

»Sticky and strong hold natural hair care formulations«

with plant-based film former Baycusan® eco E 1000
(INCI: Polyurethane-93)

The next generation of hair styling products needs to combine high-performance with more natural ingredients. Products are required to guarantee strong- and long-lasting hold and, at the same time, they need to include a higher share of natural ingredients. **Baycusan® eco E 1000** film forming polymer supports developing more natural hair care concepts with must-have styling properties. The 55% bio-based film former (according to ISO 16128) demonstrates strong hold, outstanding humidity resistance and heat protection with low flaking. Some end-consumers, however, still perceive strong hold with a sticky feeling on the hair. In this study we will demonstrate how to find just the right trade-off between strong hold and stickiness when it comes to more natural hair styling formulations, using the combination of the **Baycusan® eco E 1000** polymer and specific additives.

Study design

The following additives have been selected: Sucrose Acetate Isobutyrate, Cetearyl Alcohol (and) Ceteareth-20, Methyl Glucose Dioleate, PEG-120 Methyl Glucose Dioleate, Glyceryl Rosinate (and) Octyldodecanol, Shorea Robusta Resin (and) Octyldodecanol. They have been evaluated at a concentration between 2 and 15 wt. % in a natural hair styling gel formulation (Figure 1) containing 5 wt. % **Baycusan® eco E 1000** and Ceratonia Siliqua (Carob) Gum in combination with Succinoglycan as thickening system.



Figure 1: Test formulation

Phase	Ingredients	wt. %
A	Aqua	to 100.00
	Glycerin	0.50
B	Methylpropanediol (and) Caprylyl Glycol (and) Phenylpropanol ¹	3.50
	Panthenol	0.20
	Succinoglycan ²	1.50
	Ceratonia Siliqua (Carob) Gum ³	0.25
	Additives	2.00 to 15.00
C	Fragrance	0.10
D	Baycusan® eco E 1000	5.00
		100.00

Raw materials: ¹Dermosoft® OMP, Evonik Dr. Straetmans GmbH; ²Rheozan® SH, Solvay Novecare; ³Genu Gum RL-200Z-CG, CP Kelco.

Processing: Phase A is mixed at room temperature. Phase B is mixed in a separate vessel at room temperature. Add Phase B to Phase A while homogenizing. Continue mixing until completely uniform. Phase C is added and mixed. pH value is checked and adjusted to 5.8-6.0 with Citric Acid (10% sol.). Phase D is added and pH value is checked again. If necessary, pH value is adjusted with Citric Acid (10% sol.) Mix until everything is uniform and smooth.

Stickiness during and after application, flaking, sensory properties, bending force and high humidity curl retention of the hair tresses have been evaluated. They have been compared to a strong hold and high sticky commercial benchmark (Figure 2) containing the following film formers mixture: VP/VA Copolymer, PVP, Vinyl Caprolactam/VP/Dimethylaminoethyl Methacrylate Copolymer, Cetearyl Alcohol, Petrolatum, Propylene Glycol, Triacantanyl PVPVP/DMAPA Acrylates Copolymer, Phenoxyethanol, Steareth-21, Sodium Benzoate, Corn Starch Modified, Fragrance, PEG-8 Beeswax, Hydroxyethylcellulose, Citric Acid, Dicityl Phosphate, Ceteth-10 Phosphate, Ethylhexylglycerin, Laurtrimonium Chloride, Benzalkonium Chloride, Benzyl Alcohol, Limonene

