Sensory-tribology correlation for cosmetic products

SS-264

Sylvia Imbart[1]; Zeineb Ghanem[1]; Marc Lavarde[1] ; Clémence Bernard[1]; Anne-Marie Pensé-Lhéritier[1]; Améziane Aoussat[2]

[1] EBInnov, Ecole de Biologie Industrielle, Cergy, France
[2] LCPI, Arts et Métiers Sciences et Technologies, Paris, France

Introduction:

Cosmetic products analysis go through by several methods such as rheology (Gallegos & Franco, 1999) and texture measurements (Tai, Bianchini, & Jachowicz, 2014). A method from the food industry, tribology which is the science of friction, is more and more arising in the field of cosmetics. To our best knowledge, no published work has been found in the scientific literature for the determination of the friction coefficient and the application on cosmetics. This method is interesting because it allows to mimic the spreading and friction of the product on the hand while the rheology measurement allows to see only the flow behavior (Tadros, 1994). The originality of this work is to present the development of the tribological measurement on cosmetics. For this purpose, friction characterization will be performed on references which are used to train the panelists. Then, raw results will be analyzed, and a principal component analysis will be carried out. To conclude we will highlight the most discriminating attribute and calculate their inertia.

Materials & Methods:

SAMPLES : 3 REFERENCES

Fluid, High Peak, Slipperiness

TRIBOLOGICAL MEASUREMENT

Glassball and three PDMS plates,
Normal load : 1N (fig.1)
Sliding speed : 10mm/s (Heyer, P., & Läuger, J. (2009).
Time of measurement : 120s

STATISTICAL ANALYSIS

ANOVA (Duncan), ACP (Principal component analysis)

Table 1: Summary of reference properties.

References	Score	Apparent Viscosity (Pa.s)	Type
Slipppery	10	6684	O/W
Slippery M	5	1225	O/W
No slippery	0	4277	RW
High Peak	10	488	Gel
High Peak Q	2,5	31	Gel
No High Peak	0	2423	O/W
Fluid	10	65	O/W
Fluid Q	8,5	524	O/W
No Fluid	0	3255	O/W

Table 2: Definition of each attribute.

Phase	Attribute	Definition
PICK-UP	SLIPPERY	When the product is placed between the thumb and the forefinger and they are rubbed together (such as 'clicking fingers'), there is no resistance between them. The product facilitates the movement of the thumb and the forefinger.
	NO SLIPPERY	When the product is placed between the thumb and the forefinger and they are rubbed together (such as 'clicking fingers'), there is a resistance between the two fingers. The product slows down the movement of the thumb and the forefinger
	HIGH PEAK	When the product is placed between the thumb and the forefinger and it is slowly separated, a connecting thread is formed. Upon being overly stretched and reaching a critical point, the thread breaks.
	NO PEAK	When the product is placed between the thumb and the forefinger and it is slowly separated, no connecting thread is formed.
	FLUID	When the product is placed between the thumb and the forefinger with a pression, the product is non adhesive and flows easily from the contact area. No resistance is appreciated.
	NO FLUID	When the product is placed between the thumb and the forefinger with a pression, it does not flow. A resistance is appreciated

