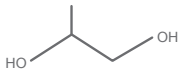
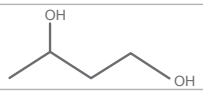
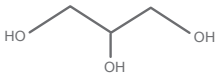
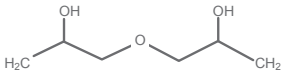

zemea®
bio-based performance
100% Plant-Based Performance
for Skin Care

Zemea® Propanediol for Skin Care

Zemea® propanediol is a natural, skin-friendly, and preservative-boosting alternative to petroleum-based glycols and glycerin for formulators who desire versatile and innovative cosmetic ingredients.

Zemea® propanediol is ideally suited for many different skin and body care applications including moisturizers, cleansers, anti-aging products, sunscreens, anti-acne products, sensitive skin products, deodorant, wipes and baby care.

Common	Ingredient	CAS#	Formula	Structure	MW	BP, °C	MP, °C	Density
Propylene Glycol	1,2-propanediol	57-55-6	$C_3H_8O_2$		76.1	187.3	-60	1.038
Zemea® Propanediol	1,3-propanediol	504-63-2	$C_3H_8O_2$		76.1	214	-24	1.053
Butylene Glycol	1,3-butanediol	107-88-0	$C_4H_{10}O_2$		90.1	204	-50	1.0053
Glycerin	1,2,3-propanediol	504-63-2	$C_3H_8O_2$		92.1	290	18	1.261
DPG	dipropylene glycol	25265-71-8	$C_6H_{14}O_3$		134.17	231	-40	1.023

Zemea® propanediol benefits in skin care formulations

Studies have demonstrated the unique performance benefits of Zemea® propanediol in skin care products.

Pure performance

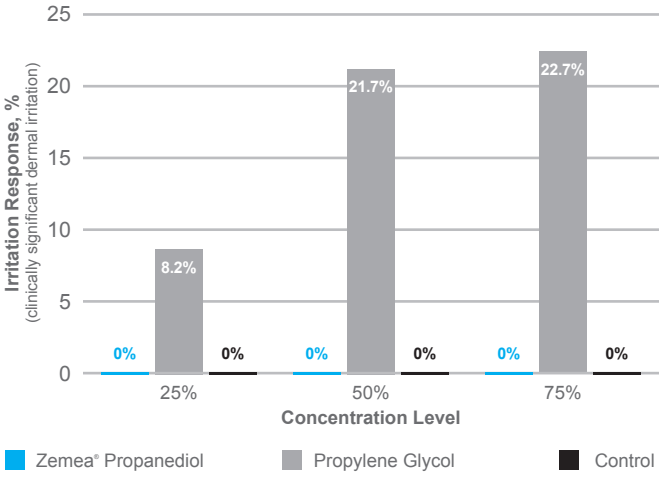
- No skin irritation
- Moisturization that lasts
- High-scoring sensorials
- Preservative-boosting
- Maximum solubility

Reduced skin irritation

In multiple studies using the modified Draize Repeated Insult Patch Test method, Zemea® propanediol produced no skin irritation, fatigue or sensitization—even at high concentrations.[1] Researchers observed no clinically significant dermal irritation or allergic contact following exposure of up to 75% Zemea® propanediol at three different pH levels.

By contrast, skin irritation was observed with propylene glycol (PG) at a concentration of 25%, with nearly one-quarter of the test population indicating positive irritation at a 75% concentration. Results from these studies show that Zemea® propanediol has low potential to irritate or sensitize human skin.

Human Skin Patch Test Results
207 individuals exposed to Zemea® propanediol or Propylene Glycol or Control at 7pH

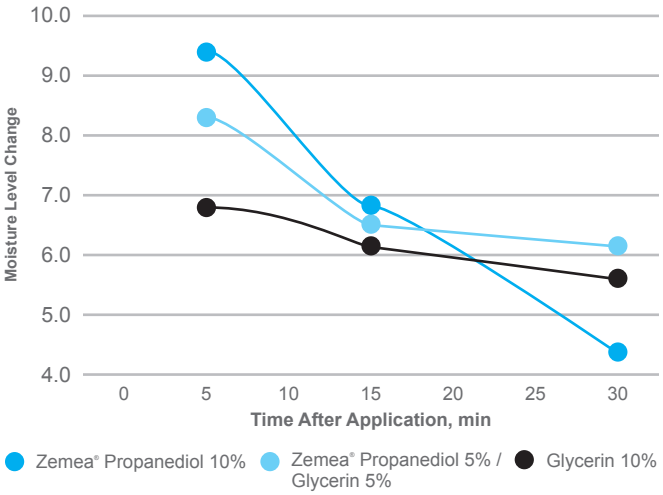


At concentrations as high as 75%, Zemea® propanediol has not produced skin irritation or sensitization reactions.

