SALVONA
Unique&Easy Micro-Encapsulation Solutions

MultiSal® Menthol
Water-Activated Freshness

MultiSal® Menthol is an advanced encapsulated cooling technology designed for moisture-triggered, long-lasting freshness. Unlike free menthol, which evaporates quickly and can irritate the skin, MultiSal® Menthol offers a controlled, water-activated release, delivering a refreshing sensation exactly when it's needed. Ideal for low-moisture formulations, it enhances comfort in applications such as deodorants, body powder, dry shampoos, after-sun care, and muscle balms. With reduced odor at rest and superior stability, this innovative cooling system is perfect for brands seeking gentle yet effective sensory innovation.

The significant benefits of MultiSal® Menthol

MultiSal® Menthol offers several key advantages over free menthol, making it a superior choice for personal care formulations. Its **moisture-triggered release** mechanism activates upon contact with sweat or water, **delivering a refreshing cooling sensation right when it's needed most**. Unlike free menthol, which fades quickly, MultiSal® Menthol provides a **prolonged and consistent effect**, enhancing user comfort and product performance. The encapsulated form also protects menthol from evaporation and degradation, **improving stability and extending shelf life**. By releasing menthol gradually, it **minimizes the risk of irritation**, making it suitable even for **sensitive skin**. Its **versatility** allows it to be used in a wide range of products—from deodorants and powders to sprays and gels—offering a premium sensory experience that differentiates products in today's competitive market.

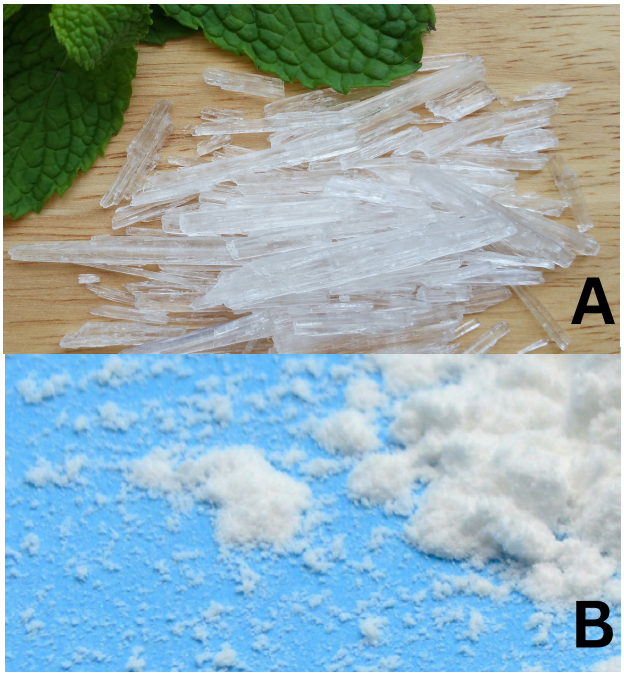

Figure 1. A) A photo of raw menthol crystals. B) Menthol crystals after encapsulation into MultiSal® Menthol.

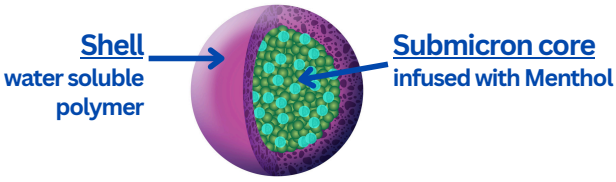

Figure 2. The structure of MultiSal® Menthol, a microsphere composed of a shell containing a sub-micron core infused with menthol encapsulated with water soluble polymer.

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Menthol, an organic compound extracted from peppermint and eucalyptus, is a white or colorless crystalline solid with a refreshing minty odor. With a melting point of 41–44°C (105.8–111.2°F), it is very slightly soluble in water (~0.4 g/L at 20°C) but highly soluble in alcohol and oils. Stable under normal conditions, menthol reacts with strong oxidizers and is susceptible to evaporation and oxidation if not protected. Its hydroxyl group (–OH) confers slight polarity, enabling hydrogen bonding, and making it a versatile compound for various applications.

Challenges in Formulation

1. Volatility and Evaporation
- Problem: Menthol evaporates easily at room temperature.
- Impact: Short-lived cooling effect, loss of active content over time, and odor instability.
- Solution: Use encapsulation (like MultiSal® Menthol) to control release and prevent loss.

