

facts



ERYLITE® Erythritol
boosts hair conditioner performance

Jungbunzlauer

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Introduction

Many people like to finish their hair cleansing routine with a conditioner. Conditioning leaves hair more manageable, glossier and fragrant, and may as well supply nourishing and repairing substances. Conditioners come with a large range of properties, but they all have one thing in common: they help to improve hair manageability by modifying the cuticle, the surface layer of the hair. Shampoo cleanses hair and scalp by removing sebum, residual styling products, dead cells and dirt, but it can have adverse effects on the cuticle. The cells of the cuticle are arranged somewhat like shingles on a roof. The stress of shampooing causes these shingles to shift slightly, leaving the cuticle itself and also the internal hair structure more vulnerable to damage. Conditioners smoothen the cuticles and restore their natural arrangement, restoring the hair's natural shield. The hair is once more protected, more manageable and ready for styling.

This conditioning effect is achieved through a mix of substances including surfactants, moisturisers, acidifiers, oils and antistatic substances. As previously shown ERYLITE® Erythritol demonstrated very beneficial effects when incorporated into a shampoo formula ^[1]. These effects range from improved combability and reduced frizz to scalp hydration and improved shampoo performance with increased foamability. This article discusses the advantages of incorporating ERYLITE® into hair conditioners to complement the benefits of ERYLITE® shampoo formulations.

ERYLITE® – a fermentation-based polyol for personal care applications

ERYLITE® is the first sugar alcohol, also called polyol, to be manufactured using a fermentation-based process. The fermentation and minimum processing make ERYLITE® a very interesting ingredient for end products destined for the “natural” shelf. It is furthermore COSMOS-approved and vegan. ERYLITE® can already be found in many personal care formulations with different applications. It is increasingly used in skin care products, where it acts as a powerful moisturising agent, increasing skin humidity ^[2]. It can be incorporated into face masks, as well as body lotions, skin and hand creams. The next step is finding opportunities to exploit these outstanding features for hair shampoo and conditioner formulas.

Combability

Combability of hair is probably the most important property when it comes to assess manageability of hair. Good combability indicates smooth healthy hair, free from knots and enables good and quick styling. A positive effect on combability is one of the most popular claims for hair care products, and was the most important benefit demonstrated when ERYLITE® was integrated into shampoos. It was therefore decided to investigate whether further improved combability could be achieved by incorporation of ERYLITE® into a conditioner.



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Test program

Claim substantiation

In order to satisfy cosmetics regulations, all product claims on conditioners must be substantiated. Companies therefore devote a great deal of effort to the research and development of formulas and substantiation of the defined claims. There are a number of substantiated claims for ERYLITE® that can be advertised on the product label, but here the focus will be on combability:

Combing force measurement

The tensile test determines the force needed to pull a comb through a sample of hair. It is the most fundamental method for evaluating the extent to which a hair care product improves combability. This is of interest because our hair is damaged every day by repetitive styling, combing and drying, as well as by straightening or curling. Furthermore, UV radiation damages hair. All of this influences the amount of force needed to comb through the hair. Young, healthy hair can usually be combed effortlessly. The results of tensile testing give an indication of the degree of damage to the cuticle surface.

Method

Commercially available hair tresses were pretreated (washed) with a solution of 10% sodium laureth sulfate (surfactant solution), a 3% ERYLITE® solution, a 5% ERYLITE® solution or a shampoo formula containing 5% ERYLITE® in order to define the baseline combing force needed to comb through the hair tress. This baseline value was needed in order to make “before and after” comparisons for the conditioners later on. After pretreatment, the tresses were detangled then measured twice using a tensile measuring system and compared to untreated tresses. The exact test method is available on request.

