



SENSORY- ENHANCED EMOLLIENTS

Silicone Alternatives in
Anticipation of Evolving
Regulations and Trends

sonneborn[™]

AN HF SINCLAIR BRAND

sonneborn™

WHERE SENSORY PERFORMANCE MEETS EVOLVING REGULATIONS AND TRENDS

Sonneborn Sensory-Enhanced Emollients and Silicone Alternatives

At Sonneborn, an HF Sinclair brand, we are dedicated to advancing cosmetic innovation. With over 120 years of expertise, we support our customers by delivering silicone-replacing emollients that not only moisturize and protect but also elevate the sensory experience, ensuring your formulations both perform and stand out.

Navigating Evolving Regulations

As regulatory pressures increase with the global move away from silicone compounds, particularly D4 (octamethylcyclotetrasiloxane), D5 (decamethylcyclopentasiloxane) and D6 (dodecamethylcyclohexasiloxane), our silicone alternatives provide a compliant, reliable solution with non-volatile applications. Designed to adhere to emerging standards, our high-purity emollients empower you to create products that satisfy modern safety and environmental requirements without compromising on quality or sensory appeal.





The Power of Sensory Attributes

We understand that a superior sensory experience is key to consumer satisfaction and loyalty. Sonneborn's sensory-enhanced emollients are crafted to deliver a luxurious, smooth feel while ensuring non-comedogenic, biodegradable and skin-friendly benefits. Our innovative formulations, including SonneNatural™ Fluidity 40P, our renewable, high-purity replacement for cyclic siloxanes, delivering exceptional sensory performance with no compromise on purity. Alongside our Renewable White Alkane is Sonnecone CM, Lilac™, and Iris™, crafted to provide a luxurious, smooth feel while offering non-comedogenic, biodegradable, and skin-friendly benefits. Together, these formulations are designed to enrich the tactile appeal of your skin care, hair care, and cosmetic products.

Trusted Solutions for Leading Brands

Our silicone alternatives are the choice of leading cosmetic brands worldwide. Whether you are developing formulations for moisturizers, sunscreens, shampoos or other personal care products, Sonneborn is your partner in creating innovative, sustainable and regulatory-compliant solutions that resonate with today's dynamic beauty movement.

Our Expertise and Global Reach

Manufactured and/or supplied from our state of the art facilities in Pennsylvania, USA, and Amsterdam, The Netherlands, our products reflect the highest standards of purity and performance. At Sonneborn, we pride ourselves on our commitment to quality, technical support and genuine partnership – ensuring that our silicone alternatives continue to inspire and innovate across the personal care industry.

Learn More

Discover how Sonneborn's sensory-enhanced emollients can transform your formulations. Visit www.sonneborn.com or contact our knowledgeable sales team to discuss how our silicone-free solutions can meet your unique needs.

SonneNatural™ Fluidity 40P

SonneNatural™ Fluidity 40P is a 100% bio-based, readily biodegradable Renewable White Alkane (INCI C15-19 Alkane) that is serving as an excellent alternative to cyclic siloxanes (D4, D5, D6) as well as low viscosity white oils and vegetable oils. Produced using patented technology, it delivers exceptionally high purity and strong performance, offering up to a 68%* cradle-to-gate product carbon footprint reduction compared to siloxanes and up to a 60%* cradle-to-grave reduction compared to white oils.

As cyclic siloxanes are increasingly restricted in the EU and other regions, like South Korea, due to persistence, bioaccumulation and environmental concerns, SonneNatural™ Fluidity 40P is a renewable, high-performance replacement that offers both regulatory confidence and formulation versatility. Its non-comedogenic**, non-irritating*** profile and high purity make it suitable for a wide range of personal care applications, including body oils, sun care, hair care, cleansers, and skin care formulations.

Purity: Meets USP, NF, Ph. Eur., BP and JP purity requirements; compliant with California Proposition 65 and BDF02 PAH requirements (32PAH Grimmer Analysis).

Inertness: Chemically inactive, ensuring it carries and delivers active ingredients without interference.

Readily Biodegradable (OECD 301B): A sustainable ingredient to prevent environmental buildup and pollution and reduce environmental impact, making it more eco-friendly.

Colorless and Odorless: A clear, odorless ingredient ideal for diverse formulations. Its transparency suits translucent products like body oils and hair, skin and sun care, while its purity enhances color accuracy in makeup. The neutral scent preserves fragrance integrity for uncompromised scented products.

