



Shell Chemicals

**Bio-based Shell
NEODOL[®], Bio-based
Shell NEODENE[®] and
Bio-based Shell IPA C+**

Your First Choice for Personal Care Formulations

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Personal Care Product Line

Bio-based Shell NEODOL, Bio-based Shell NEODENE and Bio-based Shell IPA C+ for everyday personal care

In today's consumer-conscious world, the challenge lies in formulating products that not only meet rigorous performance expectations, but also align with increased calls for sustainability.

To help formulators achieve their goals, Shell Chemicals now offers a portfolio of bio-based grades of Shell NEODOL alcohols, ethoxylates, Shell NEODENE linear alpha olefins, and Shell IPA C+.

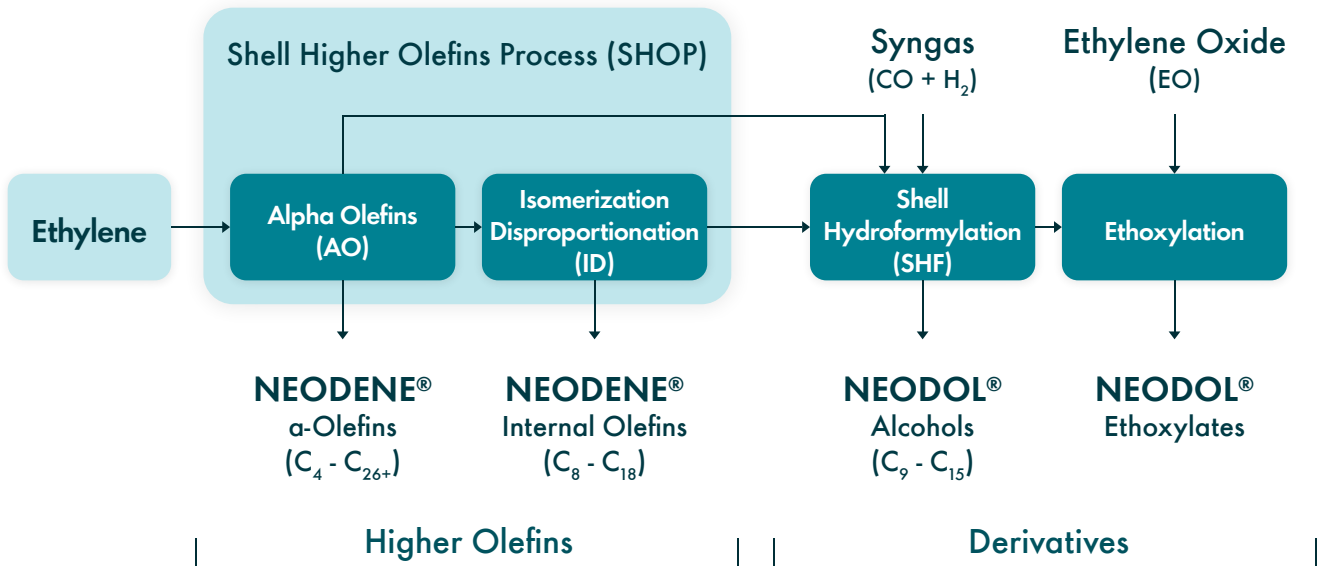
These performance grades are produced from bio-based and bio-circular feedstocks based on a mass balance approach. Shell Chemicals' bio-based and bio-circular products, collectively referred to as bio-based products, are available in large volumes from our world-scale production plant. These products have excellent quality and purity, and have global specifications.

Personal Care Product Line

Quality without compromise

The new bio-based Shell NEODOL and Shell NEODENE grades offer the same properties and high-performance qualities that formulators have trusted and valued for decades using our conventional feedstock grades.

Our Proprietary Manufacturing Process



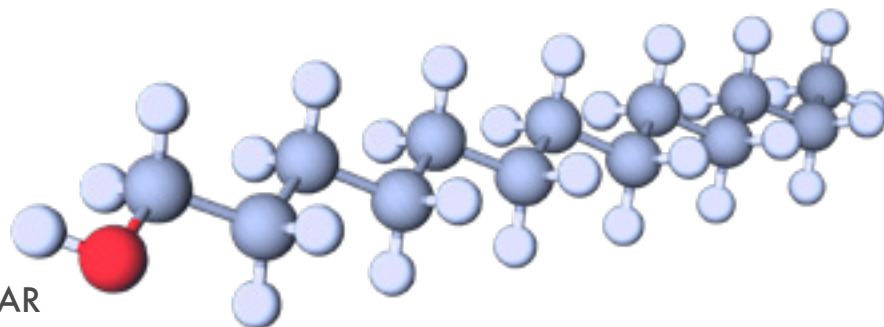
The Shell NEODOL alcohol products have been widely used because of their unique chemical composition: The lightly branched structure offers foaming power, ease of formulating, product stability, and emollient properties. These properties are well suited for body wash, shampoo, and many other personal care products. The Shell NEODENE alpha olefins have a highly linear structure, which is beneficial for intermediates use in personal care products.

