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A Data-Driven Analysis of Core Dermocosmetic Formulation Patterns for Inflammatory and Barrier-Impaired Skin Conditions

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Abstract

Dermocosmetic products for chronic inflammatory and barrier-impaired skin conditions sit in an underexamined space between cosmetics and pharmaceutical care: widely marketed, yet what actually drives their formulation is rarely made explicit or checked against evidence-based standards. This study analyzes 73 products across six major indications involving chronic inflammatory and barrier-impaired skin conditions, with ingredient composition data extracted directly from product packaging and manufacturer documentation and analyzed using ingredient-level profiling and benchmarking against current dermatology guidelines. The results identify a stable, shared formulation core across product categories, with distinct therapeutic adaptations layered on top: ceramide-rich barrier support in atopic dermatitis, mechanism-specific actives distinguishing psoriasis, rosacea and wound-healing formulas. Guideline comparison surfaces both strong alignment and specific gaps, including under-used, well-evidenced ingredients in xerosis products and guideline-flagged irritants present in sensitive-skin formulations. Together, these findings offer manufacturers a validated formulation baseline and a way to spot genuine innovation gaps, give clinicians a mechanism-based reference for product selection and help consumers gain a clearer, evidence-anchored basis for evaluating products in an increasingly crowded and claims-saturated market. The methodology is designed for reuse, offering a practical foundation for evidence-based advancement across formulation, clinical practice and product choice in dermocosmetics.

Keywords: dermocosmetics; INCI cosmetics; formulation; skin barrier; evidence-based selection; clinical guidelines

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1. Introduction

Dermocosmetics occupy a distinctive and increasingly indispensable position in clinical dermatology and evidence-based cosmetology.

This category, with many synonyms used in the literature, represents more than just an add-on to standard drug medicine [1,2]. These formulations function as active therapeutic adjuvants that modulate cutaneous barrier homeostasis, inflammatory cascades and the microbial cutaneous system in patients presenting with established dermatoses, subclinical barrier impairment or elevated risk profiles (including photoaging, iatrogenic xerosis and post-procedural sensitivity) [3]. Their systematic incorporation into therapeutic strategies

has been shown to improve adherence, reduce the frequency of flare-ups and attenuate the cumulative burden of topical corticosteroids or systemic agents, thereby reframing the management of chronic inflammatory and barrier-deficient conditions as a continuum rather than a sequence of isolated pharmacological interventions.

It is now well established that the clinical utility of dermocosmetics is inextricably linked to the precision of their formulation structure.

Optimal performance demands rigorous control of vehicle physicochemical properties, pH value matching the acid mantle, appropriate lipid:water ratios, emulsion stability under physiological or storage and transportation conditions, or controlled release kinetics of active moieties, so that the product neither disrupts residual barrier integrity nor induces secondary irritation [4].

Equally decisive is the rational selection and concentration of plant-derived constituents, whose polyphenols, flavonoids, terpenoids, fatty-acid and other important compound profiles furnish complementary antioxidant, anti-inflammatory and lipid-replenishing activities that synthetic actives alone frequently cannot replicate at similar, good tolerability [5–9]. When these botanical fractions are standardized, they significantly contribute to the restoration of stratum-corneum cohesion, the scavenging of reactive oxygen species and the down-regulation of pro-inflammatory cytokines, thereby elevating the dermocosmetic from a supportive vehicle to a mechanistically coherent therapeutic product.

The present work approaches the integrity of the skin barrier as the unifying target of dermocosmetic formulation strategy, beginning with an INCI-based deconstruction of 73 products and a statistical confirmation of a shared formulation "core" across six indications. Building on this foundation, the study characterizes the therapeutic and biotechnological ingredient categories through an evidence-tiered safety assessment, then directly tests the gap between ideal and real formulation practice by benchmarking the dataset against current therapeutic guidelines. These findings inform the study's aim of translating this empirical model into a framework usable in both clinical and industrial settings, supported by methodological layers that move the analysis from description to evaluation against an explicit, citable external standard.

1.1. The Clinical and Formulation Burden of Inflammatory and Barrier-Impaired Skin Conditions

Atopic dermatitis, psoriasis, rosacea, xerosis, sensitive skin syndrome, and impaired wound healing differ substantially in their underlying drivers [10–13], yet current international guidelines converge on a shared first step: barrier restoration and trigger identification as the foundation of care. This convergence has positioned the skin barrier as the organizing principle behind an entire adjunctive product category, dermocosmetics, now formally recognized as Step-1 foundational therapy across all six indications examined here [14–19]. Whether marketed formulations actually deliver on that mandate, however, has rarely been tested empirically against the products available on the market.