UV and Thermal Stability: Product remains stable over time and resist chemical changes when exposed to ultraviolet light from the sun or other artificial sources.

Shelf Life: Stabilized with Vitamin E for an anticipated three-year shelf life, comparable to petroleum-based ingredients.

Superior Compatibility: SonneNatural™ Fluidity 40P's non-polar structure delivers silicone-like compatibility across diverse applications. Certifications: 100% bio-based, not tested on animals, GMO-free**, Kosher, Halal and vegan.

SonneNatural™ Fluidity 40P Applications

AP/Deo

Makeup, cosmetics and lipcare

Makeup remover and cleansing oils

Body mists

Creams, ointments and balms

Hair mists and styling

Sensory Profile: SonneNatural™ Fluidity 40P has similar sensory performance and properties to D4, D5, Cyclomethicone and Dimethicone, as exemplified in Tables 1 and 2.

Table 1
Sensory Profile

| Property | SN-F-40P | D4 | D5 | Dimethicone | Cyclomethicone |
|-----------|----------|----|----|-------------|----------------|
| Cushion | + | + | + | + | + |
| Gloss | ++ | ++ | ++ | ++ | ++ |
| Slip | ++ | ++ | ++ | ++ | ++ |
| Playtime | ++ | + | + | ++ | ++ |
| Lubricity | ++ | ++ | ++ | ++ | ++ |

+ = very low | ++ = low-medium | +++ = medium | ++++ = high

Table 2
Typical property values

| Property | Method | SN-F-40P | D4 | D5 | Dimethicone | Cyclomethicone† |
|------------------------------|------------|---------------|--------|--------|-------------|-----------------|
| Viscosity @ 40°C, cSt | ASTM D445 | 3.2/4.5 | 2.25 | 3.05 | 4.62 | 3.04 |
| Flash Point, °C | ASTM D92 | 130 Min. | 51 | 73 | 94 | 76 |
| Specific Gravity @ 25°C/25°C | ASTM D4052 | 0.7700/0.8000 | 0.9439 | 0.9439 | 0.9256 | 0.9439 |

†Cyclomethicone = Mixture of D4, D5, D6.

*Cradle-to-Grave Analysis assumes PCF (Cradle-to-Gate) plus emissions at end of life to full oxidation of products (Gate-to-Grave). HF Sinclair L&S product LCA and PCF (Cradle-to-Gate) based on ISO 14040, 14044, 14067.

**based on Comedogenicity Clinical Testing completed on Fluidity 40P, 20 subjects aged 18-40.

***based on HRIPT Clinical Testing completed on Fluidity 40P, semi-occlusive patch, 112 subjects aged 20-70 and EpiOcular™ Eye Irritation Test, OECD 492.





Lilac™ and Iris™

Sensory-Enhanced Alkanes

Lilac™ (INCI C14–22 Alkane) and Iris™ (INCI C12–17 Alkane) are both highly purified alkanes ideal for use as lightweight, colorless alternatives for D4, D5 and D6 silicones, with non-volatile properties.



Colorless and odorless



Hydrophobic



Biologically stable



Non-comedogenic



Silky spreadability



Soft, powdery afterfeel

Lilac™ is a colorless, odorless, hydrophobic and stable ingredient that resists bacterial growth and is non-comedogenic. It offers silky spreadability, quick absorption and a soft, powdery afterfeel — ideal for shampoos, conditioners, creams and lotions.

Lilac™ offers a preferred afterfeel compared to other alternatives on the market. The combination of emollient with silicone-like properties makes this a very versatile ingredient in cosmetic applications where an emollient and moisturizer are required.

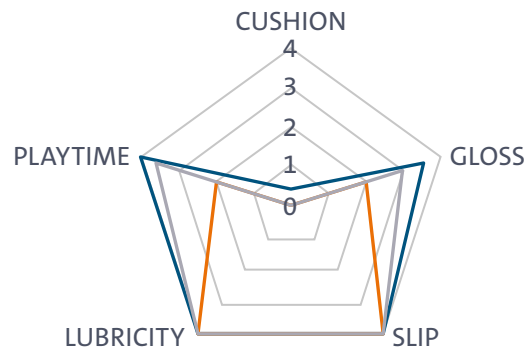
An advantage to using Lilac™ in formulations is its ability for blending at much higher temperatures, higher safety threshold and preferred afterfeel over other alternatives in the market.

Lilac™ (INCI Name C15–23 Alkane) is also available from both North America and Europe.

