



penbio™ & penNatural™

NATURALLY-ENHANCED EMOLLIENTS

Experience the Penreco® difference. Our expertise and reputation were built by over 100 years of dedicated partnerships with our customers. We are devoted to understanding the unique chemistry required to deliver customized products to meet the specific needs of today's consumer products. As the personal care and cosmetics industries have experienced the emergence of "clean beauty," our customers' increasingly want to incorporate the best natural ingredients into their products.

As an industry leader in specialty products like gels, petrolatums and white mineral oils, we rely on our experience, high standards, research and development, and innovation to create a new premium line of naturally enhanced emollient products. Penreco offers PenBio™ and PenNatural™, a line of naturally-enhanced emollients, that deliver optimal moisturization and emollient benefits similar to petrolatum, along with a wide range of sensory attributes, perfect for your personal care and cosmetic formulations. PenNatural contains shea butter, castor oil and candelilla wax. PenBio contains the same ingredients as PenNatural with the addition of microcrystalline wax or petrolatum which optimizes cost and performance across the product line.

APPLICATIONS

■ Cosmetics ■ Personal Care ■ Creams, Balms, Ointments & Lotions ■ Salves & Rubs

PRODUCT SPECIFICATIONS

Test Method	Petrolatum	PenBio Plus	PenBio Ultra	PenBio Supreme	PenNatural
Lovibond Color	2.0Y max	3.2Y 0.8R	7.0Y 1.1R	16Y 2.0R	22Y 3.0R
Melting Point, °F	125 - 135	131.0	128.0	135.0	132.0
Viscosity @ 210 °F, SUS	64 - 75	70.2	74.7	84.8	84.9
Consistency, dmm	170 - 205	175	170	120	189
*Stability @ 45 °C	Stable	Stable	Stable	Stable	Stable
*Stability @ 190 °F	Stable	Stable	Stable	Stable	Stable

*Accelerated aging study is ongoing (1-month data shown)

Product Specifications are subject to change. All product sales are subject to the applicable terms and conditions.

*Preliminary Data: these products are not yet commercially available. Please inquire if you have questions and/or would like to sample our products.

International Nomenclature of Cosmetic Ingredients (INCI)

PenNatural: Butyrospermum Parkii (Shea) Butter, Ricinus Communis (Castor) Seed Oil, and Euphorbia Cerifera (Candelilla) Wax

PenBio Supreme: Butyrospermum Parkii (Shea) Butter, Ricinus Communis (Castor) Seed Oil, Euphorbia Cerifera (Candelilla) Wax, and Microcrystalline Wax

PenBio Ultra: Petrolatum, Butyrospermum Parkii (Shea) Butter, Ricinus Communis (Castor) Seed Oil, and Euphorbia Cerifera (Candelilla) Wax

PenBio Plus: Petrolatum, Butyrospermum Parkii (Shea) Butter, Ricinus Communis (Castor) Seed Oil, and Euphorbia Cerifera (Candelilla) Wax

BIODEGRADABILITY

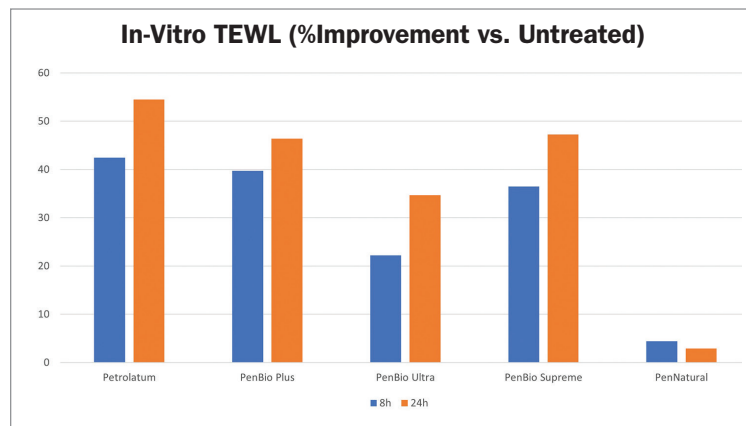
- PenBio and PenNatural products are biodegradable.
- Biodegradability testing method OECD 301B was performed by an accredited and certified bioenvironmental laboratory.



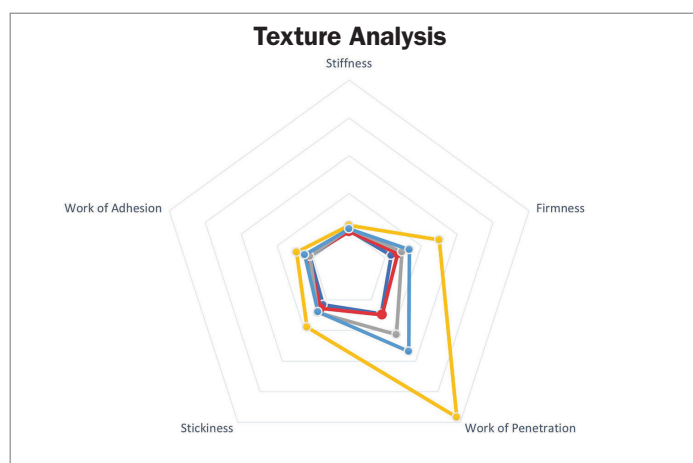
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Transepidermal Water Loss (TEWL) In-Vitro Study

The graph to the right shows significant improvement in TEWL reduction over the duration of the study for PenBio and Petrolatum control vs. untreated control. Petrolatum shows high level of occlusive moisturization as expected. PenBio Plus and PenBio Ultra retain significant moisturizing benefits of Petrolatum. PenBio Supreme improves on the performance of PenNatural with the inclusion of microcrystalline wax. The PenBio products are thus expected to deliver high and long-lasting moisturizing benefits.