1.2. From Ingredient Lists to a Formulation Concept: The Role of INCI Analysis

Every marketed dermocosmetic product discloses its composition through the International Nomenclature of Cosmetic Ingredients (INCI), providing a transparent, if concentration-approximate, record of formulation intent. This study applies INCI analysis at a scale beyond prior single-indication surveys: 73 products across six indications, deconstructed into 641 ingredient-label string variants which were subsequently normalized to account for labeling-format differences (e.g., synonym chains such as "Aqua/Water/Eau" versus "Aqua," or "*Butyrospermum parkii* (Shea Butter)" versus "Shea Butter") and consolidated into approximately 350–400 true distinct ingredients, upon which the 18-category

functional classification was subsequently performed. The resulting formulation concept—a core, indication-independent barrier-support backbone layered with indication-specific therapeutic, biotechnological, and safety-relevant adaptations—moves this study from hypothesis to tested finding, distinguishing categories that remain stable across indications from those concentrated around specific pathophysiological drivers [5,20–24].

1.3. Safety and Performance Based on Biotechnology, Actives and Delivery Systems Innovations

Fermentation-derived postbiotics, prebiotics, and biotechnologically produced peptides have moved from niche use toward broader inclusion across dermocosmetic lines, though adoption varies unevenly by indication—richly represented in rosacea, essentially absent from psoriasis despite an independent microbiome-dysbiosis literature for that condition [25–34]. This study extends beyond functional classification to a dedicated safety and evidence-tier assessment distinguishing established carcinogen classifications from contamination- or degradation-pathway risks and from genuinely contested evidence, while explicitly separating these from ingredient classes commonly flagged in consumer discourse but absent from the dataset entirely. A parallel plant-extract analysis further illustrates why ingredient-level literature verification, not INCI-name pattern-matching alone, is necessary before any safety claim is made.

1.4. The Importance of Guidelines–Practitioners–Consumers–Researchers–Manufacturers Consensus

An idealized formulation cycle assumes guidelines translate evidence into recommendations, practitioners match patients to products accordingly, and manufacturers and researchers close the loop through continuous evidence generation. Benchmarking the present dataset against a contemporary, multi-society guideline synthesis tests this cycle directly rather than assuming its interruption: atopic dermatitis formulations align most closely with guideline-stated foundational care, while sensitive skin syndrome—despite a "minimal ingredient" formulation philosophy—shows the weakest alignment, and xerosis-indicated products under-utilize a guideline-recognized, strong-evidence ingredient. These findings narrow, with evidence rather than assertion, the gap this study set out to investigate, positioning the work as a connective methodology between guideline-level knowledge, manufacturer practice, and evidence-based product selection at the point of care [14,35–40]. To distinguish between related but overlapping terms, we adopt the following definitions: A **cosmetic** is a product applied externally for cleansing, perfuming, or altering appearance without therapeutic intent [14,20,37]. A **dermocosmetic** occupies an intermediate category, formulated with dermatologically active ingredients and typically pharmacy-distributed, intended to support barrier function without meeting the regulatory threshold of a medicinal product. A **pharmaceutical** is a substance formally approved for treating or preventing disease through a defined pharmacological, immunological or metabolic action [Directive 2001/83/EC of the European Parliament and of the Council, Article 1(2)]. **Therapeutic** refers more broadly to any intervention intended to treat or mitigate a diagnosed condition, as distinct from a purely cosmetic one, according to WHO, 2000. Finally, a **pharmacological active** is an ingredient exerting a defined, mechanism-based biological effect independent of its formulation role, characterized by reproducible dose–response behavior [Directive 2001/83/EC of the European Parliament and of the Council, Article 1(2)].

1.5. Aim of the Study

Building on this rationale, the six clinical indications for analyzed dermocosmetics were selected according to the following criteria:

1. Documented epidermal-barrier impairment or heightened barrier vulnerability, high prevalence, chronic or relapsing course, rendering dermocosmetic support clinically meaningful;
2. The existence of contemporary multi-society guidelines that explicitly address supportive topical care, thereby enabling direct concordance analysis;
3. A mature market of non-prescription, INCI-labeled dermocosmetic products that permitted balanced sample sizes across indications while spanning the principal pathophysiological domains of chronic inflammation, xerosis, neurovascular reactivity and tissue repair.

The present study pursues the following specific objectives:

1. To identify and quantify a core, indication-independent formulation core structure within marketed dermocosmetic products for atopic dermatitis, psoriasis, rosacea, xerosis, sensitive skin syndrome and wound healing.
2. To characterize the indication-specific therapeutic, biotechnological and safety-relevant ingredient layers built upon this core structure.
3. To benchmark actual formulation practice against current international dermatological guideline consensus, evaluating the degree of concordance between marketed products and evidence-based recommendations.
4. To translate these combined findings into a practical, evidence-based framework capable of supporting product selection by dermatologists, guiding rational formulation by manufacturers and informing choice by consumers.

To carry out these objectives, the study draws on interlocking layers of analysis: a functional-category content review, a four-tier safety and evidence assessment, a focused look at botanical ingredients and a guideline-concordance benchmark. The integration of these outcomes allows the study to move beyond describing dermocosmetic formulation practice toward evaluating it against an explicit, external and citable evidence-based standard.