Results

Figure 1: Results of combing force test after pretreatment

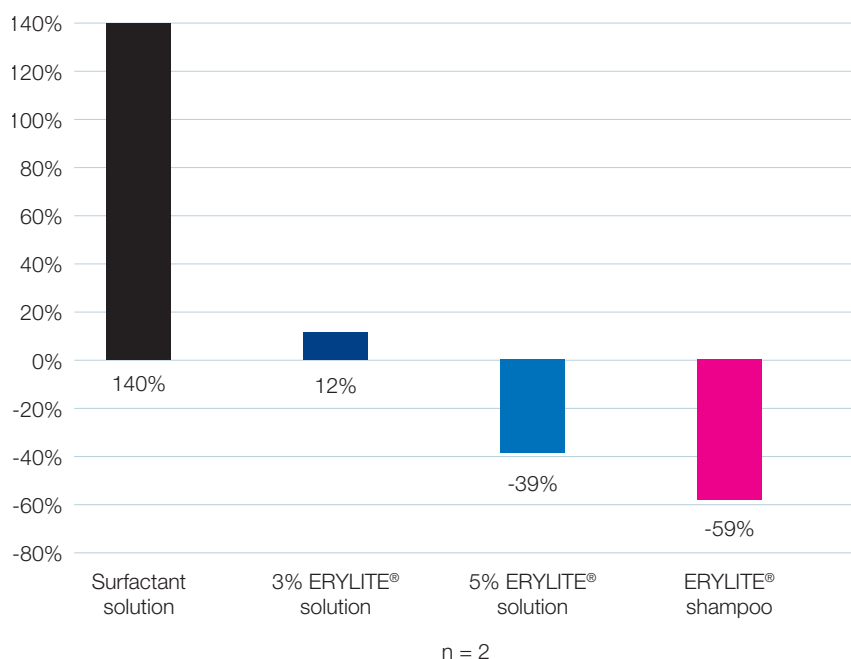
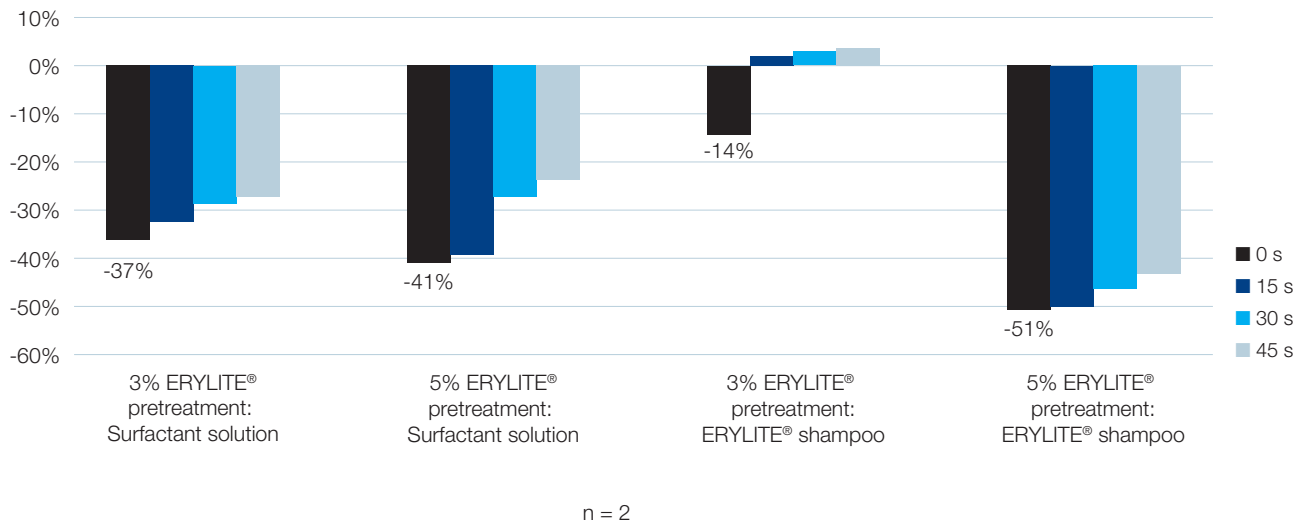


Figure 1 shows the results of tensile tests for the four pretreated tresses versus the untreated tress. The result for the untreated tress defines the 0% line (baseline). The higher the result value the worse the effect on the hair. Washing with surfactant solution alone strongly increases the combing force needed. This tress is significantly more difficult to comb through. When a tress was washed with a 3% ERYLITE® solution the combing force needed is similar to that required for the untreated tresses (i.e. close to baseline). The 5% ERYLITE® solution and the ERYLITE® shampoo both reduced the necessary combing force significantly (-39% / -59%). The last 2 tresses were by far the easiest to comb through.

