

Gabriela Daniels¹, Diogo Baltazar¹, Yimeng Jiao¹,

Temi-Lola Mahir¹, Karina Bispo dos Santos², Gislaine Leonardi², Danka Tamburic¹

¹ University of the Arts London, United Kingdom

² Universidade Estadual de Campinas, Brazil

Introduction

From a technical perspective, the core dimensions of hair manageability can be classified as aesthetic, haptic, practical and emotive. The haptic dimension of the hair involves sensations of smoothness and softness. The application of oils between washes is a common, traditional way for coily hair management. The selection of oils is driven by the desired absorption profile, as well as the desirable sensory profile of the product. The application of leave-on products is significantly influenced by the rheological profile of the product, as controlled spreadability is necessary to apply the product over a relatively large surface area without aggregation or dripping.

The objective of this project was to explore the relationship between rheological properties of oil-based formulations for coily hair and their treatment effects in terms of stiffness and surface friction.

Methods

Hair: Virgin hair (no chemical treatments); Hair tresses of $1.00 \pm 0.05\text{g}$; 8 tresses per formulation variable were prepared.

Formulations

a) **CET:** Oil base comprising castor oil and ester (isopropyl myristate)-75%, triolein 5%, antioxidant (BHT)=0.1%

b) **CET+EC:** The above + 1.5% ethyl cellulose

Rheological profile: Thermo Scientific HAAKE Mars iQ Air rheometer (Thermo Scientific, UK); **Texture profile:** Texture analyser (Fig. 1a)

Oil sorption/immersion test: A predefined amount of hair was weighed before and after one-hour immersion in the respective formulations.

Hair tress treatments: 0.2g per 1g of hair was applied. Each tress was tested for bending resistance (stiffness) and surface friction (Fig. 1b) at T0 (before treatment application), T1 (after one application) and T2 (after two applications).

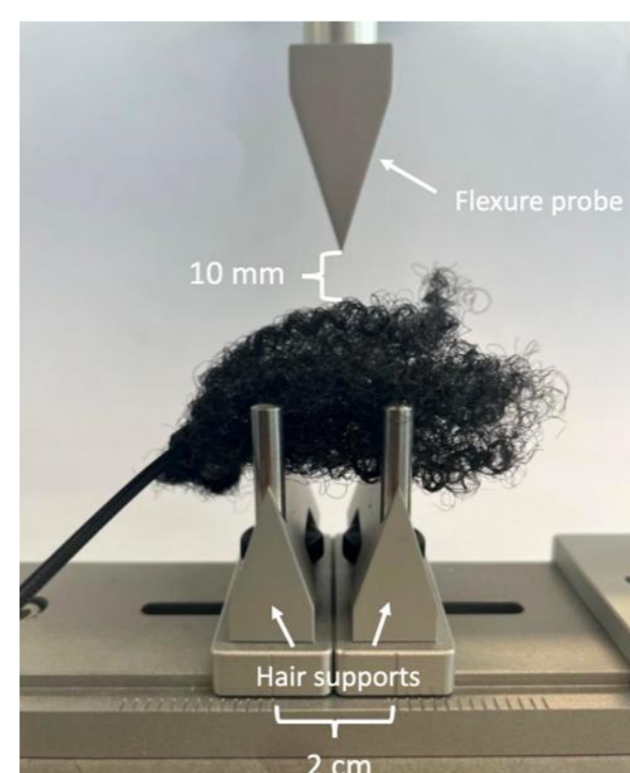


Fig.1a Bending resistance test
TA.XT Plus Texture Analyser
(Stable Microsystems, UK)