Moisturization performance vs. glycerin

In tests comparing the moisturizing effect of Zemea® propanediol to glycerin at a 10% use level, measurements taken with a Corneometer ASA-M2 showed that Zemea® propanediol provides improved skin moisturization during initial application.[2] A mixture of 5% Zemea® propanediol/ 5% glycerin in formulation demonstrated a synergistic effect that improved and extended skin moisturization. Formulating with a Zemea® propanediol/glycerin mixture also requires less glycerin, may reduce tackiness commonly observed with glycerin alone, and provides both short-term and long-term benefits.

Skin Moisturization Increase Compared to 10% Glycerin



1. DuPont Tate & Lyle Bio Products, Miller, Robert, et al., Evaluation of Plant-based 1,3-Propanediol as a 100% Natural Glycol Replacement. 2. DuPont Tate & Lyle Bio Products, Technical Bulletin: Zemea® Propanediol: Skin Moisturizing Performance.


Zemea® propanediol is ideally suited for many different skin and body care applications including moisturizers, cleansers, anti-aging products, sunscreens, anti-acne products, sensitive skin products, deodorant, wipes, and baby care.
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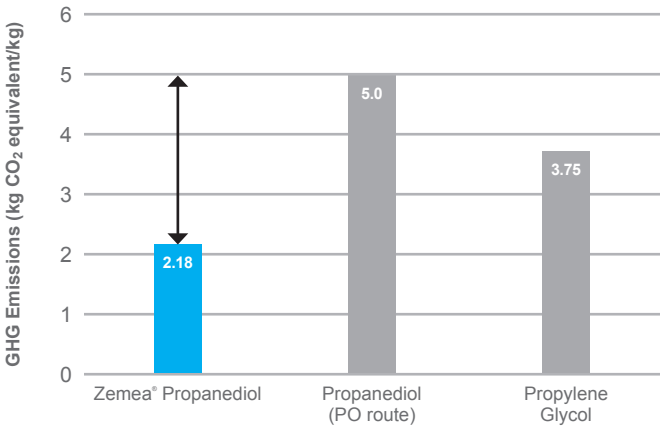
The greener alternative

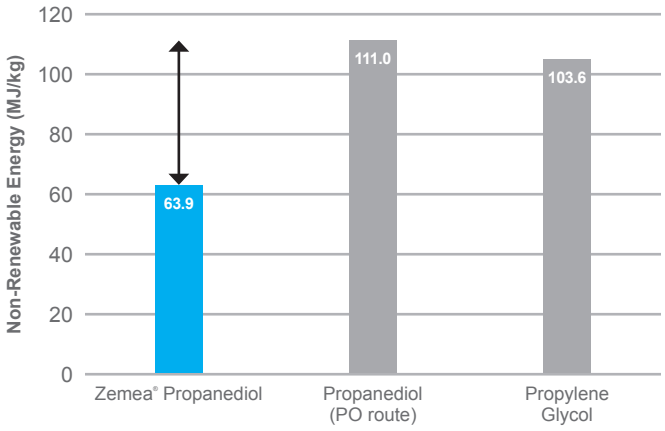
Zemea® propanediol is produced through a proprietary fermentation process using plant-derived glucose instead of petroleum-based feedstocks. The resulting product is typically 99.99% pure.

From "cradle-to-gate," Zemea® propanediol produces 47% less greenhouse gas emissions and consumes 49% less nonrenewable energy than petroleum-based 1,3-propanediol. Compared with PG, Zemea® propanediol produces 42% less greenhouse gas emissions and uses 41% less nonrenewable energy from cradle-to-gate.[8]

Zemea® propanediol is certified 100% bio-based under the USDA's BioPreferred® Program and is the world's first 100% plant-based glycol alternative to have earned certification from the Natural Products Association.



