gf was used. The tresses were treated the same as for the wet combing study.



fibra.one friction data

Results

Application of both shampoo and conditioner treatments were found to significantly reduce the COF compared to hair washed with SLES alone.



Percentage change in the coefficient of friction of treated hair compared to SLES washed

Whilst the combing force reduction of the products was similar, a large difference was observed in the frictional behaviour with the 'Dry & Damaged' treated hair being significantly smoother than the 'Classic Daily' treated hair.

In conclusion, conducting combing and friction testing on tresses can yield valuable data to analyse the performance of a broad range of consumer products.