2. Materials and Methods

2.1. Data Source and Sample

Ingredient data for this study were extracted directly from manufacturer-published documentation, following the International Nomenclature of Cosmetic Ingredients (INCI) labeling format. A total of 73 products were selected from among the leading, pharmacy-distributed dermocosmetic lines marketed for each of the six target indications, with INCI lists extracted on 8 July 2026.

A total of 73 products across 6 indications were sourced from 17 distinct country/group origins, spanning major global dermocosmetic manufacturers (L'Oréal Group, Clichy, Hauts-de-Seine, France: La Roche-Posay, Vichy, CeraVe; Pierre Fabre Group, Castres, Tarn, France: Avène, A-Derma, Ducray, Klorane; Naos, Aix-en-Provence, Bouches-du-Rhône, France: Bioderma; Beiersdorf, Hamburg, Eimsbüttel, Germany: Eucerin, Hansaplast; Kenvue, Summit, Union County, NJ, USA: Aveeno, Neutrogena; Galderma, Zug, Canton of Zug, Switzerland: Cetaphil; independent/regional players such as Ivatherm, Ivatherm S.A., Bucharest, Sector 1, Romania, Pharmaceris, Dr Irena Eris, Piaseczno, Piaseczno County, Poland, BioNike, ICIM International, Lainate, Metropolitan City of Milan, Italy, Curél, Kao Corporation, Tokyo, Chūō City, Japan, Vanicream, Pharmaceutical Specialties, Inc., Rochester, Olmsted County, MN, USA, and Weleda, Weleda AG, Arlesheim, Basel-Landschaft, Switzerland).

Product selection followed a specific clinical criterion rather than brand prominence or company scale: products were included on the basis of active dermatologist recommen-

dation for the six indications under study and primary distribution through pharmacy and parapharmacy channels, rather than general retail or prestige beauty distribution.

This distinction reflects the clinical question the study addresses. Major multinational manufacturers occupy a substantial share of everyday consumer skincare and represent significant investment in skin health and beauty broadly, but their product lines are generally positioned within the prestige or general cosmetic category rather than the dermocosmetic category specifically, and are not typically the products dermatologists recommend for inflamed, barrier-compromised or highly reactive skin. The relevant distinction is formulation profile rather than product quality overall: management of these conditions calls for minimalism, complete fragrance exclusion and ingredients specifically selected to address sensitivity and inflammation, a positioning around which pharmacy-channel dermocosmetic brands are specifically designed, and which general prestige cosmetic lines are not formulated to prioritize in the same way.

2.1.1. Selection Criteria

- Marketed as a dermocosmetic (INCI-labeled, non-prescription) product, not a prescription drug or Class-III medical device.
- Widely distributed through pharmacies, parapharmacies or major retail/e-commerce channels in at least one of the following regions: EU, North America, Asia-Pacific.
- Explicitly indicated, recommended by dermatologists or clinically positioned for the targeted skin condition.
- Represents an established, recognizable brand line to support reproducibility of the sampling frame by independent researchers.

2.1.2. Product Groups Based on Indication

- Atopic dermatitis
- Psoriasis
- Rosacea/redness-prone skin
- Xerosis/chronic dry skin
- Sensitive skin
- Wound healing/skin-repair care

2.2. Comprehensive Search of Literature for Introduction Section

The literature search was performed through targeted web-based searches of the primary biomedical and pharmaceutical sciences literature, drawing on indexed sources including PubMed/PMC, MDPI journals, Frontiers journals, Wiley journals, Elsevier and Springer Nature, along with non-academic regulatory sources.

This search prioritized recent publications, predominantly from 2022 to 2026, to ensure the paper reflects the current state of the literature.

2.3. Standardization, Categorization and Core/Adaptive Classification

Ingredient nomenclature was manually harmonized across products to resolve labeling inconsistencies (synonymous INCI names, order variants and formatting differences) prior to analysis. Each ingredient was then assigned to a shared functional categorization framework encompassing solvent, humectant, emollient, emulsifier, active/functional, preservative, biotechnologically derived and delivery-relevant excipient classes. Building on this classification, per-ingredient prevalence was calculated both within and across indications and cross-indication concordance was used to designate each category as either core (present with high, indication-independent consistency) or adaptive (present with significant, indication-linked variation).

2.4. Comparative Analysis

Building on the categorization framework described above, the dataset was examined using the following parameters:

- *Core-layer concordance index:* The proportion of products containing the complete core ingredient backbone, calculated by indication and for the pooled sample.
- *Adaptive—layer profiling:* The frequency of indication-specific active ingredients, cross-tabulated against the principal mechanistic driver reported for each condition.
- *Biotechnological analysis:* A comparison of biotechnologically derived ingredient prevalence against the core-status threshold, undertaken to determine whether specific biotech-derived actives approach core-category status.
- *Delivery—feature classification:* The frequency of occlusive, liposomal/nanocarrier, and controlled-release formulation claims, stratified by indication and by barrier-defect severity, the latter ranked qualitatively from the literature.