Bio-based Shell NEODOL Alcohols

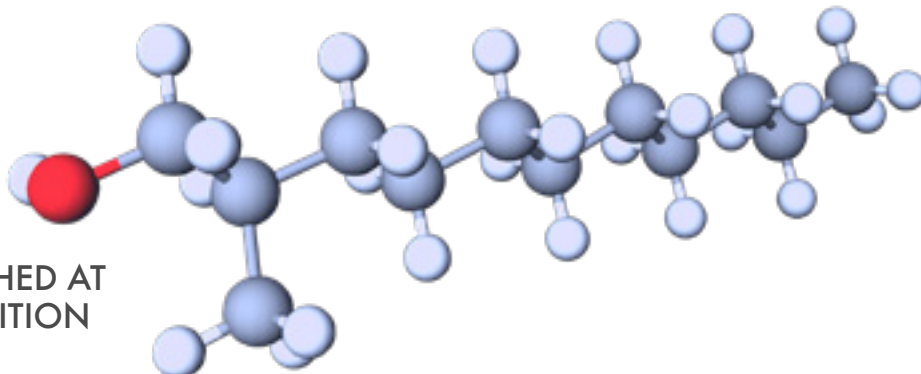
Chemical composition for high performance

The bio-based Shell NEODOL alcohol grades are produced using our proprietary hydroformylation technology. This gives both odd- and even-numbered alcohol carbon chains and a unique lightly branched structure; see the figure below. They are ideal to manufacture intermediates for cleansing agents and solubilizers. They can also be used as is, as stabilizers and emollients.

~ 80% LINEAR



~ 20% BRANCHED AT 2-ALKYL POSITION





Bio-based Shell NEODOL Alcohols

Benefits of light branching

Shell NEODOL alcohols and their derivatives are classified as “readily biodegradable” according to the OECD guidelines for chemicals. Products in this category are environmentally preferred. The essentially linear structure provides comparable properties and performance to commonly used oleo alcohols such as those based on palm kernel and coconut oils. Additionally, the light branching of Shell NEODOL products can improve handling properties and compatibility with other ingredients.

Grade	Intermediate For	INCI Name
Shell NEODOL 23	Used as is for viscosity control + emollient (skin care)	C12-13 Alcohols
Shell NEODOL 135	Used as is for viscosity control + emollient (skin care)	C11-15 Alcohols
Shell NEODOL 25	Used as is for viscosity control + emollient (skin care) Used as alkyl benzoate ester solvent (sunscreen + hair care + lip balm)	C12-15 Alcohols C12-15 Alkyl Benzoate Ester*
Shell NEODOL 45	Used as is for viscosity control + emollient (skin care)	C14-15 Alcohols
Shell NEODOL 5	Used as is for viscosity control + emollient (skin care) Used to make a cationic “quat” (hair conditioner)	Pentadecyl Alcohol

*Generic INCI name for the end product used in applications mentioned, Shell Chemicals does not manufacture the end products and, therefore, has not applied for an INCI name.



Emollients in Lotions, Sunscreen, and Skincare Products

Leave the skin feeling soft and supple

Bio-based Shell NEODOL alcohols are colourless, nonirritating, nonsticky, and nonoily, making them ideal for use in lotions and creams as emollients. They leave the skin feeling soft and supple. They can also be used as a solvent/carrier for other personal care products.

Because they are of high purity, they help maintain formulated product colour and do not contribute to yellowing. They are also well suited for cosmetics and help the formulator control the viscosity of creams and lotions and other skin care and hair care formulations. In this respect, the C14,15 and C15 alcohols (Shell NEODOL 45 and Shell NEODOL 5 grades, respectively) are well suited as emollients in higher viscosity formulations.