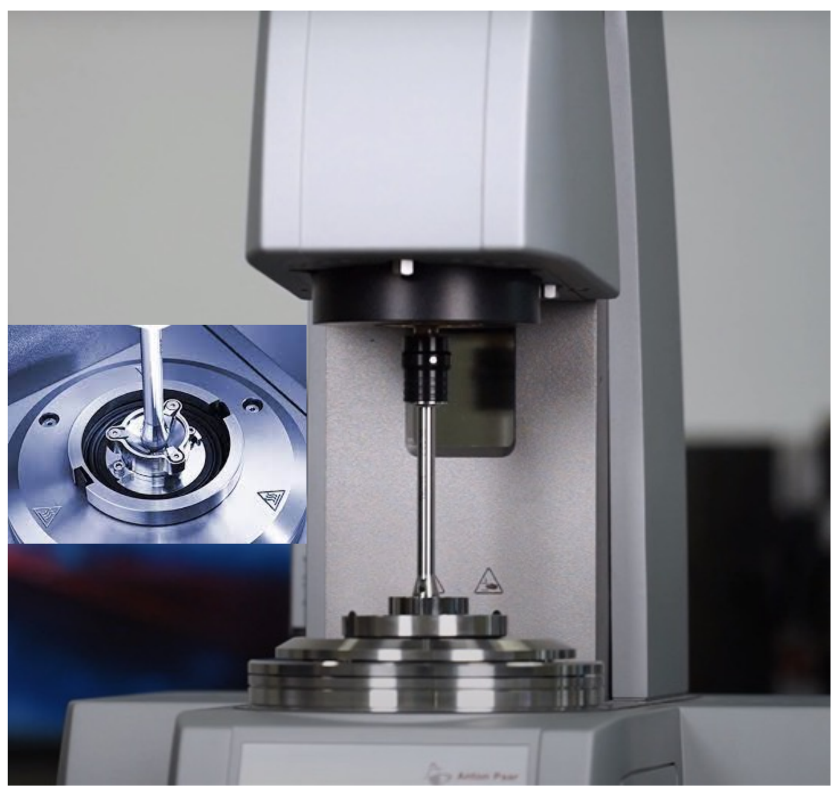

Figure 1: Rheometer MCR 301 Anton Paar mounted with a tribology module

Results & Discussion:

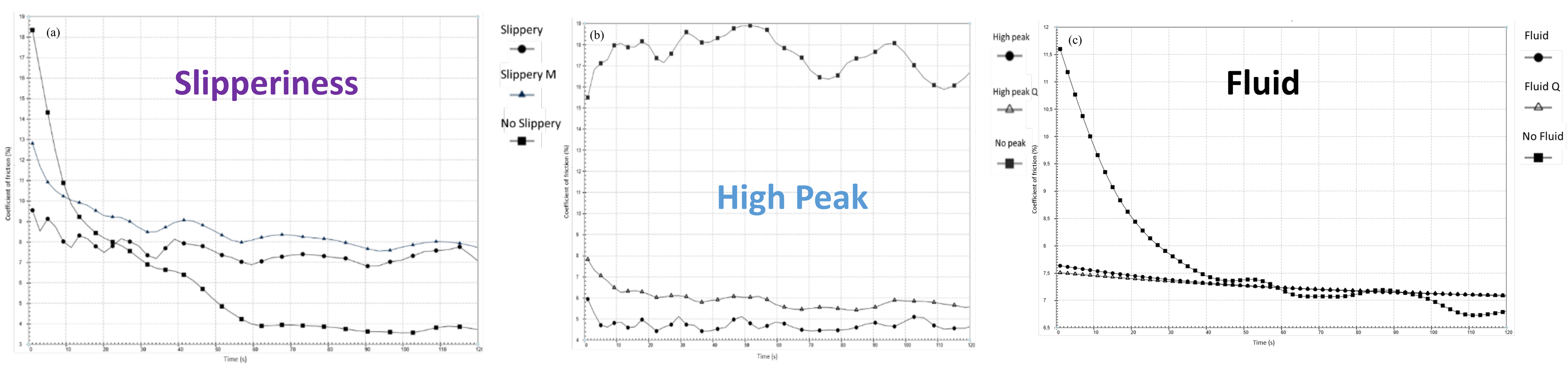

Figure 2: Representation of the evolution of the coefficient of friction for 120s of the different attributes, (a) Slipperiness, (b) High peak and (c) Fluid.