In the next step the pretreated tresses were treated further with a 3% or 5% ERYLITE® solution for one minute in order to detect a conditioning effect. For these initial conditioning tests, only hair tresses pretreated with surfactant solution and with ERYLITE® shampoo were considered, as these had shown the greatest deviations from the untreated tress values.

After the treatment with the ERYLITE® solutions the tresses were rinsed for 0 (no rinsing), 15, 30 or 45 seconds. The tresses were then detangled and measured twice using the tensile measuring system. The rinsing times indicate a long-term effect for regular treatment. The comb force levels measured for the 2 test candidates in the first tensile test (+140% / -59%) are now defining the new baseline for the conditioning test.

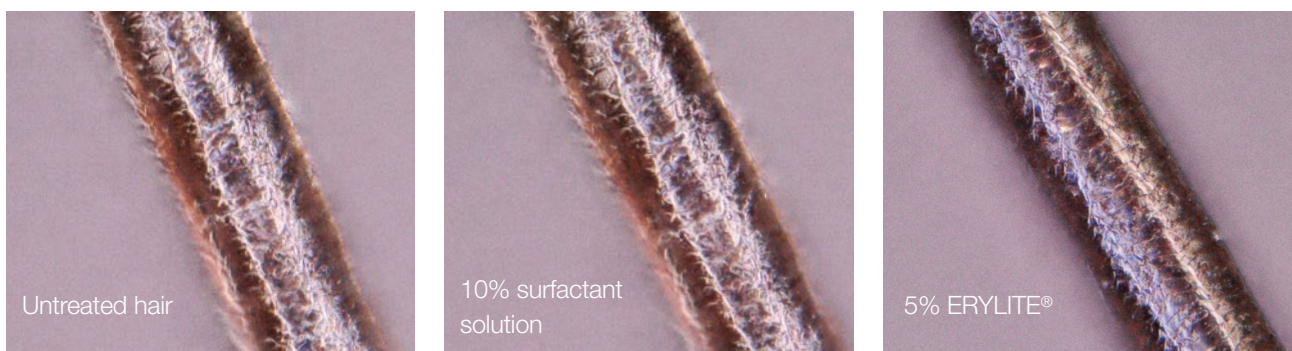
Figure 2: Influence of 3% and 5% solution of ERYLITE® on combing forces



It is obvious that both 3% ERYLITE® solution and 5% ERYLITE® solution have a strong effect on hair pretreated with a surfactant solution alone. These tresses, which had initially required a much greater combing force, were now much easier to comb. In the first instance the effect of the 5% ERYLITE® solution appears to be stronger but with longer rinsing times its effect is on a par with the 3% ERYLITE® solution.

The positive effect can be visualised under the microscope.

Figure 3: Microscope images of the same individual hair after different treatments



The untreated hair shows an uneven surface, the shingle cells have become visible due to shifting. After treatment with 10% surfactant solution the shape of the hair surface has even deteriorated. Treatment with 5% ERYLITE® solution improves the hair surface structure again, the shingle cells are back in position, the hair surface appears to be very smooth.

The effect of a 3% ERYLITE® solution on tresses prewashed with ERYLITE® shampoo is almost negligible, whereas a 5% ERYLITE® solution shows an impressive further reduction of the combing force needed (figure 2). Moreover, the positive effect lingers even after prolonged rinsing of the tress. It would appear that the 3% ERYLITE® solution cannot achieve any great further improvement if the shampoo already contains 5% ERYLITE®. In contrast, the 5% ERYLITE® solution further reduces the necessary combing force.

In conclusion: all untreated hair demonstrates significantly improved combing force, and thus manageability, when an ERYLITE®-based shampoo is used (figure 1). It is further improved if a 5% ERYLITE® solution is used as a conditioning agent (figure 2). Furthermore, hair prewashed with surfactant alone shows significantly improved combing force when treated with an ERYLITE® solution, although the adverse effect of the surfactant can only be mitigated; it cannot be reversed or eliminated.