Greenhouse Gas Emissions
56% less than Propanediol
42% less than Propylene Glycol



Non-Renewable Energy Use
42% less than Propanediol
38% less than Propylene Glycol

Zemea® propanediol approvals, certifications and registrations

Approvals/Certifications:

- Natural Products Association (NPA)
- USDA BioPreferred® Program – 100% Bio-based
- Natural Health Products Ingredient – Health Canada
- Complies with ISO 16128-1:2016
- EPA Design for the Environment (DfE)
- GRAS
- Halal
- Kosher
- USP-NF

Registrations:

- INCI Name: Propanediol
- EINECS Number: 207-997-3
- CAS Number: 504-63-2
- REACH Registration Number: 01-2119489383-28-0000

8. Zemea® propanediol LCA data based on Loudon process design data; peer reviewed by Five Winds International.

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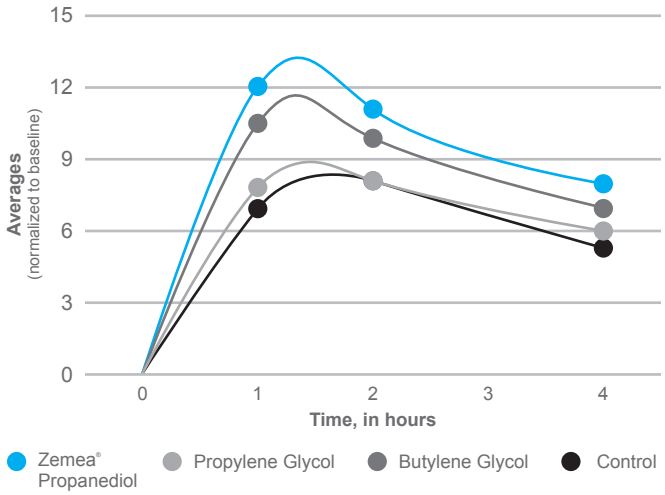
Moisturization performance vs. petroleum-based glycols

In two independent tests conducted between Zemea® propanediol and petroleum-based glycols, measurements with a Corneometer 825 PC® (Courage + Khazaka) revealed that Zemea® propanediol was more efficient than either PG or butylene glycol (BG) at moisturizing the skin at a 5% use level.[3]

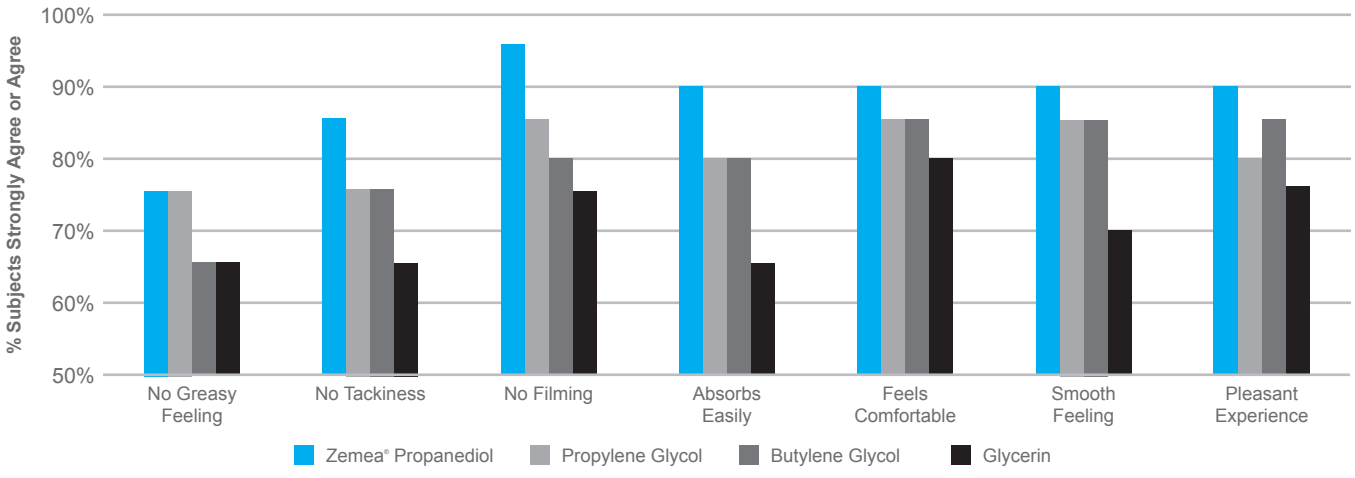


High-scoring sensorials

In repeated consumer sensory studies, lotions formulated with Zemea® propanediol rated higher for all sensory attributes than lotions formulated with glycerin.