Ingredient classification followed a hybrid approach, assigning categories based on chemical structure (e.g., Lipid/Fatty Acid, Ceramide), functional performance (e.g., Soothing/Anti-inflammatory, Antioxidant) or biosynthetic origin (e.g., Biotic), consistent with the mixed conventions used in INCI nomenclature and the broader formulation-science literature, where no single classification principle is applied uniformly. Categories defined by unambiguous chemical or structural criteria (e.g., Ceramide, Lipid/Fatty Acid, Solvent/Base) admit little classification ambiguity; categories defined partly by performance (e.g., Named Active Ingredient) are, by nature, more sensitive to the specific criteria applied, a consideration addressed further in the Discussion section [41–45].

This study identifies which ingredients and ingredient categories are present, absent, or concentrated within products marketed for each indication, based on declared INCI listings. It does not evaluate, and is not designed to evaluate, the functional performance of the finished formulation. Properties such as delivery efficiency, percutaneous penetration, product stability or comparative therapeutic efficacy are governed by factors outside the scope of ingredient-list data alone, including vehicle type. Accordingly, this paper's findings should be interpreted as compositional patterns, not as evidence of formulation quality or performance.

3. Results and Discussion

In the dermocosmetic formulation sciences, the distinction between structural and active ingredients is defined by function: structural (or base) components (emulsifiers, emollients, solvents, preservatives, pH adjusters) construct the physical and sensory architecture of the vehicle, whereas active ingredients are those whose inclusion is justified by a defined biological mechanism and act through a specific biological pathway, such as enzyme inhibition, receptor-level modulation or barrier-lipid reconstitution [21]. Critically, EU cosmetic regulation imposes no obligation for manufacturers to disclose actual concentrations; Regulation (EC) No 1223/2009 requires only that ingredients be listed in descending order of weight, with those present at or below 1% permitted in any sequence thereafter (European Parliament and Council, 2009).

This regulatory framework opens a gap between marketing claims and actual composition: a product may be promoted as "barrier-restoring" or "anti-aging" even when the relevant actives are present below the threshold needed for a measurable effect. Only a limited group of substances (niacinamide, retinol and certain well-characterized peptides) possess a clearly established concentration–response relationship that allows them to be regarded as true actives on the basis of dose. For the majority of listed ingredients, no such threshold exists, so their position on the INCI list alone cannot confirm therapeutic relevance.

The difficulty is increased by the frequent multifunctional nature of many raw materials: cetyl alcohol, conventionally classified as an emulsifier, simultaneously contributes measurable lipid-barrier replenishment at concentrations typical of cream formulations, while glycerin functions predominantly as a humectant yet retains a secondary occlusive contribution. Antioxidants illustrate this dual role with particular clarity: when vitamin E appears high in the INCI list, it is likely present at a level capable of scavenging free radicals in the skin and can therefore be considered a cutaneous active; when the same compound occupies a terminal position, it is almost certainly added solely to protect the formula from lipid peroxidation and functions merely as a technological stabilizer [46–51].

Consequently, the relative position of an ingredient on the INCI list remains the only practical indicator available to the clinician or formulator for distinguishing genuine biological activity from purely structural or stabilizing roles.

Regarding the concentration of the analyzed ingredients, this article does not aim to address this topic, given the high complexity of the subject, which warrants a separate, dedicated study.

As with any ingredient classification using multiple criteria, categories defined partly by functional performance rather than by unambiguous chemical structure (notably, *Named Active Ingredient*) are inherently more sensitive to the specific classification criteria applied, and associated findings should be interpreted with this in mind relative to structurally defined categories such as *Ceramide or Lipid/Fatty Acid*.

Where an ingredient serves more than one well-documented cosmetic function (e.g., Caprylyl Glycol as both humectant and preservative-booster; Urea as both humectant and keratolytic; Panthenol as both humectant and barrier-repair active), it was assigned to a single primary category reflecting its most commonly cited or dominant mechanism in the formulation-science literature, in order to maintain a consistent, non-overlapping classification suitable for category-level frequency and statistical comparison.

3.1. Ingredient Category Coverage

The atopic dermatitis sample shows the most complete and internally consistent barrier-support backbone of all six indications: solvent, emollient, humectant and emulsifier categories reach 100% product coverage, and ceramides appear in a majority of products (61.5%)—by far the highest ceramide coverage among the six categories. This matches the established pathophysiology of atopic dermatitis, where *stratum corneum* lipid (ceramide) deficiency is a primary, well-documented barrier defect. Preservative (92.3%) and antioxidant (84.6%) coverage are also high, consistent with mature, well-optimized leave-on emollient formulations [Figures 1 and 2].