Study #24-064 – 24-068



Texture Profiling of PenBio, PenNatural and Petrolatum

PenBio and PenNatural, naturally enhanced emollients, were evaluated using instrumental texture profiling methods against Petrolatum benchmark product. The textural properties measured included stiffness, firmness, penetration, stickiness, and adhesion. The naturally based emollients have texture profiles that resemble Petrolatum. PenBio Plus most closely mirrored Petrolatum results across all measured parameters. This was followed by PenBio Ultra and PenNatural. PenBio Supreme was most different from Petrolatum in this test because it contained an additional wax structurant.

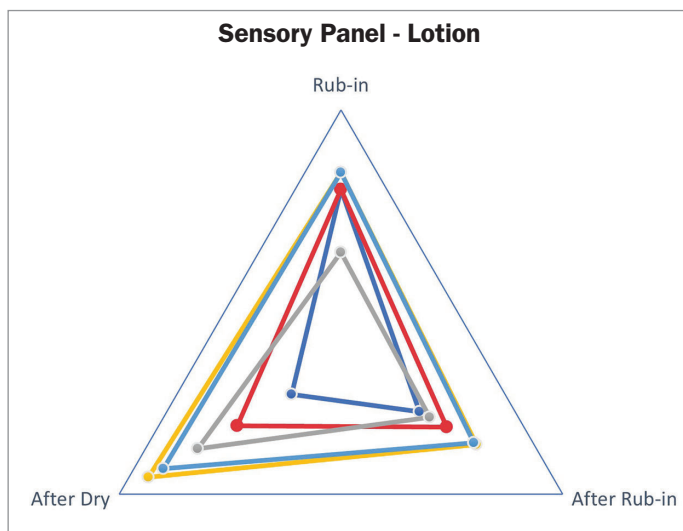
*Texture Profiling measurements were done on TA.XT Plus texture analyzer using the TA-23 round end probe

Sensory Evaluation of Lotion Formulations

Petrolatum, PenBio and PenNatural were separately added at 3% into a lotion formulation base. These lotions were tested at three use stages: rub-in, immediately after rub-in, and 7 minutes after drying. The graph shows average preference on a 5-point scale. Panelists (N = 9) also wrote comments at each use stage.

Key Learnings

- PenBio Plus performed most similarly to Petrolatum across all stages. Panelists reported a slightly oily and shiny texture.
- PenBio Supreme and PenNatural performed very similar at all stages. The samples absorbed well and applied well on the skin. They had a thicker, more luxurious feel.
- PenBio Ultra went on smooth and took slightly longer to be absorbed onto the skin.



PRODUCT KEY: —○— Petrolatum —○— PenBio Plus —○— PenBio Ultra —○— PenBio Supreme —○— PenNatural