Shell NEODOL Solubility

Good solubility and compatibility with other ingredients

At room temperature, Shell NEODOL products are easily mixed with many solvents. The table compares Shell NEODOL 45 alcohol to 2-hexyl-1-dodecanol, a commonly used C16 alcohol, demonstrating the similarity between the two alcohols. In addition, Shell NEODOL 25 is miscible with many vegetable oils.

Solubility of Shell NEODOL 45 and a typical C16 Guerbet alcohol in various solvents

Solvent (90%)	Room Temperature		Heated to 50°C	
	NEODOL 45	C16 GUERBET ALCOHOL	NEODOL 45	C16 GUERBET ALCOHOL
Water	✗	✗	✗	✗
Isopropyl Alcohol (IPA C+)	✓	✓	✓	✓
Propylene Glycol	✓	✗	✓	✓
Glycerin	d	✗	d	✗
Castor Oil	✗	✗	✓	✗
Sesame Oil	✗	✓	✗	✓
Mineral Oil	✓	✓	✓	✓
C12-15 Alkyl Benzoate	✓	✓	✓	✓
Isopropyl Myristate	✓	✓	✓	✓
Octyl Palmitate	✓	✓	✓	✓
Isododecane	✓	✓	✓	✓
Isohexadecane	✓	✓	✓	✓
Cyclopentasiloxane	✗	✓	✗	✓
Dimethicone	✗	✗	d	✗
Ethanol (100% conc)	✓	✓	✓	✓
Ethanol (75% conc)	✓	d	✓	✓
Ethanol (50% conc)	d	✗	d	d

LEGEND

✗ = Insoluble ✓ = Soluble d = Dispersible



Isopropyl Alcohol (IPA) C+

High solvency for well-blended formulations

Shell Chemicals bio-based Isopropyl Alcohol (IPA) C+ is a clear, colorless liquid with high purity making it ideal for use in a wide range of personal care applications including: skincare, haircare, cleansing, and makeup. With high solvency power, IPA C+ enables dissolving and blending of ingredients, creating stable and well-mixed formulations.

The properties of IPA C+ provide flexibility to the formulator to be used as an astringent to remove excess oils and sebum or as an antiseptic to cleanse and remove bacteria. IPA C+ is non-oily and lightweight for use in topical skincare topical lotions, leaving skin feeling clean and dry and in certain formulations may provide a toning effect on the skin, making it appear smoother and more refined.

Shell IPA C+ is safe for use in the production of biocidal products in compliance with EU Biocidal Products Regulation (Article 15), European Directorate for the Quality of Medicines and Healthcare (EDQM) European Pharmacopoeia Standards and US Cosmetic Ingredient Review Panel.



Bio-based Shell NEODOL Ethoxylates

Versatile building blocks that meet your needs

When looking for excellent emulsification and cleansing properties, Shell NEODOL ethoxylates should be your first choice. Being colourless, and ranging from liquids to low-melting-point solids, they are ideal for use in multiple formulations. Shell Chemicals' portfolio offers carbon numbers from C9 to C15, and various EO numbers, enabling them to be used in a variety of products including, body wash, cosmetics, hair care, and skin care.

Good for:
Emulsification
Cleansing
Foaming
Biodegradability



Grade	Intermediate For	INCI Name
Shell NEODOL 91-6	Used "as is" for skin care, e.g. creams and lotions	C9-11 Alketh-6
Shell NEODOL 91-8	Used "as is" for skin and hair care, e.g. facial cleanser and hair mousse	C9-11 Alketh-8
Shell NEODOL 23-2	Used as a sulfate, for Rinse off / Cleansing, e.g. Shampoo	Sodium C12-13 Alketh-2 Sulfate*
Shell NEODOL 135-1	Used as a sulfate, for Rinse off / Cleansing, e.g. Shampoo and Liquid Soap	Sodium C11-15 Alketh-1 Sulfate*
Shell NEODOL 135-3	Used as a sulfate, for Rinse off / Cleansing, e.g. Shampoo and Liquid Soap	Sodium C11-15 Alketh-3 Sulfate*
Shell NEODOL 25-3	Used as a sulfate, for Rinse off / Cleansing, e.g. Shampoo and Liquid Soap	Sodium C12-15 Alketh-3 Sulfate*