2. Skin Irritation
- Problem: Free menthol in high concentrations can cause a burning or stinging sensation.
- Impact: Limits use in products for sensitive skin, underarms, or mucosal areas.
- Solution: Precise dosing, MultiSal® Menthol, or combining with soothing agents like aloe or panthenol.

3. Poor Water Solubility
- Problem: Menthol is lipophilic and barely soluble in water (~0.4 g/L).
- Impact: Difficult to evenly disperse in water-based lotions without specialized solubilizers.
- Solution: Use emulsifiers or MultiSal® Menthol that suspend or deliver menthol in aqueous systems.

4. Crystallization in Formula
- Problem: Menthol can recrystallize in the lotion base over time, particularly when stored in cold conditions.
- Impact: Gritty texture, phase separation, visual instability.
- Solution: Careful control of concentration (<1%), use of co-solvents, or MultiSal® Menthol.

5. Heat Sensitivity During Manufacturing
- Problem: Menthol may degrade or evaporate during heating steps.
- Impact: Loss of cooling effect and inconsistent product performance.
- Solution: Add menthol at cooler processing temperatures (<40°C), or use encapsulated MultiSal® Menthol that protects it during processing.

6. Overpowering Odor
- Problem: Menthol's strong minty aroma can overwhelm fragrance profiles.
- Impact: Limits fragrance creativity or causes sensory imbalance.
- Solution: Use odorless encapsulated menthol, MultiSal® Menthol, or balance with complementary essential oils or fragrance masking agents.

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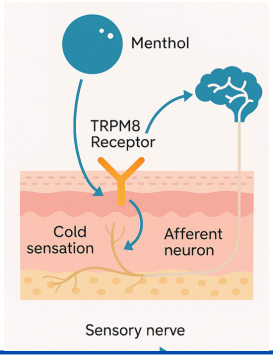
The sensory effect on skin

When applied to the skin, it creates a distinctive "cooling" or "fresh" sensation. Due to this effect, menthol is widely used in cosmetic products to give the skin a refreshing feel. When combined with other powerful skincare ingredients, menthol can enhance the sensory experience, complementing the action of these active components.
Beyond its cooling properties, menthol is also recognized for its topical analgesic effects, making it an ideal ingredient for products aimed at soothing irritated skin, such as scalp treatments, after-sun

Key Benefits

- Instant Cooling Sensation: Activates cold receptors for a refreshing feel
- Soothing Relief: Calms irritation, itch, and minor discomfort
- Sensory Enhancement: Adds a tingling or invigorating effect to skin, scalp, or lips
- Odor Control: Provides a clean, minty aroma; masks unpleasant odors
- Counterirritant Action: Distracts from pain in topical analgesics
- Improved Perceived Efficacy: Adds a functional "feel" to products that boosts consumer satisfaction



Mechanism of Action: Menthol on the Skin

Menthol produces a cooling sensation on the skin and mucous membranes without actually changing temperature. This effect is due to its interaction with specific sensory receptors in the skin:

1. Activation of TRPM8 Receptors (Cold-Sensing Ion Channels)

- TRPM8 (Transient Receptor Potential Melastatin 8) is a cold-sensitive receptor found in sensory neurons of the skin.
- Menthol binds to and activates these receptors, tricking the nervous system into perceiving a cooling effect, similar to touching something cold.

2. Neurological Signaling Pathway

- Once TRPM8 is activated, it sends a signal through afferent neurons to the brain.
- The brain interprets this signal as cold, resulting in a subjective sensation of cooling or tingling.

3. Counterirritant Effect

- In higher concentrations, menthol can act as a counterirritant, overriding pain or itch signals by introducing a competing sensation (cold), thus distracting the brain from discomfort.
- This mechanism is used in topical pain relievers and anti-itch treatments.
- No Real Temperature Drop. The skin temperature remains the same; menthol does not physically cool the tissue, but rather modulates sensory perception.

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THE TECHNOLOGY

MultiSal® technology is a double-layered encapsulation. Menthol is first contained within sub-micron spheres and re-encapsulated within larger microspheres. The double layers are essential for the finished product's long shelf life and stability.