The Psoriasis sample is distinguished by the presence of named keratolytic and anti-psoriatic actives (Salicylic Acid, Capryloyl Salicylic Acid, Urea, Coal Tar, Ictasol/Ichthammol) in 41.7% of products—the second-highest pharmacologically active coverage of the six indications after Rosacea, reflecting a treatment logic centered on scale removal and epidermal turnover normalization rather than pure barrier replenishment. Ceramide coverage is markedly lower than in Atopic Dermatitis (16.7% vs. 61.5%) [Figures 3 and 4].

Rosacea products show the richest soothing/anti-inflammatory layer of all six indications (84.6% product coverage, 32 total ingredient mentions) and the highest biotechnological-ingredient coverage (30.8%), including two postbiotic ferment filtrates (Leuconostoc/Radish Root Ferment Filtrate, Sphingomonas Ferment Extract), a prebiotic (Fructooligosaccharides), a fermentation-derived polysaccharide (Biosaccharide Gum-1), and two biotech-produced peptides. This is also the only indication where UV filters reach majority coverage (53.8%) among the group samples, consistent with photoprotection being a first-line, guideline-supported recommendation in rosacea management. Named actives

are more physiologically targeted than cosmetic filler ingredients: Caffeine (vasoconstrictor), Dimethyl Sulfone/MSM (anti-inflammatory) and Hydroxyphenyl Propamidobenzoic Acid (antioxidant/photoprotective) all point to a neurovascular- and photodamage-aware formulation strategy distinct from the barrier-lipid focus seen in Atopic Dermatitis and Xerosis [Figures 5 and 6].

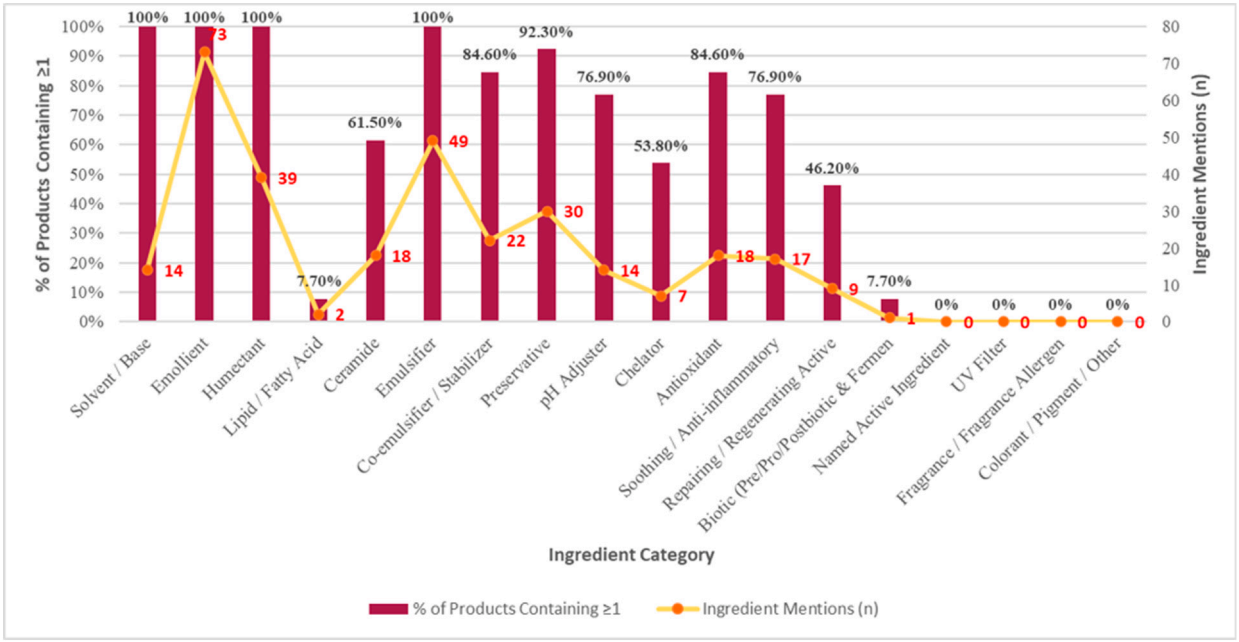


Figure 1. Atopic dermatitis—ingredient category coverage and ingredient mentions.