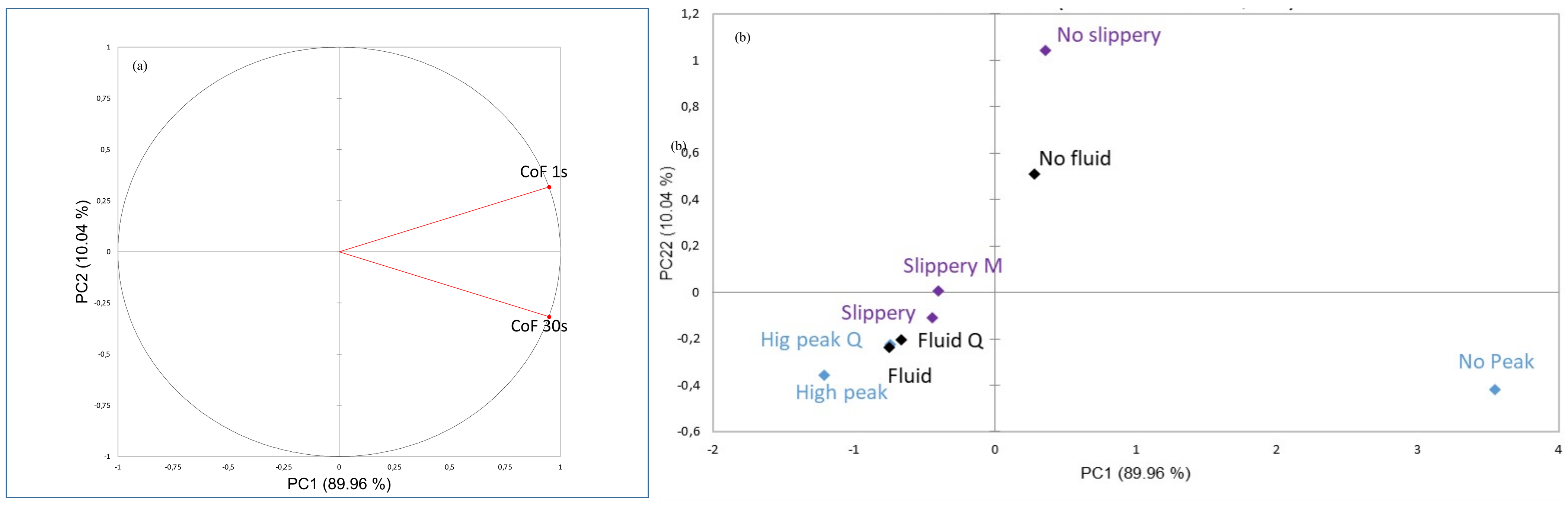

Figure 3: (a) PCA loading plot of the coefficient of friction (variables) and (b) scatter plot of the references (individuals) for the tribological measurement (PC1 89.96%, PC2 10.04%).

The fig.2 shows 3 different profiles of tribology measurment. The PCA (fig.3) demonstrates the variability of the samples according to coefficient of friction at 1s ans 60s. The tribological measurement put in place has highlighted the adhesion capacity and the de-structuration under friction by the glass ball of the cosmetic products, corresponding to the use of the product by the consumer. The values obtained were variables because the references had different ingredient compositions which gave them equally different properties. However, the coefficient of friction obtained for the products were correlated with their use for each attribute. The fluid attribute was not very well evaluated by this method because the product is made to flow so it will not stick to the glass ball for low values of this attribute. On the other hand, the high peak attribute had the highest inertia value (13), the products were very well discriminated by the tribological measurement. Finally, the slippery parameter also showed a low discrimination by this test.