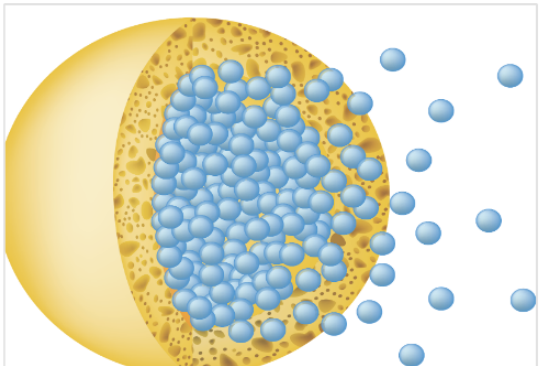

Figure 3: MultiSal® Menthol is a microsphere technology with a core and shell. The shell is water-sensitive and must be dissolved to release the sub-micron spheres infused with Menthol.

Figure 4: Appearance of MultiSal® Menthol as a fine powder.

Key Advantages in Water-Free Formats

- Preservative-free or minimal preservation is required.
- Lightweight & travel-friendly
- Higher concentration of actives without dilution
- Excellent for “clean beauty” or sustainable product lines.

Labeling & Positioning Tips

- Highlight “Encapsulated Menthol for Long-Lasting Soothing”

Marketing Claim Language

Taglines & Features for Labels or Ads”

- “Time-Released Freshness”
- “Moisture-Activated Technology That Calms on Contact”
- “Soothing Skin Science—Powered by MultiSal™ Technology”
- “Smart Freshness Delivery: Works When You Need It”
- “Encapsulated Menthol for Longer-Lasting Hydration & Relief“.

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Technical Data

Table 1. INCI of MultiSal® Menthol

INCI Name
Sodium Starch Octenylsuccinate
Menthol
Euphorbia Cerifera (Candelilla) Wax
Butyrospermum Parkii (Shea) Butter

Recommended usage wt %

Use levels typically range from 0.1% to 1% in cosmetics; higher levels (up to 5%) are used for OTC pain relief.

Table 3. Suggested Dose of MultiSal® Menthol

Application	% MultiSal® Menthol	Dosage (kg/kg)
Lip Care	1	0.2
Skin Care	2-5	0.4-1.0
Pain Relief	4-8	0.8-1.6
Foot Care	7-20	1.4-4.0

Possible applications

Category	Example Uses
Skincare	After-sun lotions, body gels, anti-itch creams
Hair & Scalp Care	Dry Shampoo, Scalp sprays, anti-dandruff shampoos, tonics
Deodorants	Body Powder, Alcohol-free roll-ons, cream deodorants
Lip Care	Balms, scrubs, and plumpers
Pain Relief	Muscle balms, cooling patches, sports recovery gels
Men's Grooming	Aftershaves, shave gels
Wellness	Foot soaks, massage creams, cooling wipes

MultiSal® Menthol is typically formulated with silica as an anti-stick agent to improve flow and handling. However, Salvona also offers a **silica-free** version for customers seeking cleaner label options or improved compatibility with specific formulations.

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Menthol Retention and Stability

The stability and retention of MultiSal® Menthol were evaluated through Thermal Gravimetric Analysis (TGA), comparing it to free menthol under elevated temperature conditions.

TGA is a scientific method used to measure changes in the mass of a material as it is heated over time. It's commonly used to assess the thermal stability and composition of ingredients like menthol.

Basic Principle

- A small sample (e.g., free menthol or encapsulated menthol) is placed on a precision balance inside a furnace.
- The system gradually increases the temperature (e.g., up to 60°C or more).
- As the temperature rises, the sample may lose mass due to:
  - Evaporation (like volatile oils or menthol vaporizing)
  - Decomposition (chemical breakdown of the material)

The mass loss is recorded in real time and plotted as a TGA curve (mass vs. temperature or time).

TGA Testing Process

Comparing free menthol vs. MultiSal® Menthol)

The samples (5–20 mg) are exposed to a controlled heating program, gradually raising (5–10°C/minute) the temperature to simulate real-world formulation or storage conditions, typically up to 60°C. As the temperature increases, the instrument continuously measures the weight of each sample.