Figure 2: INCI declaration of commercial benchmark



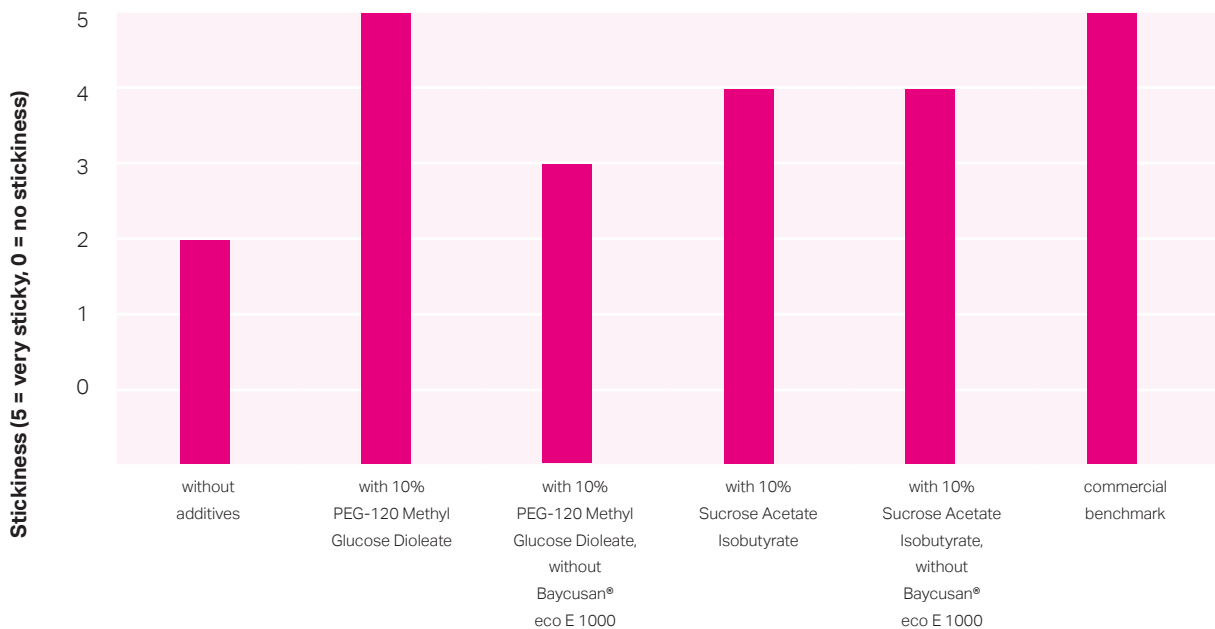
Baycusan® eco E 1000

Stickiness boosting

The above mentioned additives increase the stickiness feeling of the formulation on the hair tresses. 10 wt. % is the optimal concentration for a significant increase of the stickiness on the hair tresses. The highest stickiness is obtained with 10% PEG-120 Methyl Glucose Dioleate and is at the same level as the commercial benchmark one. 10 wt. % Sucrose Acetate Isobutyrate or Cetearyl Alcohol (and) Cetearth-20 imparts a rather high stickiness.

To develop a sticky and strong hold hair styling gel based on **Baycusan® eco E 1000**, the use of 10 wt. % Sucrose Acetate Isobutyrate or 10 wt. % PEG-120 Methyl Glucose Dioleate is recommended. Furthermore, in case of the use of PEG-120 Methyl Glucose Dioleate in the natural hair gel formulation, **Baycusan® eco E 1000** even boosts the stickiness of the formulation (Figure 3).