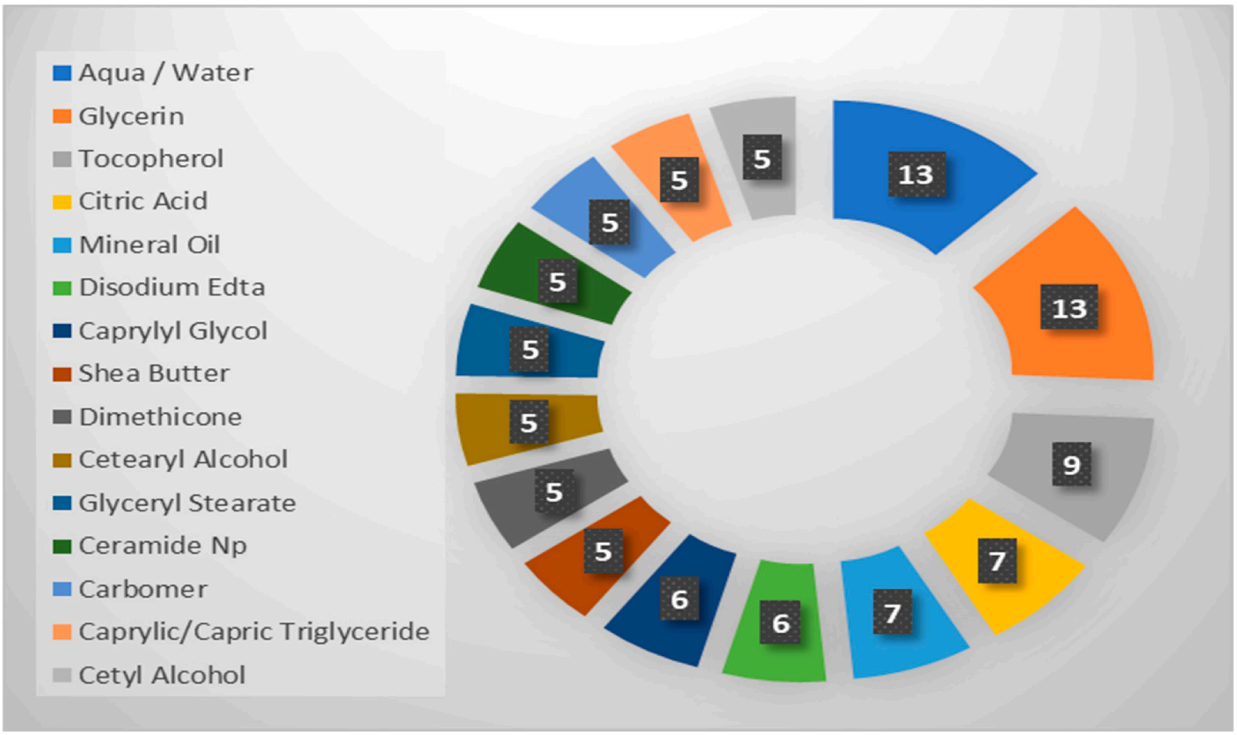


Figure 2. Atopic dermatitis—common ingredients.

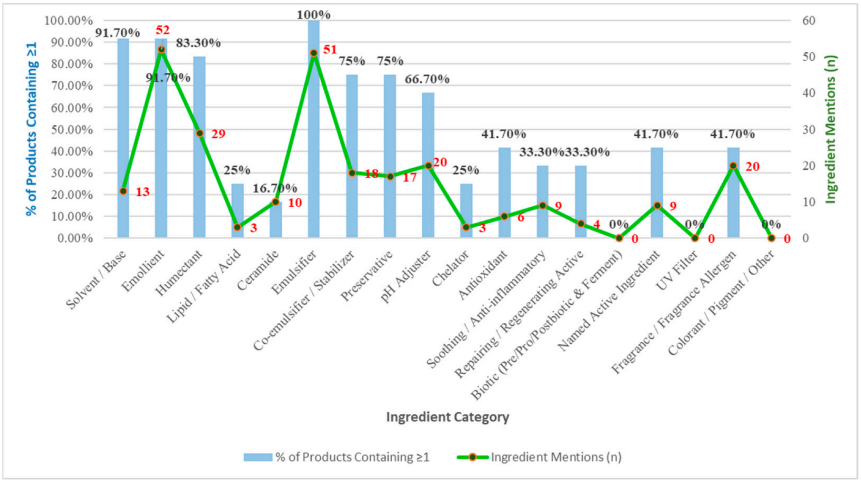


Figure 3. Psoriasis—ingredient category coverage and ingredient mentions.

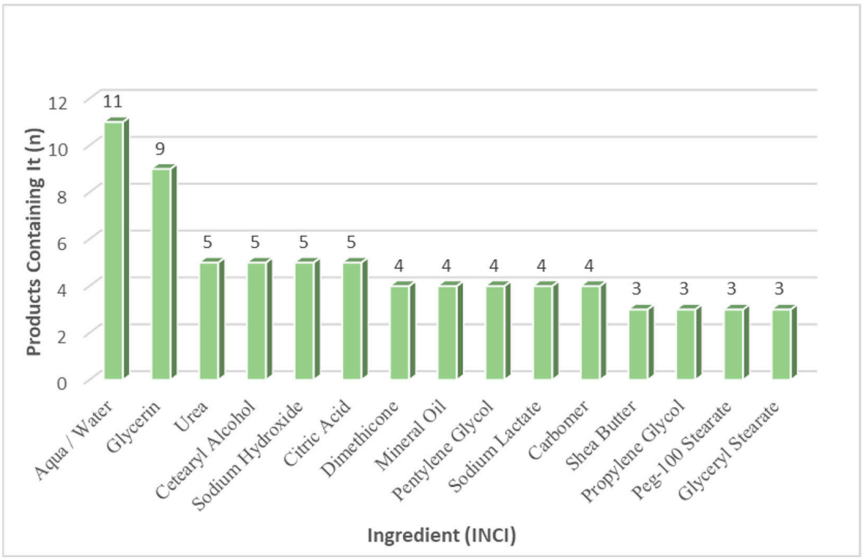


Figure 4. Psoriasis—common ingredients within this indication.