What the Data Means:

Observation	Interpretation
Residual mass at high temperature	Indicates a volatile compound is evaporating quickly (e.g., free menthol)
Gradual or delayed mass loss	Suggests **encapsulation or thermal stability**, as in MultiSal® Menthol
Residual mass at high temperature	Represents non-volatile carriers, like encapsulating polymers
Onset temperature	The temperature where weight loss begins—used to compare stability thresholds

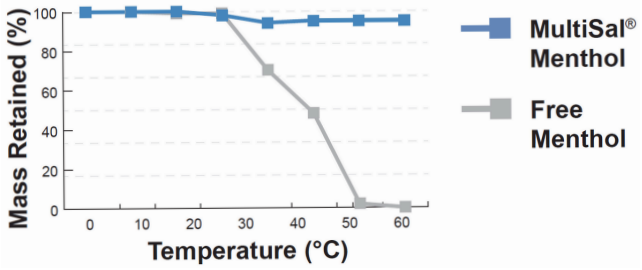

Figure 5. Retention and stability of MultiSal® Menthol Versus Free Menthol at Elevated Temperatures

Free menthol began degrading above 30 °C and was fully degraded by 50 °C, while MultiSal® Menthol retained 94% of its mass at 60 °C. Encapsulation significantly improved thermal stability and retention.

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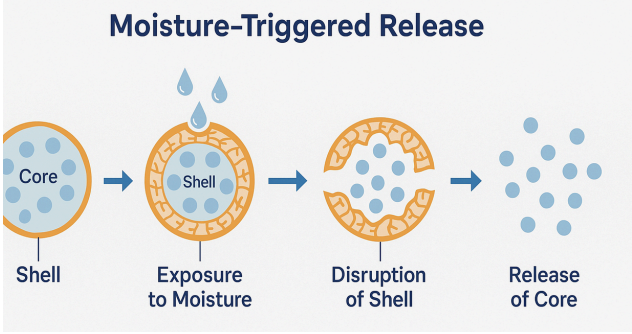
Moisture-Triggered Release

Moisture-triggered release is a smart delivery mechanism where active ingredients are encapsulated in a carrier system that remains stable until it comes into contact with moisture, such as sweat, humidity, or the skin's natural hydration. Once exposed, the capsule begins to break down or swell, gradually releasing its contents in a controlled and targeted manner.

Mechanism

Encapsulation: The mechanism of water-activated release in MultiSal® technology relies on an innovative, polymer-based shell structure. Each microsphere features a shell composed of long-chain polymers that are interlocked to form a stable matrix. When exposed to moisture—whether from the skin, sweat, or humidity—the shell begins to swell, soften, or break down, disrupting the polymer network. This collapse of the outer shell triggers the release of submicron spheres contained in the core, which carry actives like menthol. These inner spheres then spread across the skin, gradually releasing their payload for targeted, long-lasting performance. This intelligent release mechanism ensures that menthol and other actives are delivered precisely when and where they're needed, enhancing product efficacy and user experience.



Sensory Evaluation

To evaluate moisture-triggered release, a comparative study was conducted using a deodorant stick containing 1% menthol—either in free form or encapsulated in MultiSal®. A measured amount (0.1 g) was applied to a 16 cm² area of skin. After 5 hours, panelists (n=6) self-assessed the intensity of the cooling sensation under two conditions: dry skin and skin lightly sprayed with water to simulate sweating.

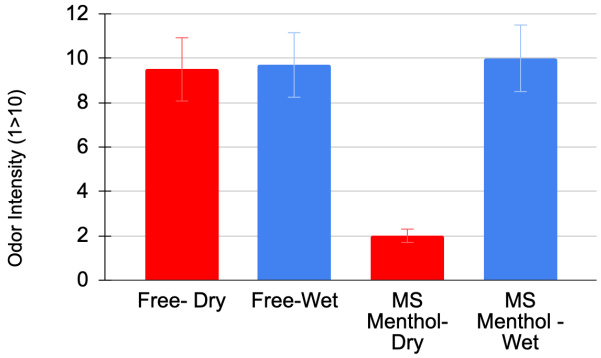


Figure 6. Water triggered release of MultiSal® Menthol Versus Free Menthol.

The results demonstrated a clear difference in performance. The MultiSal® Menthol remained largely inactive on dry skin, showing minimal sensation, but upon exposure to moisture, a significantly more substantial and more noticeable cooling effect was activated. In contrast, free menthol showed reduced impact over time and no apparent increase in response when water was applied. These findings confirm that MultiSal® Menthol provides a reliable, on-demand cooling sensation through moisture-triggered release, making it ideal for long-wear applications such as deodorants and leave-on skincare.