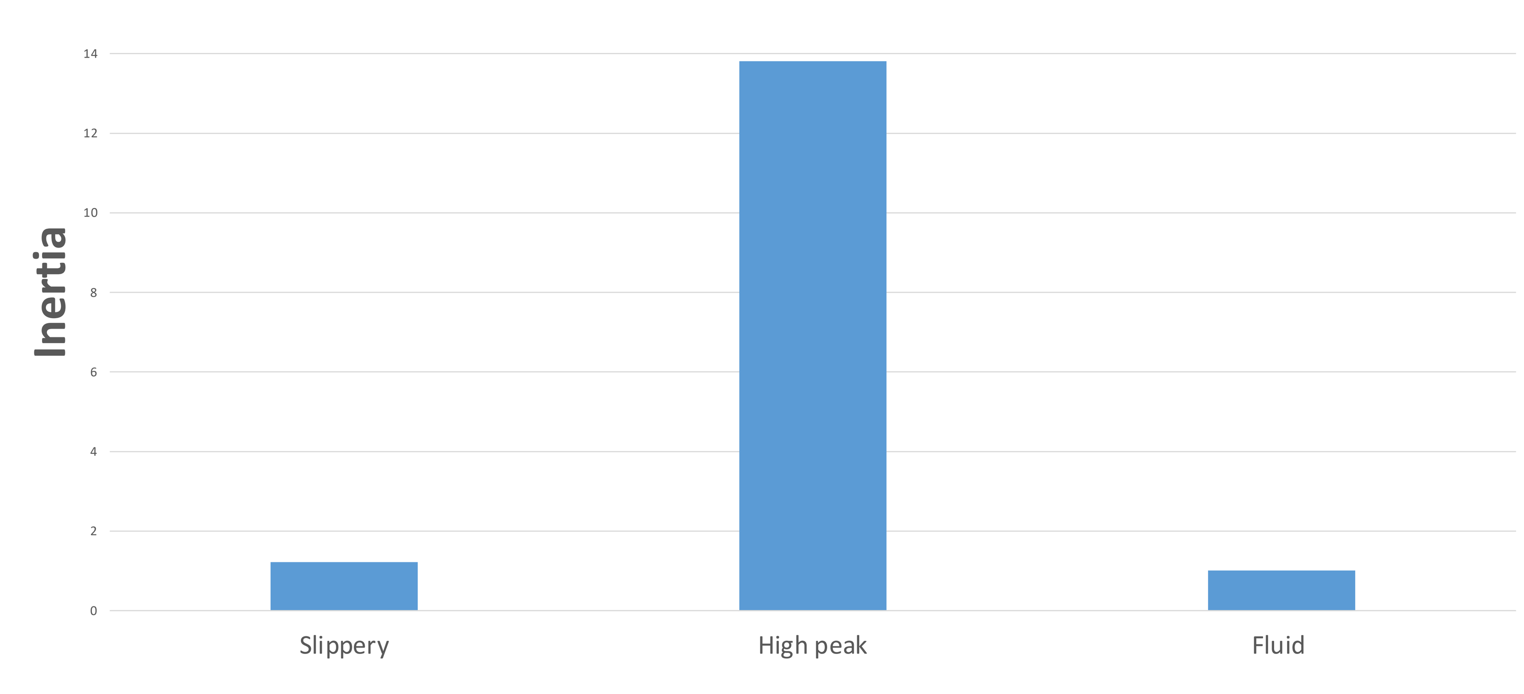

Figure 4: Inertia calculated from the data set of PCA.

The data with the greatest inertia (fig.4) corresponds to a scattered point cloud, the higher the inertia, the farther the points are. For the fluid and slippery attributes, the inertias were low (1.01 and 1.21) so the references were slightly discriminated against. On the other hand for the high peak attribute, the inertia was 13, which showed that the points were far away and therefore discriminated.

Conclusion:

The aim of this work was to present a tribological methodology for the characterization of sensorial perception of cosmetics products. References with defined sensorial scores were analyzed. Statistical analyses made it possible to highlight the good performance of the method for the high peak attribute. This method can be deployed for other attributes in order to see if it is relevant to set it up in addition to the rheology and texture analyses. Furthermore, this tribological method can be used to choose the best formula to satisfy consumers as well as industrial requirements. Such technique would save time and money for cosmetics manufacturing.

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