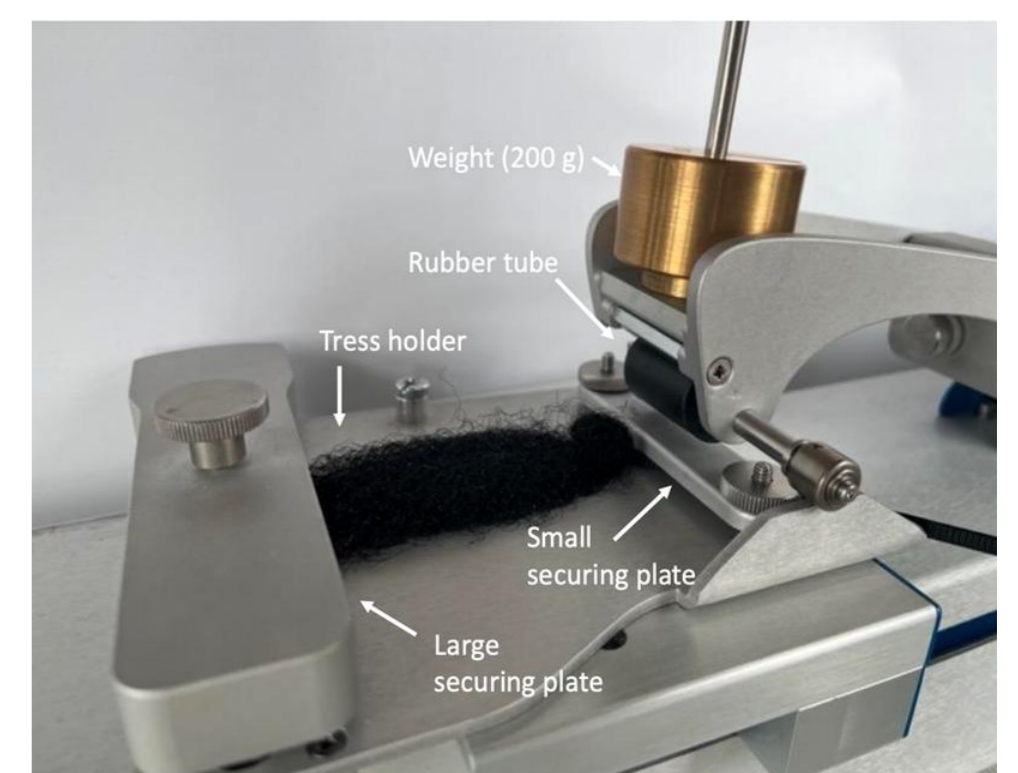


Fig.1b Friction test
Fibra one (Dia Stron, UK)

