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## ***A technological phytotensor for rapid and long-lasting makeup benefits***

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### **1. Introduction**

A number of consumers feel the need to reconsider their beauty routines because they are often overwhelmed by an excessively broad choice of beauty products. Even so, the search for products with proven efficacy and having several cosmetic benefits remains a prerequisite. This search for sophisticated simplicity in today's care routines has resulted in a pronounced interest for trends such as "skin streaming" involving the use of products in several key steps or the hybrid combination of products providing both skin care and makeup. This explains why many products with demonstrated efficacy and having several cosmetic benefits have thus enjoyed undeniable success. In addition, efficacy temporality is a predominant claim for skin care products and makeup. For skin care products, the rapid perception of benefits is closely related to interpreting their functional performance by users. For makeup, the "long-lasting" effect is clearly one of the most often advanced claims. It expresses the prolonged persistence of pigments that provides a well-groomed appearance the entire day. In this context, tensors are very interesting candidates for responding to current expectations of consumers. Their physical properties enable the formation of a film on the surface of the skin, providing a multitude of cosmetic benefits both perceptible and measurable over time. Tensors of plant origin, or phytotensors, are especially appreciated because they respond to the criteria of naturality demanded by the global cosmetics market, while forming non-occlusive and non-sticky film a skin's surface. Based on these observations, SILAB has used its expertise in both mastering natural and the biopolymerization of polysaccharides to develop a new film-forming active ingredient (*Castanea sativa* (Chestnut) Seed Extract), whose tensor effect and adhesion properties have been enhanced thanks to a novel and patented technology.

## 2. Materials and Methods

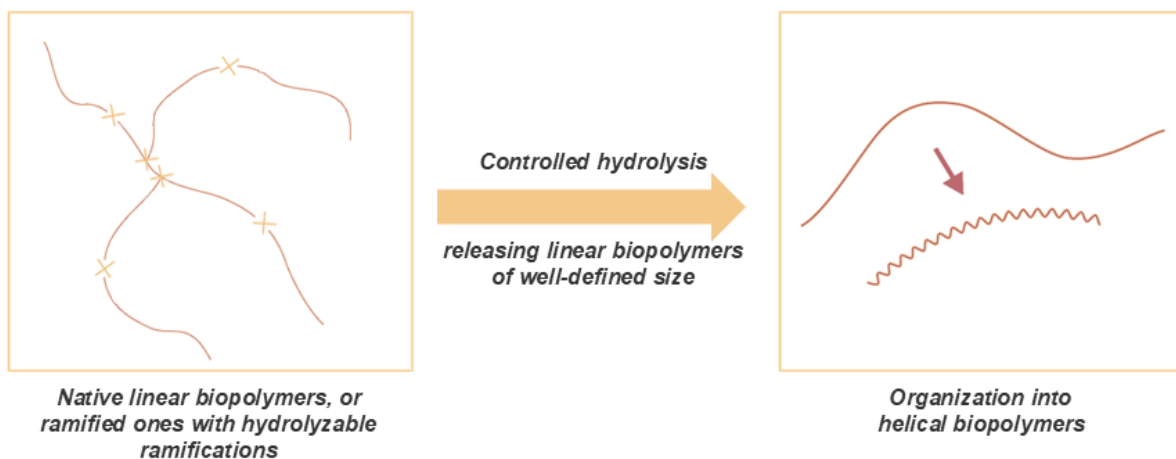
SILAB has developed the FHB technology<sup>®</sup> (Functionalized helical biopolymers technology<sup>®</sup>) to provide its film-forming active ingredient with a powerful tensor effect and optimal adhesion. This technology results in functionalized helical biopolymers, which are obtained following three key steps.

### 1) *Selection of a raw material rich in polysaccharides*

This first step consists of selecting a raw material with a specific molecular composition, rich in linear biopolymers, or ramified ones with hydrolysable ramifications, which is a prerequisite to obtain helical biopolymers. For this development, SILAB chose to beneficially use chestnuts because they have a high content of hydrolysable ramified polysaccharides.

### 2) *Controlled hydrolysis for a powerful tensor effect*

The second step of the FHB technology<sup>®</sup> involves the development of a controlled hydrolysis applied to native biopolymers from chestnuts and resulting in the release of linear biopolymers of well-defined size to obtain helical biopolymers (figure 1). Indeed, the size and linearity of biopolymer chains are two parameters that determine their capacity to organize into helices. When biopolymers adopt this conformation, they retract, which gives the film its tensor properties.