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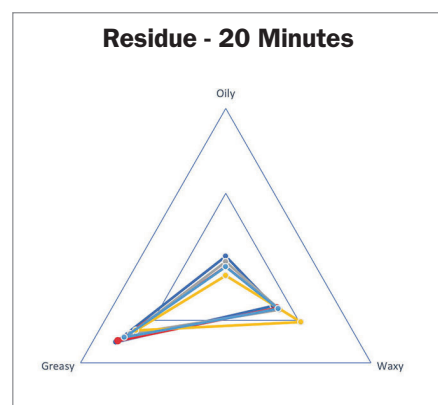
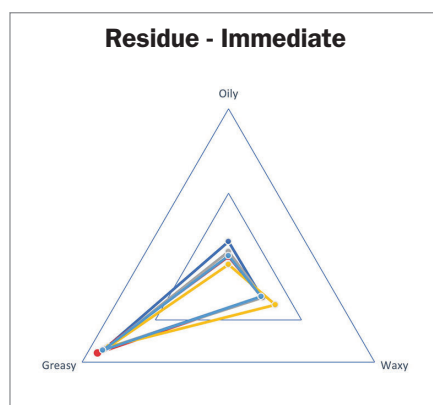
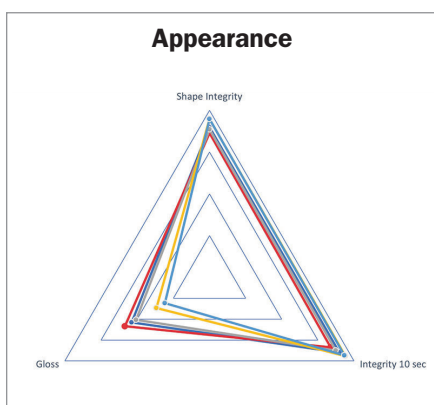
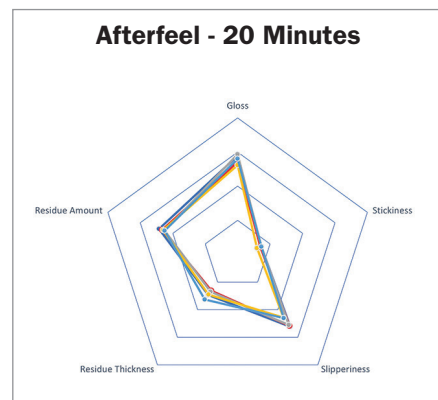
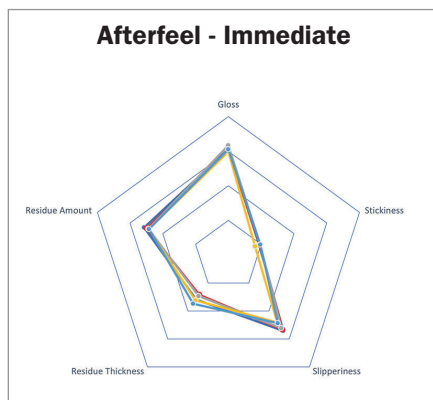
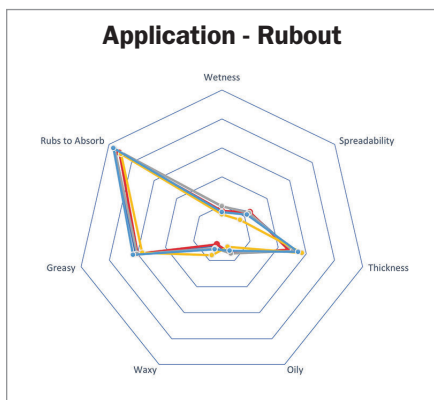
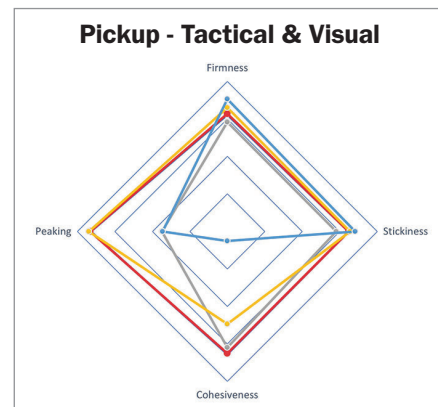
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Sensory Evaluation of Petrolatum, PenBio, and PenNatural

An expert panel descriptive sensory analysis was performed to assess the appearance and skin feel attributes of PenBio, PenNatural and Petrolatum.

Key Learnings

- These products had similar overall sensory profiles.
- PenBio Plus was the closest product to Petrolatum.
- PenBio Ultra differs mostly from Petrolatum in stickiness and peaking.
- PenBio Supreme shows the most difference from Petrolatum of the samples tested — especially in appearance, pickup and residue.
- PenNatural differed mostly from Petrolatum in appearance and pickup.
- PenNatural is more matte, firmer, less cohesive and lower in peaking.



PRODUCT KEY: —○— Petrolatum —○— PenBio Plus —○— PenBio Ultra —○— PenBio Supreme —○— PenNatural

Study #10605

LOTION FORMULATION

This formulation creates a creamy nourishing lotion that delivers the moisturizing and skin feel benefits of Petrolatum, PenBio, or PenNatural. It has a light, soothing, breezy, and indulgent tropical fragrance.

PROCEDURE

1. Heat Phase 1 and Phase 2 components separately to 50 – 70 °C.
2. Pour Phase 1 into Phase 2 and blend well.
3. Cool to 40 °C then add Phase 3 components sequentially.
4. Blend to homogenize.

PHASE	INGREDIENT	INCI NOMENCLATURE	W/W%
1	Distilled Water	Aqua	68.00
1	Glycerin, USP	Glycerin	5.00
2	Sunflower Oil	Helianthus Annuus (Sunflower) Seed Oil	8.00
2	CreamMaker WAX (HLB 12-13)	Cetearyl Alcohol (and) Polysorbate 60	5.00
2	Shea Butter	Butyrospermum Parkii (Shea) Butter	8.00
2	PenNatural, PenBio, or Petrolatum*	refer to the INCI listing on page 1	3.00
3	Hexanediol CG	1,2-Hexanediol (and) Caprylyl Glycol	0.80
3	Phenoxyethanol	Phenoxyethanol	0.90
3	Vitamin E	Tocopheryl Acetate	1.00
3	Fragrance: Coral Reef	Fragrance	0.30

*Products in **bold** are supplied by Calumet Specialty Products Partners, L.P.

*Each lotion formulation was created using either Petrolatum, PenBio Plus, PenBio Ultra, PenBio Supreme;

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