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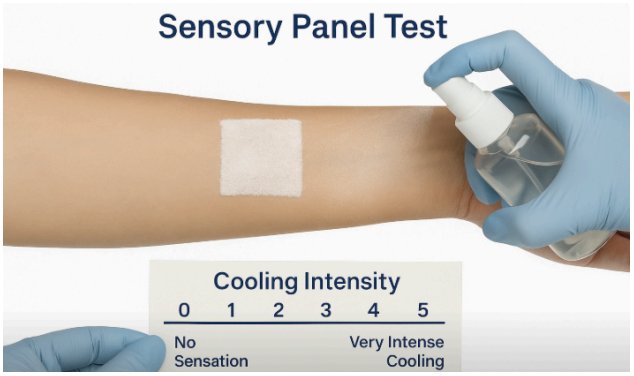
Longer-lasting Freshness

To evaluate the cooling effect of MultiSal® Menthol, a controlled sensory panel study was conducted with 12 healthy adult participants. The test areas were the inner forearm or upper back, each marked at 5×5 cm². Panelists applied 0.3 grams of a body powder formulation containing 1% menthol, either in free form or encapsulated in MultiSal®. To assess moisture-triggered activation, water was lightly sprayed on select test areas within 5 min of application. Participants then rated the cooling sensation using a standardized intensity scale from 0 (no sensation) to 5 (very intense cooling). This method provided direct insight into the onset, strength, and duration of menthol's cooling effect under both dry and moist conditions.



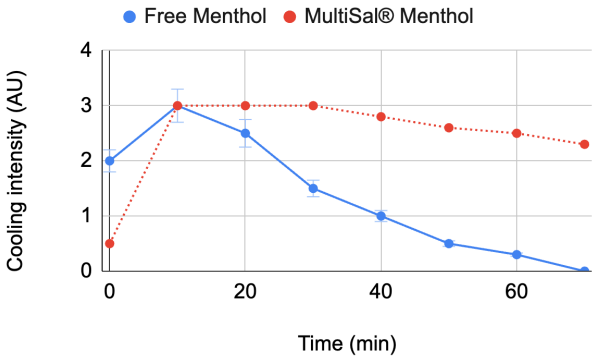


Figure 7. Cooling Intensity of MultiSal® Menthol Compared to Free Menthol

The samples were initially evaluated in their dry state. After 5 minutes, panelists sprayed water onto the test area, and a second evaluation was conducted at the 10-minute mark.

MultiSal® Menthol demonstrated significant improvements over free menthol in both cooling intensity and duration. Free menthol began with a moderate cooling intensity (rated 2) and gradually increased to 3 within the first 10 minutes. However, its effect declined after 20 minutes, falling below a rating of 1 by the 40-minute mark. In contrast, MultiSal® Menthol started with a lower initial intensity (0.5) but quickly rose to a rating of 3 within 10 minutes. It then sustained this intensity for 40 minutes before gradually tapering off. These results clearly illustrate that MultiSal® Menthol offers a more sustained and consistent cooling experience compared to free menthol.

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Formulation

Table 4. Refreshing Deodorant Stick with MultiSal® Menthol

INCI	WT%
Cyclopentasiloxane	36.33
Stearyl Alcohol	35.00
Zea Mays (Corn) Starch	5.00
Hydrogenated Castor Oil	4.00
Cetyl Alcohol	4.00
Glyceryl Oleate	3.00
Butyrospermum Parkii (Shea) Butter	5.00
Sodium Bicarbonate	1.00
MultiSal® Menthol	**6.67**

Table 5. Loose Powder Dry Shampoo with MultiSal® Menthol

INCI	WT%
Tapioca Starch	41.00
Aluminum Starch Octenylsucciniate	46.00
Kaolin	3.00
MultiSal® Fragrance	**5.00**
MultiSal Menthol®	**5.00**

Table 6. Cooling Body Balm Stick with MultiSal® Menthol

INCI	WT%
Water	Q.S.
Propanediol	30.00
Sodium Hydroxide	0.95
Stearic Acid	6.00
Glycerin	1.00
Hordeum Vulgare (Barley Powder)	10.00
Aloe Barbadensis Leaf Juice	0.50
MultiSal® Menthol	**1.00**
HydroSal® SalCool	**3.00**
Polyglyceryl-10 Oleate	3.00
Fragrance	Q.S.
Hempseed or CBD Oil	0.75
Colorant	Q.S.