**Figure 1.** Development of a helical tensor biopolymer.

The conditions of hydrolysis and selection of the optimal size of biopolymers were validated by comparing the film-forming capacity of the *Castanea sativa* (Chestnut) Seed Extract biopolymers to smaller (highly hydrolyzed), or larger ones (native biopolymers). Using optical microscopy, the company showed that biopolymers of smaller size have no film-forming properties. Native biopolymers are as film-forming as the *Castanea sativa* (Chestnut) Seed Extract, however, a Raman microspectroscopy confirmed that they contain 20% less helices than the *Castanea sativa* (Chestnut) Seed Extract. This result was then correlated to the evaluation of the tensor effect by a sensory study carried out by a panel of trained evaluators. The *Castanea sativa* (Chestnut) Seed Extract demonstrated a 32% greater tensor effect than the native biopolymers. These results confirm that the controlled hydrolysis of native biopolymers into helical biopolymers gives the *Castanea sativa* (Chestnut) Seed Extract its film-forming properties and a powerful tensor effect.

### **3) Functionalization for optimized adhesion properties**

The last step of the FHB technology® is the ionic functionalization of helical biopolymers in order to enhance the adhesion properties of the *Castanea sativa* (Chestnut) Seed Extract for improved durability over time.

The adhesion capacity of the *Castanea sativa* (Chestnut) Seed Extract was assessed on opacity charts, in comparison to non-functionalized helical biopolymers. The results demonstrated that the *Castanea sativa* (Chestnut) Seed Extract shows less detachment surface, expressed by a 20% reduction in the number of white pixels, confirming that functionalization gives the biopolymer greater adhesive power.

## **3. Results**

Thanks to its powerful tensor effect and increased adhesion conferred by the unique FHB technology®, the *Castanea sativa* (Chestnut) Seed Extract establishes itself as a polyvalent tensor for the face and body, acting as a true makeup perfecter as well as a beauty enhancer.

### **1) A perceptible tensor action**

The tensor properties of the *Castanea sativa* (Chestnut) Seed Extract were shown by a sensorial analysis by a panel of trained evaluators. Immediately after the single application of the *Castanea sativa* (Chestnut) Seed Extract formulated at 0.16% in a gel, 95% of the evaluators felt a tensor effect greater than that felt after applying the placebo formula. This effect is dose-dependent since when tested at 0.50%, the felt tensor efficacy was greater and the opinion was unanimous among the evaluators. When applied to the face as an emulsion, the film-forming active ingredient also provides an instantaneous tensor and smoothing effect. After

testing on the body, the evaluators reported an immediate smoothing effect and a sensation of soft skin.

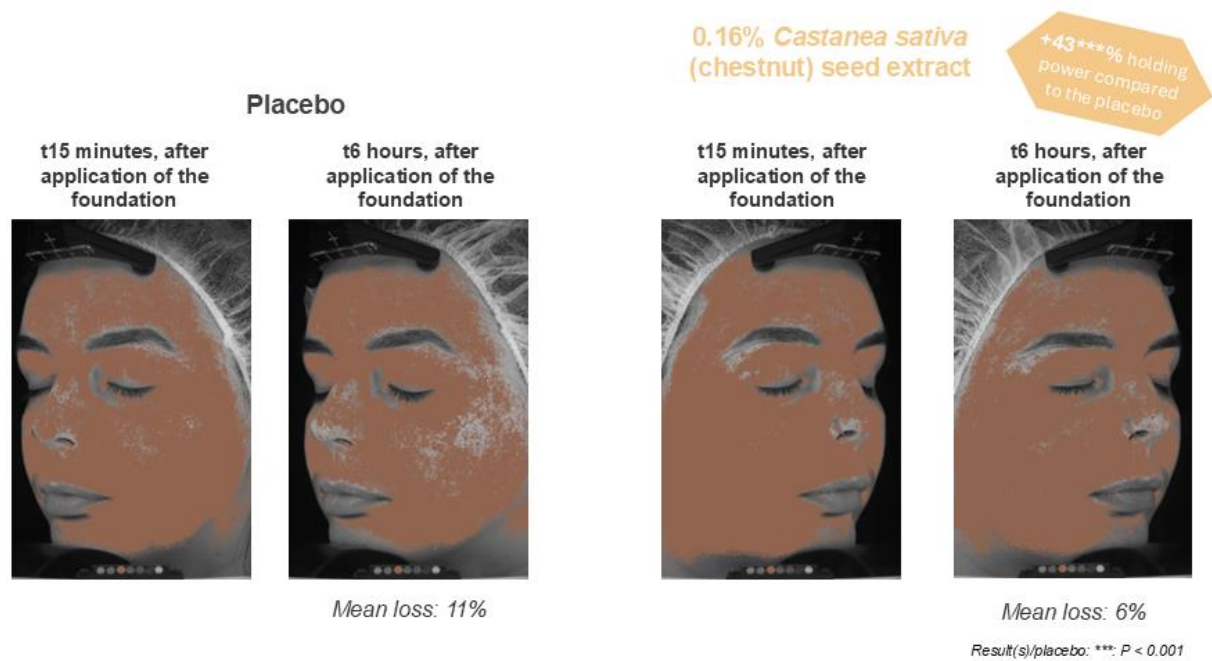
Consumer studies in China and France confirmed the results of the sensorial evaluation by the trained panel. The participants in fact confirmed the tensor efficacy of the *Castanea sativa* (Chestnut) Seed Extract. This effect was felt immediately after an application and remained perceptible for 12 hours. More than 70% of Caucasian volunteers having tested the film-forming ingredient agreed to say that their skin felt like it was lifted immediately. They reported that their skin was tenser and smoother as of application and throughout the day.