Iris™ is a highly purified mixture of alkanes offering enhanced skin-feel for a wide range of personal care applications. Iris is a colorless, odorless liquid, with the sensory characteristics of cyclopentasiloxane, and was developed as an alternative to D5 silicones in cosmetic formulations.

Lilac™ vs. D5 and Dimethicone

Lilac™ — Cyclopentasiloxane, D5 —
Dimethicone, 20 cSt —



Lilac™ and Iris™ Applications

Petrolatum Applications

PERSONAL CARE

AP/Deo

Body Wash

Hair Shampoo & Conditioner

Hair Styling and Finishing

Hand Cleaners

Moisturizing Lotions

Permanent Waves

Scalp Protector

Skin Creams and Lotions

Sun Care Products

PHARMACEUTICAL

Medicated Ointments

Suppositories

| Product Information | Lilac™ | Iris™ |
|-----------------------|---------------------------------|---------------------------------|
| INCI Name | C14–22 Alkane | C12–17 Alkane |
| CAS Number | 8042-47-5 | 8042-47-5 |
| CAS Registry Name (s) | White Mineral Oil, Paraffin Oil | White Mineral Oil, Paraffin Oil |

| Typical Features | Lilac™ (NA) | Lilac™-EU | Iris™* |
|--------------------------------------|-------------|------------|------------|
| Density at 20°C (g/cm³) | 810–830 | 810–830 | 791–806 |
| Density at 20°C (Test method) | ASTM D4052 | ASTM D4052 | ASTM D4052 |
| Kin. Viscosity at 40°C (mm²/s) | 3.9–5.0 | 3.9–5.0 | 2.25–2.95 |
| Kin. Viscosity at 40°C (Test method) | ASTM D445 | ASTM D7279 | ASTM D445 |
| Pour Point °C | 3 Max | 3 Max | -12 Max |
| Pour Point °C (Test Method) | D97 | D97 | D97 |

*Iris™ does not meet the REACH regulation for European Sales

**Lilac G INCI Name C15-23 Alkane is also available out of US and EU with same specifications.

Sensory Profile: To help choose the right ingredient for your particular formulation with non-volatile properties, those similar to silicones, please refer to the sensory selection guide below where both products are compared to Cyclopentasiloxane, D5.

| Product | Cushion | Lubricity | Gloss | Slip | Playtime |
|------------------------|---------|-----------|-------|------|----------|
| Lilac | + | +++ | +++ | ++++ | ++ |
| Iris | + | +++ | ++ | ++++ | ++ |
| Cyclopentasiloxane, D5 | + | ++ | ++ | ++++ | ++ |

+ = very low | ++ = low-medium | +++ = medium | ++++ = high

Sonnecone CM

Sensory-Enhanced Petrolatum

Distinctly Unique: By applying developmental expertise, Sonneborn has created a product that is not easily recognizable as petrolatum.

Sonnecone CM has a sensory profile that complements many personal care formulations with its silky skin-feel, excellent spreadability, non-volatile properties, easy handling and smooth application as it melts at skin temperature. It is 100% White Petrolatum USP that also meets the FDA requirements for food grade petrolatum in 21 CFR 172.880.

Sonnecone CM is a soft, translucent, high-gloss White Petrolatum USP that offers a powdery soft afterfeel. It is an excellent emollient for skin lotions designed to be lightweight, yet deliver optimal moisturizing benefits.

Applications and Properties: Combining the traditional benefits of a petrolatum with enhanced sensory characteristics, Sonnecone CM can be used as one of your most versatile formulating ingredients. Sonnecone CM provides a unique non-greasy texture with a smoother, drier feel and a satiny finish after application.





Sonnecone CM Most Used Applications

Petrolatum Applications

PERSONAL CARE

Anti-Ash Skin Products

Color Cosmetics

Dry Body Oil

Hair Smoothing

Hair Styling

Hand Cleaners

Hand and Body Lotions

Massage Cream

Moisturizing Lotions

Moisturizing Body Wash

Scalp Protector

Skin Creams and Lotions

Sun Care Products

PHARMACEUTICAL

Medicated Ointments

Comparison of Afterfeel Attributes (Neat Form)

| Attributes | Competitor's Silicones | | | |
|-----------------|------------------------|------------------------|--------------------|---------------------|
| | Sonneborn Products | Cyclohexasiloxane (D6) | Dimethicone 50 cSt | Dimethicone 100 cSt |
| Light | ✓ | ✓ | ✓ | ✓ |
| Fast Absorption | ✓ | ✓ | ✓ | |
| Soft | ✓ | | ✓ | |

Rheology and Skin-feel: Petrolatum has long been a benchmark for moisturization and skin protection. Certain petrolatums at high levels often impart a heavy feel on the skin surface. For this reason, rheology plays an important role in how face and body care products are applied, spread and absorbed into the skin's surface. Sonnecone CM has been developed to enhance skin-feel without compromising the many functional benefits of classic petrolatum.