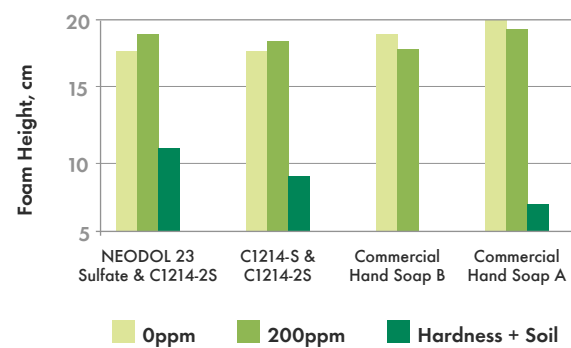
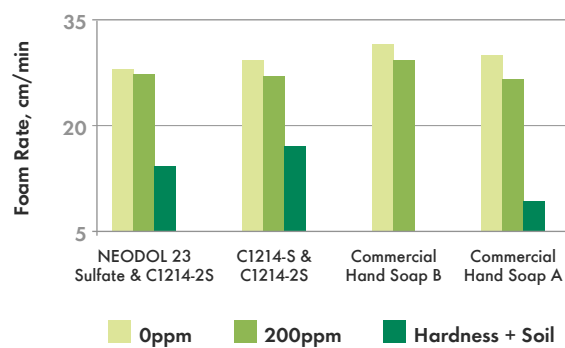


Sulfates Produced Using Shell NEODOL

Ideal for foaming and lather

Sulfates based on Shell NEODOL product grades can substitute for oleo analogues in personal care products such as shampoo, body wash and liquid soap products. The sulfates can be based on the Shell NEODOL alcohol itself and on lower-EO-number Shell NEODOL ethoxylates. The high linearity of anionic

surfactants based on Shell NEODOL have excellent lather and cleansing properties. Their low critical micelle concentration means they are as effective as oleo grades at reducing interfacial tension (skin/water and hair/water), providing effective cleansing.



A prototype liquid soap formulation as shown in the table was tested to compare back-to-back Shell NEODOL 23 and oleo-based sulfates for foaming. Oleo alcohol ethoxysulfate was present as a common ingredient.

ppm), 2) in the presence of hard water (200 ppm, referring to total calcium, magnesium salts), and 3) with hard water plus an oily soil. This is because Shell NEODOL alcohol, with 80% linearity, achieves similar foaming tendency as the fully linear lauryl alcohol.]

[The charts show that Shell NEODOL 23 alcohol sulfate is a good substitute for oleo alcohol sulfate, giving similar foam formation rates and stability (with 58 ppm Surfactant Active, 3 min test duration) when tested at three conditions: 1) in deionised water (0

Component	%w
Water	84.9
Alcohol Ethoxy Sulfate	5.4
Alcohol Sulfate	6.2
LMMEA	1.0
Cocoamidopropyl Betaine	1.2
Sodium Chloride	1.5

Bio-based Shell NEODENE

Intermediates for multiple applications

Shell NEODENE high-purity, linear alpha olefins offer versatility in product manufacturing and can be used as intermediates to increase foaming performance in cleansing agents and moisturizers, as well as other applications.

Examples of Shell NEODENE linear alpha olefins use in several applications:





EPA Safer Choice, EU Ecolabel, and Kosher Compliance

Certified safe and sustainable ingredients

Safer Choice is a voluntary EPA program that certifies cleaning and other products made with ingredients that are safer for people, pets, and the planet without sacrificing performance. Products on the EPA Safer Choice Ingredient List must meet strict criteria on the biodegradation, degradation products, and level of aquatic toxicity.

In Europe the following Shell NEODOL grades are listed in the Detergents Ingredients Database (DID) which can support product applications for environmental standards/schemes such as Ecolabel: NEODOL 23-2; NEODOL 25-3; NEODOL 25-7; NEODOL 91-5; NEODOL 91-6 and NEODOL 91-8.

Several Shell NEODOL products have been reviewed by EPA's Safer Choice program and qualify for use in Safer Choice-certified grades; see the illustration below.

Additionally, Shell NEODENE and Shell NEODOL bio-based grades (mass balance approach) are kosher certified.

Safer Choice qualified Shell NEODOL offerings



*CAS listed in SCIL (Safer Choice Ingredient List)

Shell NEODOL and Shell NEODENE: Examples of Product Formulations

Example prototype shampoo formulation

Typical Ingredients	Shell NEODOL and Shell NEODENE Options
Water (Aqua)	
Sodium C12-13 Alketh Sulfate*	Shell NEODOL 23-2 based Sulfate
Cocamidopropyl Betaine	
Sodium C14-16 Olefin Sulfonate	Shell NEODENE 14-16 based Olefin Sulfonate
Glycerin	
MIPA C12-15 Alketh Sulfate*	Shell NEODOL 25-3 based Alkanolamine
C14-15 Alcohols	Shell NEODOL 45 as viscosity controller
Dye, perfume, preservatives, etc.	