## **2) A makeup perfector**

The *Castanea sativa* (Chestnut) Seed Extract has a makeup perfector effect that was determined by analyzing a foundation holding power on Caucasian and Asian volunteers. The film-forming active ingredient was formulated at 0.16% in a foundation and compared to a placebo formula.

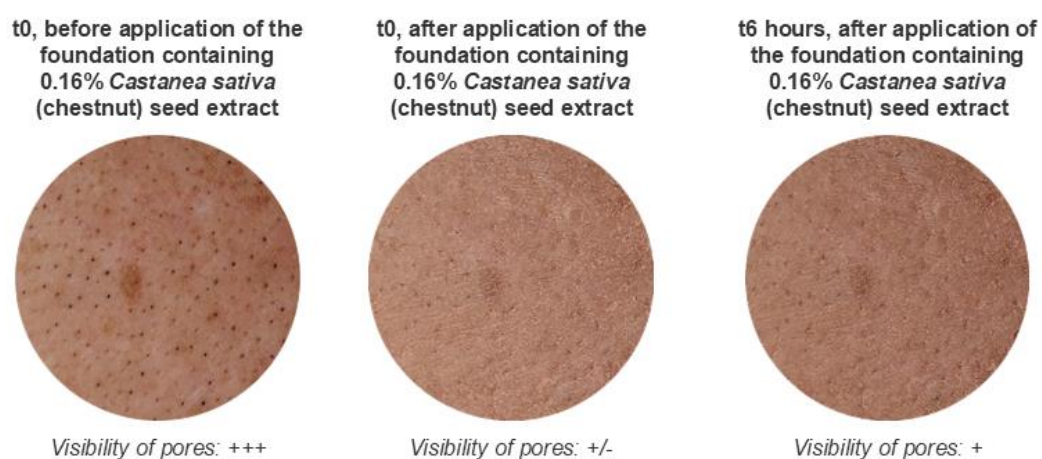
The Caucasian panel was composed of 28 healthy women between (mean age  $50 \pm 14$  years) with all skin types. The Asian panel involved 17 healthy volunteers (12 men and 5 women) (mean age  $41 \pm 10$  years), selected based on oily skin (sebum content more than or equal to  $150 \mu\text{g}/\text{cm}^2$ ), dilated pores (size  $\geq 3$  on a scale from 0 (thin pores) to 5 (dilated pores) according to the Skin Aging Atlas, Vol. 2, Asian type, R. Bazin, Editions Med'com). Men also needed to be clean-shaven.

The results showed that, 6 hours after application by Caucasian volunteers and compared to the placebo formula, the *Castanea sativa* (Chestnut) Seed Extract significantly increases makeup holding power (digital photos taken with the VISIA-CR® system in UV mode). This effect was observed in 82% of the subjects (figure 2).



**Figure 2.** Visualization of the effect of the *Castanea sativa* (Chestnut) Seed Extract on the foundation holding power in Caucasian volunteers.

In addition, a clinical scoring of the visibility of pores by a dermatologist was conducted on Asian volunteers, and the results show a reduction after application of the foundation. Compared to the placebo formula, 6 hours after application this coverage is better with the foundation containing the *Castanea sativa* (Chestnut) Seed Extract at 0.16% (-3%), reflecting better holding over time. In 71% of subjects, the visibility of pores was reduced on the side treated with the active ingredient, compared to 59% on the side treated with the placebo (figure 3).



**Figure 3.** Visualization of the effect of the *Castanea sativa* (Chestnut) Seed Extract on the visibility of pores in Asian volunteers.

The makeup perfector effect of the *Castanea sativa* (Chestnut) Seed Extract was also confirmed on the eyeshadow holding power in Caucasian volunteers (data not shown).

### 3) A beauty enhancer

The beauty enhancer effect of the *Castanea sativa* (Chestnut) Seed Extract was also determined on the face of Caucasian volunteers by studying skin microrelief (by fringe projection) and complexion radiance (by visual scoring by trained evaluators). A subjective evaluation by subjects (using a questionnaire) supplements the results.