Flow Onset: The rheology of petrolatum can be defined by the decrease in viscosity with increasing temperature. We define flow onset as the temperature at which the dynamic viscosity reaches 25 Pa*s (pascal-second). By looking at the difference between the flow onset temperature of a "standard" petrolatum used in typical personal care products versus that of Sonnecone CM, one can predict the relative rheology and therefore its spreadability, drag, and overall skin-feel properties upon application.

The typical flow onset temperature of a "standard" USP Petrolatum (for example, Sonneborn's White Protopet™ 1S) is between 45°C and 55°C, whereas the flow onset temperature of Sonnecone CM occurs between 30°C and 40°C. At body temperature, Sonnecone CM becomes fluid, therefore exhibiting easier spreadability, less drag and an overall lighter skin-feel upon application.

Most petrolatums are resistant to spreading and have a heavier/greasier skin-feel. Conversely, the spreadability of Sonnecone CM resembles that of some silicones.

The table below shows the flow onset temperatures of Sonnecone CM versus White Protopet™ 1S Petrolatum:

| Product | *Flow Onset °C |
|--------------------|----------------|
| Sonnecone CM | 31.7 |
| White Protopet™ 1S | 53.0 |

This particular Sonnecone property adds a more appealing sensory dimension to petrolatum, while still delivering the same attributes of moisturization, occlusivity and skin protection.

There are two properties described on this page that illustrate the rheological enhancement of Sonnecone CM over that of standard petrolatum; these are known as flow onset and complex viscosity. Flow onset relates to spreadability properties, whereas complex viscosity, which provides similar information, is more related to rub-in and absorption.

Complex Viscosity: Complex viscosity is a characteristic that helps predict certain sensory qualities of petrolatum. Between the temperature range of 35°C to 45°C, the complex viscosity for Sonnecone CM approaches 0.1 Pa*s. The temperature for the complex viscosity to reach 0.1 Pa*s for typical USP Petrolatum is above 47°C. The table below describes the temperature at which G' is equal to 0.1 Pa*s, or the pressure at which there is no "drag" or resistance when rubbing a product into the skin; i.e., the point at which a product feels light and absorbed into the skin.

| Product | *0.1 Pa*s |
|--------------------|-----------|
| Sonnecone CM | 35.9°C |
| White Protopet™ 1S | >65°C |

*Instrument used in study is TA AR2000ex Rheometer

The temperature range at which the Sonnecone CM viscosity approaches 0.1 Pa*s is close to that of skin temperature. When Sonnecone CM is applied to the skin, it spreads smoothly and without the drag or tackiness that is characteristic of standard petrolatum. This characteristic further enhances the elegant application and skin-feel of Sonnecone CM. Lower drag and lower flow onset temperature are desirable characteristics in personal care formulations including creams and ointments.

Sensory Profile: Sonnecone CM offers all the advantages of a White Petrolatum USP, with reduced cushion and high gloss.

To help find the right product for your particular formulation, please refer to the table below comparing Sonnecone CM with White Protobet™ 1S.

Typical Properties of Sonnecone CM

| Product | Kin Viscosity @ 100°C, (cSt) | Drop Point (°C) | Cone Penetration (dmm) | Lovibond color (Y) | Compliance | | |
|-------------------|------------------------------|-----------------|------------------------|--------------------|------------|------|-----|
| Test method : USP | Test method is ASTM D445 | USP | ASTM D937 | IP17 | Ph. Eur. | FDA* | USP |
| Sonnecone CM | 3.62 | 35–70 | 240–300 | 3" cell: 1 max | ✓ | ✓ | ✓ |

* 21 CFR 172.880

| Product | Cushion | Lubricity | Gloss | Slip | Playtime |
|--------------------|---------|-----------|-------|------|----------|
| Sonnecone CM | ++ | ++++ | ++++ | ++++ | ++++ |
| White Protobet™ 1S | ++++ | +++ | ++ | ++ | +++ |

+ = very low | ++ = low-medium | +++ = medium | ++++ = high





Innovation leads us,
trusted ingredients
define us.

sonneborn[™]

AN HF SINCLAIR BRAND

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LUB34489 (06.2025)

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