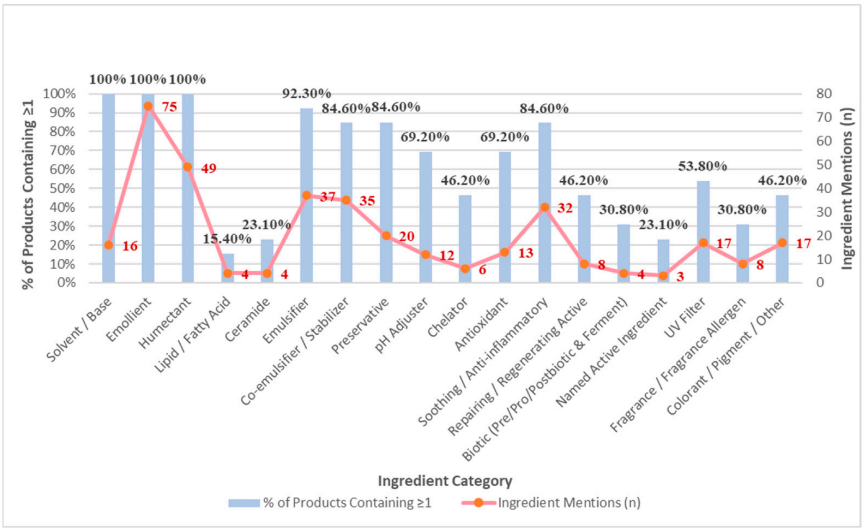


Figure 5. Rosacea/redness-prone skin—ingredient category coverage and ingredient mentions.

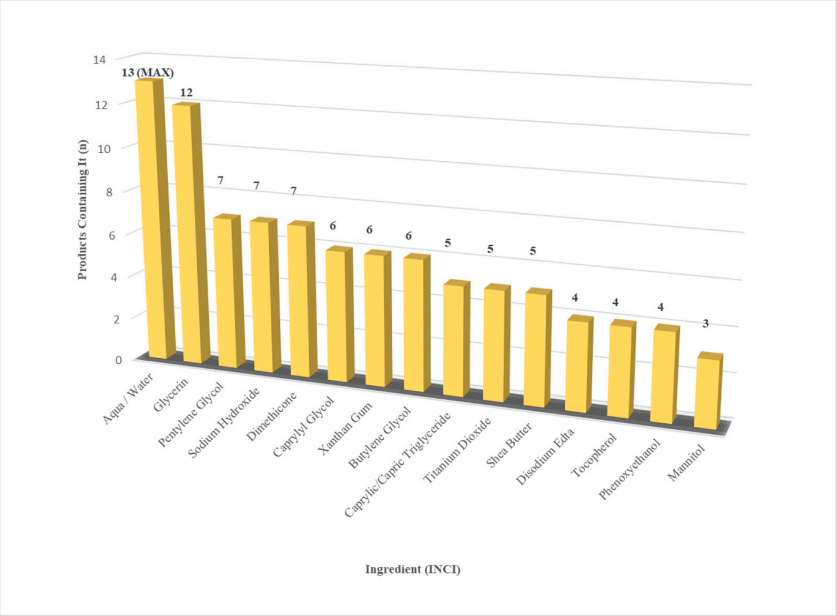


Figure 6. Rosacea/redness-prone skin—common ingredients within this indication.

Xerosis products show the minimalist barrier-repair backbone: solvent and emollient categories at 100% coverage, humectant at 92.3%, but comparatively restrained soothing/anti-inflammatory (30.8%) and antioxidant (38.5%) layers relative to atopic dermatitis or rosacea. Products are primarily designed to hydrate and replenish lipids. Ceramide coverage (30.8%) is between the atopic dermatitis and psoriasis extremes. This indication has the second-lowest average ingredient count per product (19.5), which suggests that a leaner, more classically emollient-led approach is targeted for chronic dry skin compared to the more elaborate, multi-active formulations seen in rosacea (27.7 ingredients/product average) [Figures 7 and 8].