This study was conducted on a group of 19 women, (mean age  $60 \pm 7$  years), and a placebo group of 18 women, (mean age  $60 \pm 8$  years). All volunteers were selected based on their age (between 40 and 70 years old), a slight to moderate stage of wrinkles on the crow's feet and a dull complexion. The film-forming active ingredient was formulated at 0.32% in gel (compared to a placebo formula) and assessed at two different study times (15 minutes and 8 hours after a single application) to determine the rapid and long-lasting effects.

The results showed that, as of 15 minutes after a single application by Caucasian volunteers and compared to the placebo group, the *Castanea sativa* (Chestnut) Seed Extract significantly smooths microrelief of the face (-3%,  $P < 0.05$ ). This smoothing effect continues up to 8 hours after application, when a 6% ( $P < 0.05$ ) reduction in the density of surface irregularities is observed in 84% of the subjects. The active ingredient therefore rapidly smooths the surface of the skin and this effect continues throughout the day.

In addition, compared to the placebo, the *Castanea sativa* (Chestnut) Seed Extract rapidly and significantly improves the parameters characteristic of complexion radiance in Caucasian volunteers. Fifteen minutes after a single application, the complexion is more luminous, fresher and the olive color and the state of eye fatigue are reduced (significant effects compared to the placebo). These effects continue up to 8 hours after application, with an 11% increase of reflection of the skin ( $P < 0.05$ ) and a 17% increase of pink color ( $P < 0.01$ ) in 89% and 95% of the volunteers, respectively. There is also an 11% reduction of olive color ( $P < 0.01$ ) and a 9% reduction of the state of eye fatigue ( $P < 0.05$ ) in 89% and 79% of the volunteers, respectively. The *Castanea sativa* (Chestnut) Seed Extract therefore rapidly boosts complexion radiance and this effect continues throughout the day (figure 4).



**Figure 4.** Visualization of the rapid and long-lasting effect of the *Castanea sativa* (Chestnut) Seed Extract on complexion radiance in Caucasian volunteers.

These benefits on microrelief and complexion radiance were confirmed by volunteers themselves through subjective evaluations. Indeed, as of 15 minutes after a single application, the film-forming active ingredient is generally perceived as more effective than the placebo by the Caucasian volunteers. This positive perception continues all day long, since 8 hours after application, 79% of subjects reported their skin to be smoother, 63% of them found it more attractive and 68% more radiant (compared to 33%, 22% and 28%, respectively ( $P < 0.01$ ) of volunteers having used the placebo formula). In addition, 8 hours after application, all the volunteers agreed that their skin was softer compared to only 44% of the volunteers having used the placebo formula ( $P < 0.001$ ).

The beauty enhancer capacity of the *Castanea sativa* (Chestnut) Seed Extract was also tested at 0.64% in a radiance-boost gel-cream on the face and the same previous-mentioned benefits were observed (data not shown). Tested on the body at 0.16%, the *Castanea sativa* (Chestnut) Seed Extract also smooths the microrelief of the thighs and favors skin softness 4 hours after a single application (data not shown).

#### 4. Discussion

In order to develop its phytensor (*Castanea sativa* (Chestnut) Seed Extract), SILAB optimized the value of chestnut polysaccharides. The company chose to obtain its supply of chestnuts locally. Indeed, the ancestral culture of chestnuts is currently the pride and renown of several French regions including the Limousin (where SILAB is settled), one of the oldest chestnut producers in France. SILAB has been an integral part of the local economic landscape for 40 years and makes full use of the natural resources it contains. The company thereby sustains its historic partnership with regional, organic-certified producers. SILAB thus



guarantees rigorous traceability back to the plot of land and is committed to virtuous agriculture that complies with good farming practices and protects ecosystems. Using its expertise in mastering natural and in biopolymerization, SILAB developed a patented technology, enabling to convert specifically selected native polysaccharides from chestnuts into functionalized helical biopolymers offering optimized tensor and adhesion properties. The resulting film-forming active ingredient offers multiple rapid and long-lasting benefits for the face and body.

This patented active ingredient has established itself as the next generation polyvalent tensor and is recommended at a dose of 0.16 to 0.64%. Available in preservative-free powder, it is easy to formulate in face, body care and makeup formulations. It complies with biodiversity regulations as well as with international cosmetics regulations (Europe, USA, China, Japan, etc.) and has a natural origin content of 100% (ISO 16128).

## 5. Conclusion

All these results show that the *Castanea sativa* (Chestnut) Seed Extract provides rapid and long-lasting cosmetics benefits on the face and the body, with proven smoothing and radiance-boosting effects. Included in foundation or primer formulas, it also ensures the long-lasting holding power of makeup.