Figure 3: Results of stickiness evaluation

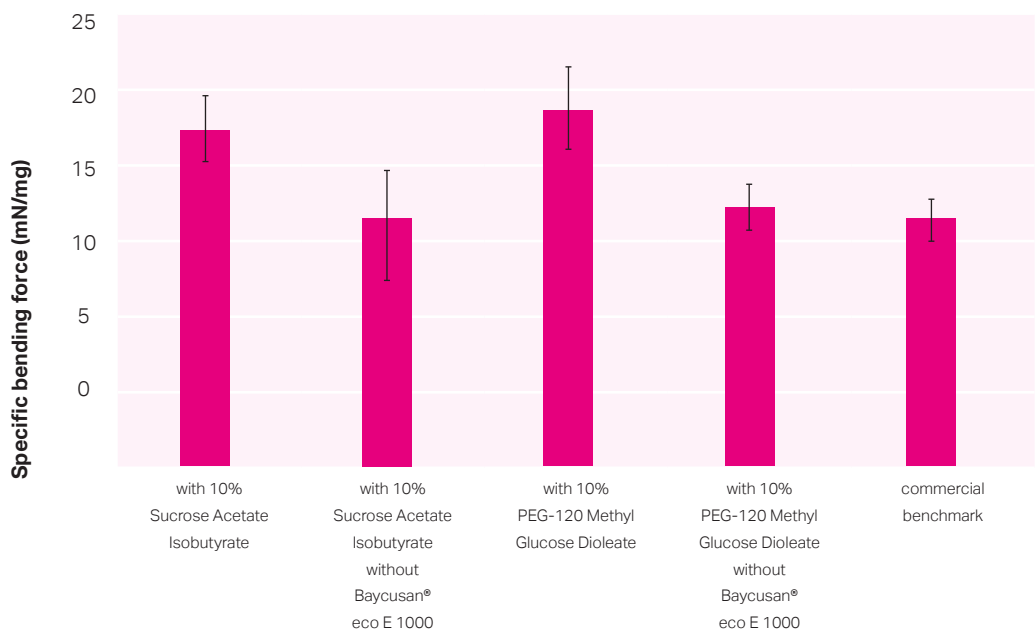


Strong holding power

The specific bending forces of the formulations containing **Baycusan® eco E 1000** and the additives are higher than the specific bending forces of the commercial formulation while the same formulation was applied on the hair (Figure 4). We can confirm that **Baycusan® eco E 1000** imparts the strong holding power to the sticky formulations based on

10 wt. % Sucrose Acetate Isobutyrate or PEG-120 Methyl Glucose Dioleate. No significant differences in holding power have been observed between the gel formulation containing 10 wt. % Sucrose Acetate Isobutyrate and the formulation with 10 wt. % PEG-120 Methyl Glucose Dioleate.

Figure 4: Results of specific bending force



Flaking

One critical aspect of strong hold styling gel formulations is the possible gel residues left on the hair which is often the drawback of styling products with high stiffness. The test formulation without any additive shows almost no flaking on the hair. By adding 10 wt. % Sucrose Acetate

Isobutyrate, no flaking can be observed unlike is the case with the commercial benchmark. With 10 wt. % PEG-120 Methyl Glucose Dioleate, similar flaking to commercial benchmark has been identified (Figure 5).

Figure 5: Pictures of residues on hair after combing



Method: 0.5 g of formulation was applied per gram of hair. After drying, hair tresse was combed ten times. Gel residues were observed on the hair tresses and on the comb.

Conclusion

Baycusan® eco E 1000 fixative agent imparts strong hold to hair styling gels while maintaining high natural content. The stickiness of natural hair styling gels can be increased by including an additive. The stickiness level can be controlled by the type and the concentration of the respective additive. In the above described test, it has

been shown that the stickiness can be easily achieved by combining **Baycusan® eco E 1000** with either Sucrose Acetate Isobutyrate at 10 wt. % or 10 wt. % PEG-120 Methyl Glucose Dioleate without sacrificing the holding power and the sensory properties of the initial formulation as shown in **Figure 6**.

Figure 6: Summary of test results

	Test formulation	Test formulation with 10% PEG-120 Methyl Glucose Dioleate	Test formulation with 10 wt.% Sucrose Acetate Isobutyrate	Commercial benchmark
Stickiness	-	+++	++	+++
Holding power	+++	++	++	++
Flaking	+	++	-	+++

Furthermore, the concept of stickiness can be transferred to other types of hair styling formulations such as hair setting lotions. As a matter of fact, similar results have been obtained in an emulsion-based setting lotion stabilized with Glyceryl Stearate SE.

This leads to the conclusion that **Baycusan® eco E 100** naturally-derived film former allows for higher flexibility in formulating hair styling products from non-sticky to very sticky feeling on the hair.

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