Example prototype liquid hand soap formulation

Typical Ingredients	Shell NEODOL and Shell NEODENE Options
Water (Aqua)	
Sodium C12-13 Alketh Sulfate*	Shell NEODOL 23-2 based Sulfate
Cocamidopropyl Betaine	
Sodium C14-16 Olefin Sulfonate	Shell NEODENE 14-16 based Olefin Sulfonate
Glycerin	
Fatty Acid Monoethanol Amide	
Perfume, preservatives, etc.	

*Formerly known as "Sodium C12-13 Pareth Sulfate"

Shell NEODOL: Examples of Product Formulations

Example prototype sunscreen formulation

Typical Ingredients	Shell NEODOL Options
Water (Aqua)	
UVA/UVB-filter	
C12-15 Alkyl Benzoate	Shell NEODOL 25 based solubilizer
Glycerin	
C12-13 Alkyl lactate	Shell NEODOL 23 based emollient
Perfume, preservatives, etc.	

Example prototype body wash formulation

Typical Ingredients	Shell NEODOL Options
Water (Aqua)	
Sodium C12-13 Alketh Sulfate*	Shell NEODOL 23-2 based Sulfate
Cocamidopropyl Betaine	
Propylene Glycol	
Sodium Chloride	
Dye, Perfume, preservatives, etc.	

*Formerly known as "Sodium C12-13 Pareth Sulfate"

Shell IPA C+: Examples of Product Formulations

Example prototype hair conditioner formulation

Typical Ingredients	Shell Options
Water (Aqua)	
Quaternary Ammonium Compound	
Isopropyl Alcohol (IPA)	Shell IPA C+

Example prototype scalp and hair rejuvenation shampoo formulation

Typical Ingredients	Shell Options
Water (Aqua)	
Stearyl Alcohol	
Behentrimonium Chloride	
Cetyl Alcohol	
Isopropyl Alcohol (IPA)	Shell IPA C+
Perfume, preservatives, etc.	

Example prototype aftershave treatment formulation

Typical Ingredients	Shell Options
Water (Aqua)	
Isopropyl Alcohol (IPA)	Shell IPA C+
Sd Alcohol 40B	
Acetylsalicylic Acid	
Glycerin	
Propylene Glycol	
Perfume, preservatives, etc.	

An aerial photograph of a dense, vibrant green forest. In the lower right quadrant, a large, irregularly shaped pond reflects the sky and surrounding trees. The overall scene is bright and natural, with sunlight filtering through the canopy.

Efficiency and Assurance with Mass Balance

The path to sustainable solutions

The mass balance accounting approach is a key component of Shell Chemicals' sustainability portfolio including bio-based, lower carbon, and bio-circular solutions. It is not just about the final product; it is about transforming the way we create and manufacture to help you deliver on your sustainability goals.

Mass Balance allows personal care product manufacturers to partially replace conventional materials and products with more sustainable alternatives without establishing new manufacturing processes. The process is certified by an independent third-party which helps provide assurance, transparency, and credibility for sustainability claims. It also helps reduce resource consumption and minimize environmental impact while it helps assure the product quality and consistency.