Zemea® propanediol is also effective at reducing the tackiness associated with high concentrations of glycerin in certain formulations.[4]

Consumer Sensory Testing
Skin Lotion with 5% glycol



3. DuPont Tate & Lyle Bio Products, Miller, Robert, et al., Evaluation of Plant-based 1,3-Propanediol as a 100% Natural Glycol Replacement. 4. Ibid.

Preservative-boosting performance

CTFA Preservative Challenge Testing has shown that Zemea® propanediol can boost the efficacy of preservatives in a formulation. Seven different preservatives were tested at 50% of the recommended use level in a skin care emulsion. The Zemea® propanediol use level was varied from 0-6% to determine the minimum level of Zemea® propanediol needed to pass the challenge test.[5]

It is noted that the avergae minimum inhibitory concentration(MIC) and average minimum lethal concentration (MLC) for Zemea® propanediol is 8.36 (MIC50), 9.90% (MIC90), and 10.40% (MLC), respectively.[6]

Minimum Percentage of Zemea® Propanediol Needed to Boost Preservative Efficacy

Preservatives		Challenge Organisms: gram-positive *Staphylococcus aureus*	gram-negative *Escherichia coli*	gram-negative *Pseudomonas aeruginosa*	yeast *Candida albicans*	mold *Aspergillus niger*
phenoxyethanol-based	Microcare PM3 (0.15%)	2%	2%	2%	4%	2% (1 log reduction)
	euxyl® PE 9010 (0.25%)	4%	4%	2%	6%	2% (1 log reduction)
	Neolone PE (0.3%)	2%	2%		6%	2% (1 log reduction)
	Jeecide CAP-4 Optiphen (0.25%)	2%	2%		6%	2% (1 log reduction)
natural	Lexgard® Natural (0.5%)	Preservative levels provided sufficient reduction to <1.00 CFU/g without addition of Zemea® propanediol.				2% (1 log reduction)
	Dermosoft 688 ECO (0.1%)				2%	2% (1 log reduction)
	Geogard® ULTRA (0.5%)				2%	2% (1 log reduction)

Organisms reduced to <1.00 CFU/g at Day 7

Effective solubility

Zemea® propanediol has a unique set of Hansen Solubility Parameters. Software modeling suggested that Zemea® propanediol can be an effective solvent for actives and functional materials in skin care products and sunscreens.[7]

In tests, Zemea® propanediol worked well as a primary solvent to maximize the solubility of ferulic acid and allantoin. Zemea® propanediol worked well as a secondary solvent to manage the solubility and extend delivery time of ascorbic acid and glycolic acid. Zemea® propanediol worked well as a solvent to optimize formulation design and efficacy for salicylic acid and hexylresorcinol. In a broad-spectrum, daily-wear facial moisturizer, the addition of Zemea® propanediol effectively kept the sunscreen actives ensulizole and sulisobenzone in solution during the evaporative process on the skin, leading to greater efficacy.[7]

5. DuPont Tate & Lyle Bio Products, Technical Bulletin: Zemea® Propanediol: Potential for Boosting Preservative Efficacy. 6. DTL Technical Bulletin Antibacterial and Antifungal Properties of 1,3 Propanediol and Propylene Glycol 7. DuPont Tate & Lyle Bio Products, Technical Bulletin: Zemea® Propanediol: A Natural Solvent for Active Ingredients. 8. DuPont Tate & Lyle Bio Products, Technical Bulletin: Zemea® Propanediol in Broad Spectrum Protection Daily Facial Moisturizer.

Zemea® propanediol

Learn more at: Zemea-Performs.com

DuPont Tate & Lyle Bio Products

DuPont Tate & Lyle Bio Products Company, LLC., is a joint venture between DuPont, a global science company, and Tate & Lyle, a world-leading renewable food and industrial ingredients company. DuPont Tate & Lyle Bio Products provides natural and renewably sourced ingredients that enhance product performance. We offer solutions for a wide variety of markets and applications through our performance brands, Susterra® and Zemea®. For more information, visit www.duponttateandlyle.com

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