Results

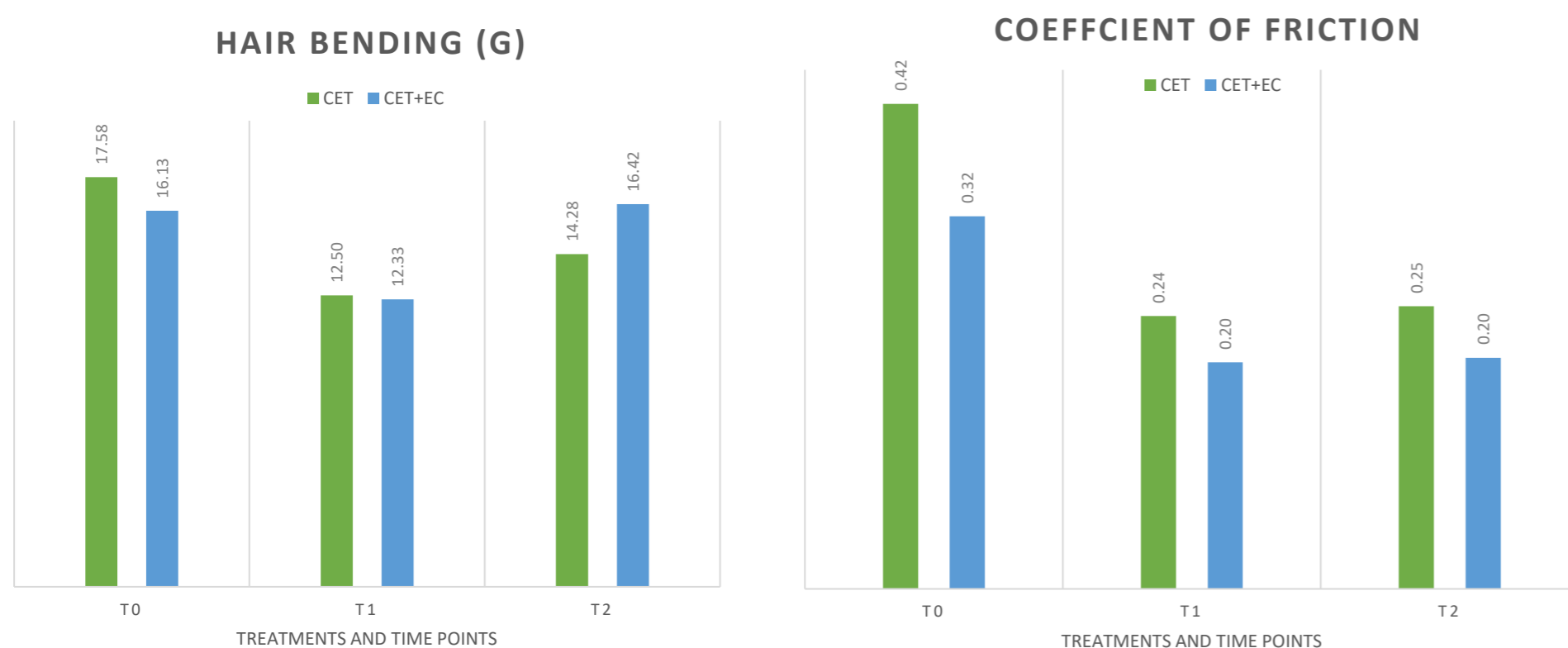


Fig.2a Bending resistance test results. Statistically significant reduction in stiffness between T0 and T1 for CET, and an increase between T1 and T2 for CET+EC

Fig.2b Friction test results. Statistically significant reduction of CoF between T0 and T1, and between T0 and T2 for both CET and CET+EC treatments

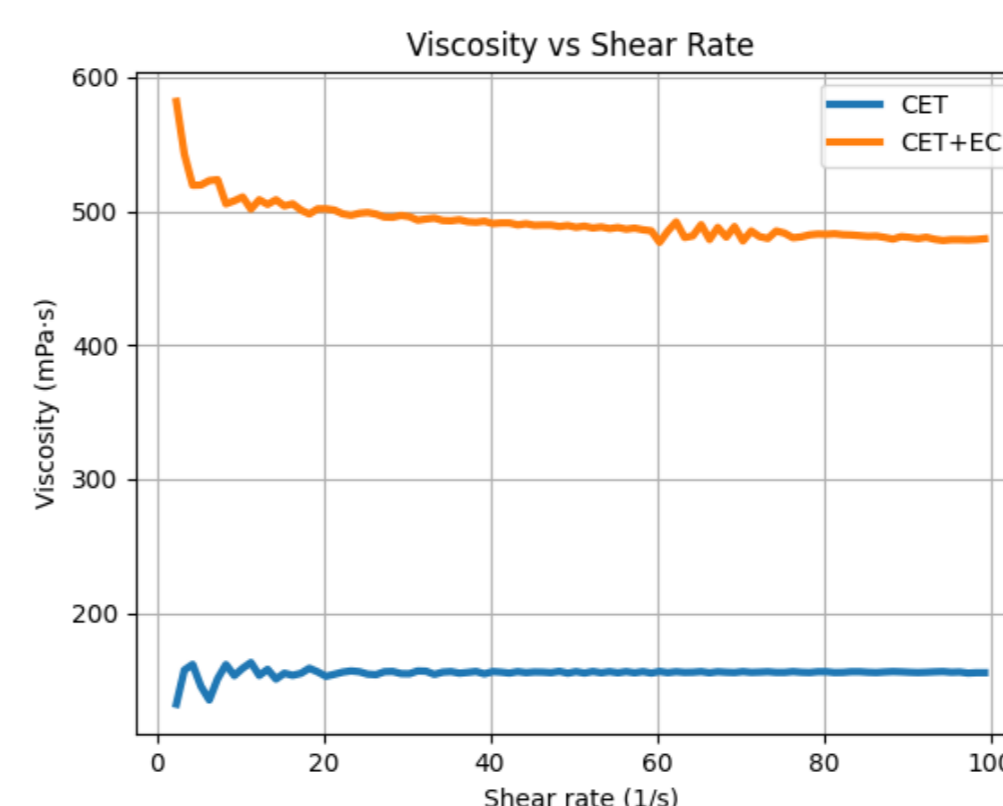


Fig.3 Viscosity vs share rate plot.
CET: low viscosity, Newtonian flow
CET+EC: higher viscosity, shear-thinning flow

Table 1. Results of texture analysis and oil immersion test

	Formulation firmness (g)	Formulation stickiness (g)	% Weight gain
CET	17.91	-23.7	5.50%
CET+EC	42.26	-77.54	12.00%

Conclusions

- ❑ Oil-based treatments improve hair manageability by significantly **reducing stiffness and friction after one application**, making hair softer and smoother.
- ❑ Both formulations significantly **lower surface friction**, improving slip and reducing tangling.
- ❑ The **Castor oil + EC system spreads more slowly**, creating a coating that is **lubricating at the surface but could build up, causing fibre stiffness**. The desirable levels of surface lubrication and stiffness are subjective hair qualities, so formulators could use these data to help them create products to specifications.

Acknowledgements

The authors would like to thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES), Finance Code 001, for financial support, and Elina Zalite and Cintia Gomes Cintra (University of the Arts London) for their technical support.