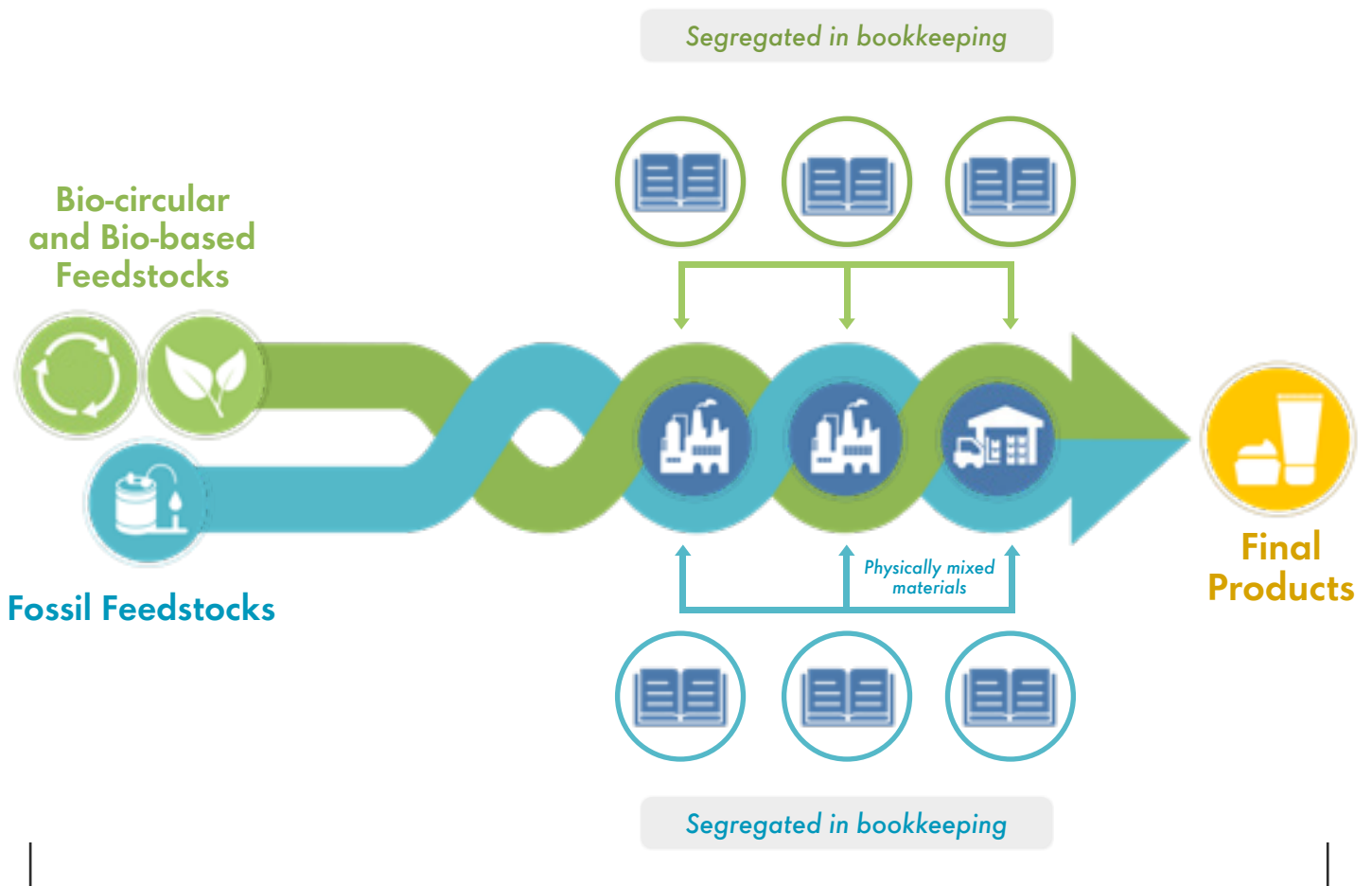
Shell Chemicals has several third-party certification systems in place where the bio-based content is verified by an independent organization, and more are being added to provide options for our customers.

Companies can advance their sustainability goals when they incorporate bio-based Shell NEODOL, Shell NEODENE, and/or Shell IPA C+ in their formulations.

Bio-based Mass Balance Process

Understanding mass balance

Shell Chemicals' bio-based content is verified by an independent, third-party certification organization such as (but not limited to) ISCC PLUS, REDcert and SCS global services.



Shell Chemicals' Commitment

Supporting your business, every step of the way

Shell Chemicals is a global leader, producer, and supplier of alcohols, ethoxylates, and higher olefins. Market leaders in personal care products already use Shell ingredients in their formulations and know that Shell Chemicals is a reliable partner for technical and commercial assistance.

Our bio-based products are manufactured to global standards and provide transparency and accountability with our options for third-party certification. Our integration with other Shell businesses provides our customers the ability to secure advantaged feedstocks, performance products, scale, and reliable delivery.

The scientists at Shell Chemicals continually develop, refine, and improve our personal care product line and are always willing to offer industry-leading expertise to customers formulating with Shell NEODOL, Shell NEODENE, and Shell IPA C+.

At Shell Chemicals, Product Stewardship is paramount. We hold ourselves accountable to high standards in health, safety, security and the environment (HSSE) for our products. By collaborating both independently and with industry groups, we are constantly evaluating and elevating our product line to address our customers' needs. By offering bio-based feedstocks, based on mass balance, you can enhance your products to meet growing consumer demand for more sustainable personal care products.

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