In summary, ERYLITE® has a conditioning effect on hair, regardless of the type of prewashing. This conclusion opens the way to conditioning claims for ERYLITE®.

Formula substantiation

To substantiate the performance claims advertised on a hair care product, substantiating tests need to be performed on the finished product as well as on individual ingredients. The background to this requirement is that the functionality leading to a claimable effect is typically attributed to single ingredients, in this case to ERYLITE®. However, any finished formulation also has to be evaluated in respect of intended claims, and it too has to show the desired functionalities in order to qualify for a claim on the final packaging. Individual ingredients may interfere with each other, diminishing or even erasing verified positive claims due to incompatibilities. To validate the claims and performance proven for ERYLITE® as a single ingredient, final formulations need to demonstrate the same favourable results.

Hence, in order to further assess the conditioning effects of ERYLITE®, hair conditioner formulas were developed. Conditioners can be divided into two groups: leave-in and rinse-off. While a rinse-off conditioner is washed out of the hair after a defined period of time, a leave-in conditioner (often sprayed on) remains in the hair. Both a leave-in and a rinse-off conditioner were developed and tested to reveal any differences in the performance of ERYLITE®.

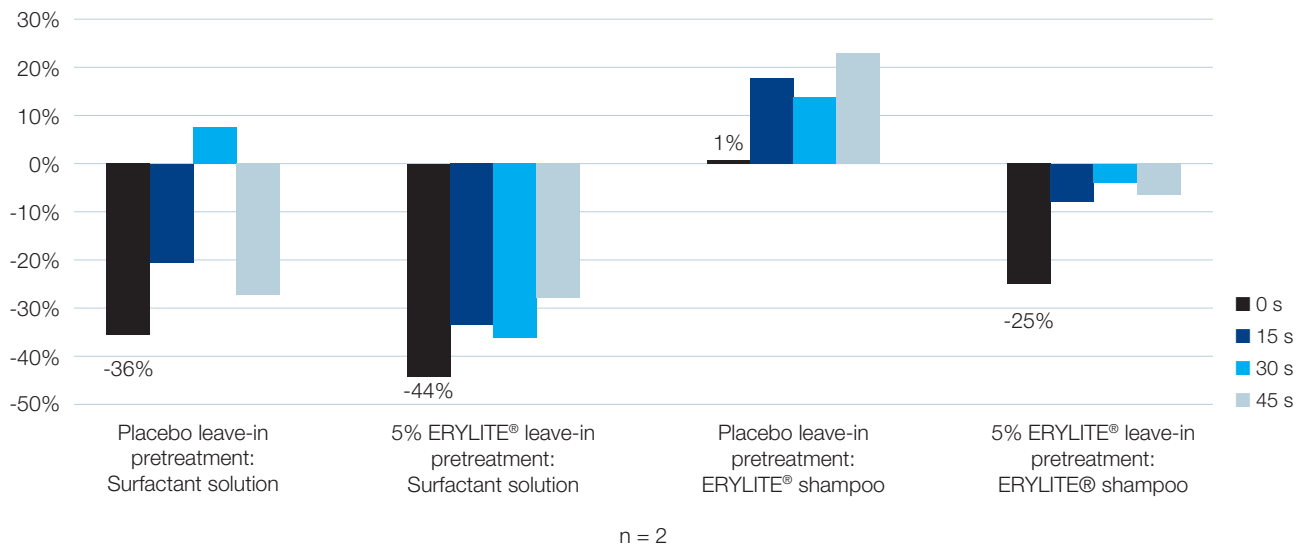
Leave-in conditioner

Hair tresses prewashed with surfactant solution or with 5% ERYLITE® shampoo were treated with two leave-in hair conditioner formulas for comparison. One conditioner contained 5% ERYLITE®, as 5% ERYLITE® had shown best performance in the previous test, and one conditioner contained no ERYLITE®. The conditioner is a spray-on format.