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Table 5. Loose Powder Dry Shampoo with MultiSal® Menthol

INCI	WT%
Tapioca Starch	41.00
Aluminum Starch Octenylsucciniate	46.00
Kaolin	3.00
MultiSal® Fragrance	**5.00**
MultiSal Menthol®	**5.00**

Table 7. Soothing Body Powder with MultiSal® Menthol

INCI	WT%
Tapioca Starch (and) Polymethylsilsesquioxane	47.50
MultiSal Menthol®	**5.00**
Barley (Hordeum Vulgare) Starch	47.50

MultiSal® Menthol is ideal for finished products that aim to deliver a controlled, long-lasting cooling sensation, especially where moisture-triggered or time-release effects enhance user experience.

The following product categories benefit most:

- Body powders (e.g., foot powder, after-sports powders): moisture-triggered cooling upon perspiration
- Deodorant sticks or roll-ons: provide a fresh sensation during sweating
- Cooling anhydrous sprays: instant and sustained relief from heat or irritation
- After-sun oil-based lotions: soothing post-sun exposure with a longer-lasting effect
- Facial powder cleansers: refreshing sensation without overwhelming tingle
- Lip plumpers or glosses: mild, prolonged tingling effect
- Topical analgesics (non-drug): menthol-like relief without fast fade
- Cooling patches: slow release triggered by skin moisture.

Marketing Claims

When using MultiSal® Menthol in a finished product, claims should focus on its **controlled release, prolonged cooling, and moisture-activated performance,** while ensuring compliance with cosmetic or OTC guidelines applicable to the region and category.

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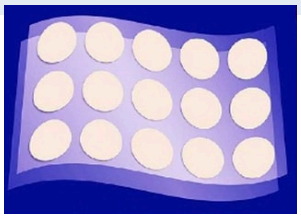
Triggered release, invigorating and refreshing sensation

Examples of finished product ideas with MultiSal® Menthol

Powder Make-up and Foundations

Light & breathable sensation even with full coverage after addition of MultiSal® Menthol



Overnight Blemish Patches

Combine MultiSal® Menthol and MultiSal® Salicylic Acid for maximum efficacy. Reduce blemish size and irritation overnight

Dry Shampoos

Absorb excess oil, impurities, and sweat with a cooling sensation. Instantly reduce irritation with MultiSal® Menthol, while adding volume and texture to refresh a hairstyle

Medicated Body Powder

Cooling sensation with a moisture-absorbing relief from itch and irritation with addition of MultiSal® Menthol

Toothpaste & Toothpaste Tablets

Easily added to toothpaste and pressed tablets for intense and long-lasting refreshing sensations. MultiSal® Menthol is considered generally safe for oral care products.

Medicated Lip Balm

Moisturizing for chapped, cracked, and dry lips. Combine with MultiSal® Menthol for a cooling and soothing lip treatment

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Key references and scientific literature supporting the use of menthol in cosmetics and dermatology, including its mechanism of action, benefits, and applications in topical formulations:

Scientific and Dermatological References

- Eccles, R. (1994). “Menthol and Related Cooling Compounds.” Journal of Pharmacy and Pharmacology, 46(8), 618–630. Explores menthol's pharmacological action on thermoreceptors (TRPM8) and its role in cooling sensation.

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- Wright, C. E., et al. (1997). “Menthol: Effects on thermoreceptors and thermoregulation.”International Journal of Neuroscience, 88(3-4), 129–134. Provides insights into menthol’s effects on skin thermoreceptors and potential therapeutic implications.

Cosmetic Formulation & Ingredient References

- Personal Care Product Council (PCPC) – INCI Directory. Menthol is listed as a fragrance ingredient, skin conditioning agent, and denaturant.
- CIR (Cosmetic Ingredient Review) Expert Panel (2011). “Safety Assessment of Menthol as Used in Cosmetics.” Concludes that menthol is safe in rinse-off and leave-on products at specified concentrations.
- Harry’s Cosmeticology, 9th Edition (M. Reiger), covers formulation guidelines, sensory modifiers such as menthol, and their role in enhancing the user experience.
- Lodén, M., & Maibach, H. I. (Eds.) (2009).“Treatment of Dry Skin Syndrome.”Includes discussion of menthol as a sensory modifier in moisturizers and therapeutic skincare products.

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