The first combing force measurement was taken immediately after spraying on the conditioner. Even though the format is leave-in, it was important to observe whether any effect observed was sustained if the hair was rinsed. For this purpose, tresses were rinsed after 15, 30 or 45 seconds and combing force measured using the tensile measuring system. Like in the first conditioning tests, the baseline for the comparisons are the results of the prewashing step (+140% / -59%).



Figure 4: Combing forces measured after leave-in hair conditioner treatment



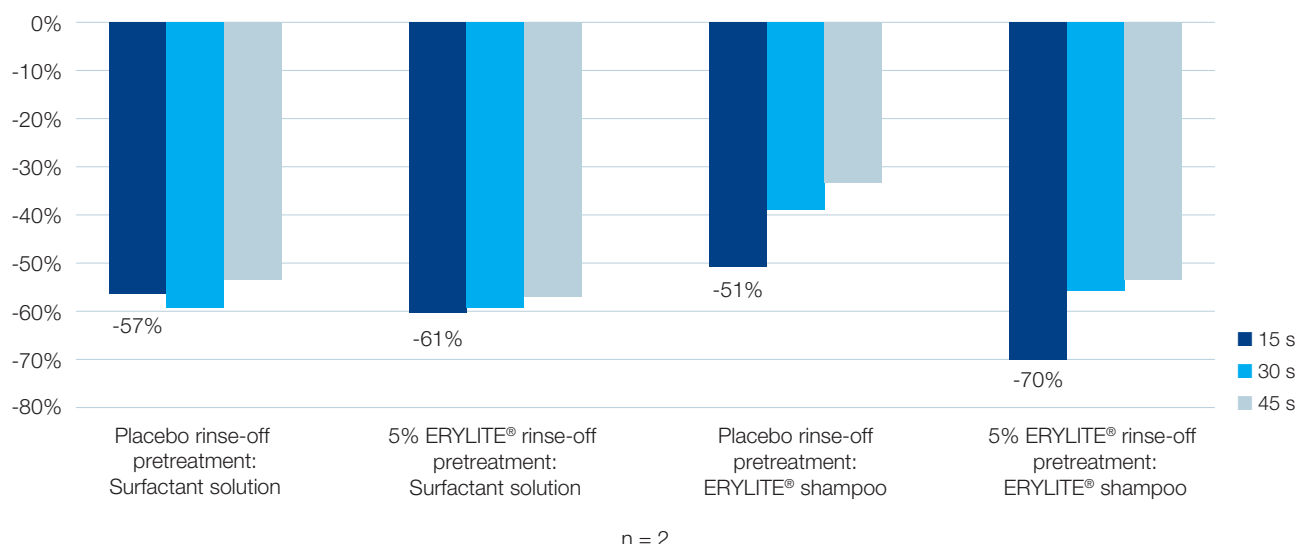
The results of the tensile measurement show that both conditioners – with and without ERYLITE® – have a conditioning effect on the tresses prewashed with surfactant alone. However, if we look at how sustainable that is effect is, the ERYLITE®-based conditioner is clearly superior, as its effect is sustained even after prolonged rinsing periods. It thus has greater rinsing stability.

For the tresses prewashed with ERYLITE® shampoo it is evident that the leave-in conditioner without ERYLITE® actually had an adverse effect on combability. The combing force was unchanged at the moment of spraying on, but rinsing appears to cancel out some of the beneficial effects of prewashing with ERYLITE® shampoo. The conclusion is therefore that an ERYLITE®-based leave-in conditioner is beneficial when standard shampoos are used, but using an ERYLITE® conditioner together with an ERYLITE® shampoo boosts the positive effects and stabilises them for a prolonged period and upon rinsing.

Rinse-off conditioner

Hair tresses prewashed with surfactant solution or 5% ERYLITE® shampoo were treated with two rinse-off hair conditioner formulas for comparison. One conditioner contained 5% ERYLITE® and one conditioner contained no ERYLITE®. The conditioner was of high viscosity and was applied directly onto the tresses. The tresses were rinsed after 15, 30 or 45 seconds and measured using the tensile measuring system. Once again, the baseline is the test results from the prewashing step.

Figure 5: Combing forces measured after rinse-off hair conditioner treatment



Tresses prewashed with surfactant solution show a very good but undifferentiated combing force response after treatment with rinse-off conditioners, with or without ERYLITE®. The results clearly indicate that the combing force is reduced by about the same amount for both conditioners.

When tresses were prewashed with ERYLITE® shampoo, there were obvious differences. While the ERYLITE®-free conditioner reduced combing force by 50%, the ERYLITE®-based conditioner reduced combing force by 70%. Furthermore, the effect is more stable, as becomes evident when the forces are measured after prolonged periods of rinsing.

Summary & Discussion

ERYLITE® was tested for its effects on combability of hair when used as a conditioner. A clearly detectable reduction in combing force could be observed, substantiating a claim for combability improvement. Ready-to-use formulations for leave-in and rinse-off conditioners were developed to demonstrate the effect of ERYLITE® in a finished formula.

Leave-in conditioners with ERYLITE® can clearly reduce the combing force needed for hair that has been washed with regular shampoo or with an ERYLITE®-based shampoo. The figures also suggest that the effect of the ERYLITE® conditioners is stronger and more sustainable when hair is washed with an ordinary shampoo. But it is important to consider the different baseline when interpreting the results. The baseline for hair washed with surfactant solution alone yielded a combing force increase of 140% compared to untreated hair – a strongly impaired combability. Conditioning with the ERYLITE® conditioner yields a combing force reduction of 44%. After 2 hair treatment steps the overall combability is still significantly worse than for the original untreated hair. In contrast, the hair prewashed with the ERYLITE® shampoo yielded a combing force reduction of 59% and the ERYLITE® conditioner decreased the combing force relative to this baseline by 25%. Treatment with ERYLITE® shampoo and conditioner in combination leads to an entirely different quality of hair care and manageability. The ERYLITE®-free conditioning formula kept the combing force level stable.

For the rinse-off ERYLITE® conditioner, the effect was strong and sustainable, regardless of the type of shampoo used. For hair washed with regular shampoo the ERYLITE®-free conditioner also yielded a good result. It may therefore be assumed that any conditioning product will reduce the combing forces needed when the baseline is high. The ERYLITE® conditioner, however, had the strongest effect when hair was prewashed with the ERYLITE® shampoo. Considering the different baselines, the combination of ERYLITE® containing shampoo and conditioner yields hair, that is easily combable and manageable and in a significantly better shape than hair washed with hair care products without ERYLITE®.

References

- [1] ERYLITE® Erythritol – adding functionality to hair shampoo, published on cosmeticdesign.com, April 2016.
- [2] Haji, F., Kljaic, S. & Jungbunzlauer. Moisturise naturally with ERYLITE® Erythritol. Cosmet. Des. (2011)

About Jungbunzlauer

Jungbunzlauer is one of the world's leading producers of biodegradable ingredients of natural origin. We enable our customers to manufacture healthier, safer, tastier and more sustainable products. Due to continuous investments, state-of-the-art manufacturing processes and comprehensive quality management, we are able to assure outstanding product quality. Our mission "From nature to ingredients®" commits us to the protection of people and their environment. Jungbunzlauer offers ERYLITE® Erythritol as pure bulk sweetener as well as ERYLITE® Stevia, blends of ERYLITE® with steviol glycosides at different sweetness levels.

The Authors

Ferid Haji – Product Group Manager, Jungbunzlauer International AG
ferid.haji@jungbunzlauer.com

Laura Riemensperger – Application Technology, Application Technology Assistant, Jungbunzlauer Ladenburg GmbH
laura.riemensperger@jungbunzlauer.com

Felix Weiher – Application Technology, Team Leader Non Food, Jungbunzlauer Ladenburg GmbH
felix.weiher@jungbunzlauer.com

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Headquarters **Jungbunzlauer Suisse AG** · CH-4002 Basel · Switzerland · Phone +41-61-2955 100 · headquarters@jungbunzlauer.com

www.jungbunzlauer.com

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