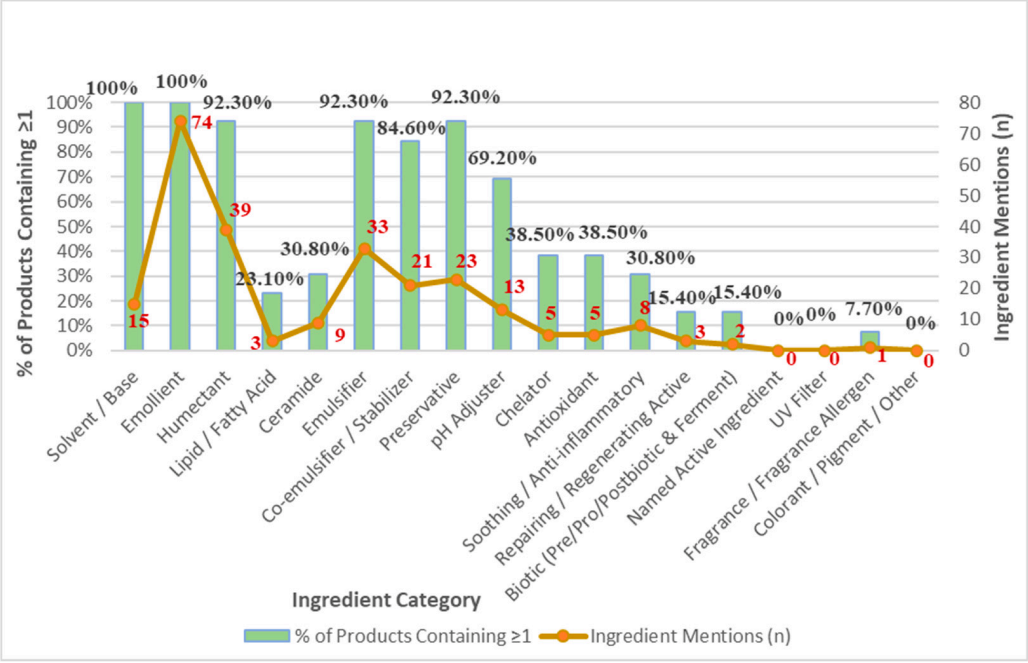


Figure 7. Xerosis/chronic dry skin—ingredient category coverage and ingredient mentions.

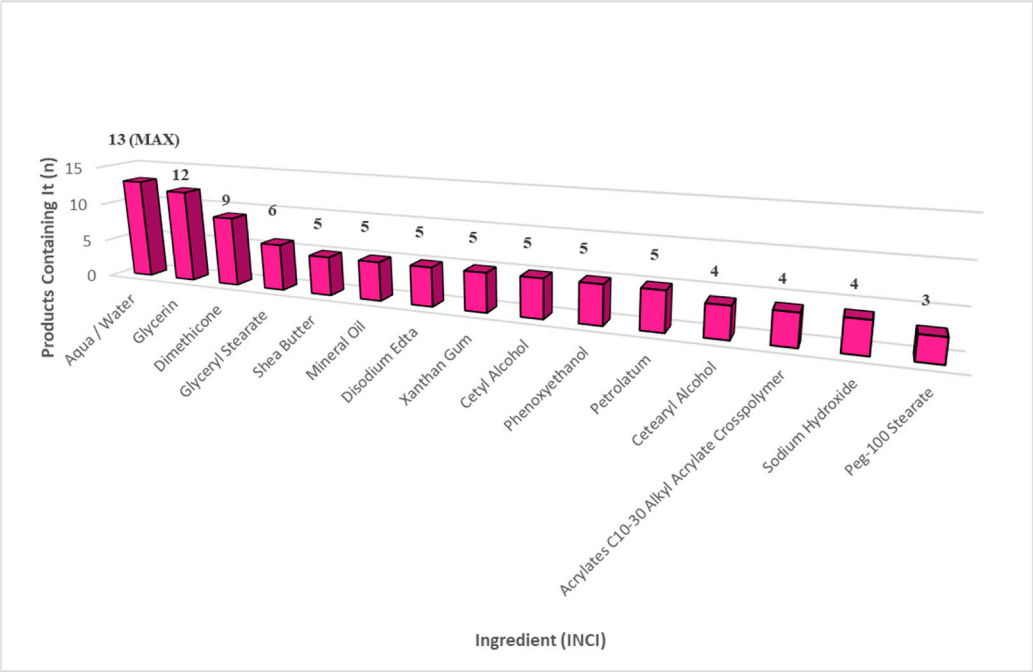


Figure 8. Xerosis/chronic dry skin—common ingredients within this indication.

The lowest average ingredient count of all six indications (14.4 ingredients/product) is observed in sensitive skin products, with comparatively restrained coverage of preservative (66.7%), pH-adjuster (44.4%), and chelator (22.2%) categories, suggesting a deliberate 'minimal-ingredient, minimal-irritant' formulation concept for reactive skin. Fragrance/fragrance-allergen coverage is the lowest of all six indications (11.1%), reinforcing that this category prioritizes safety and excludes potential irritants and biotechnological/active-ingredient complexity [Figures 9 and 10].

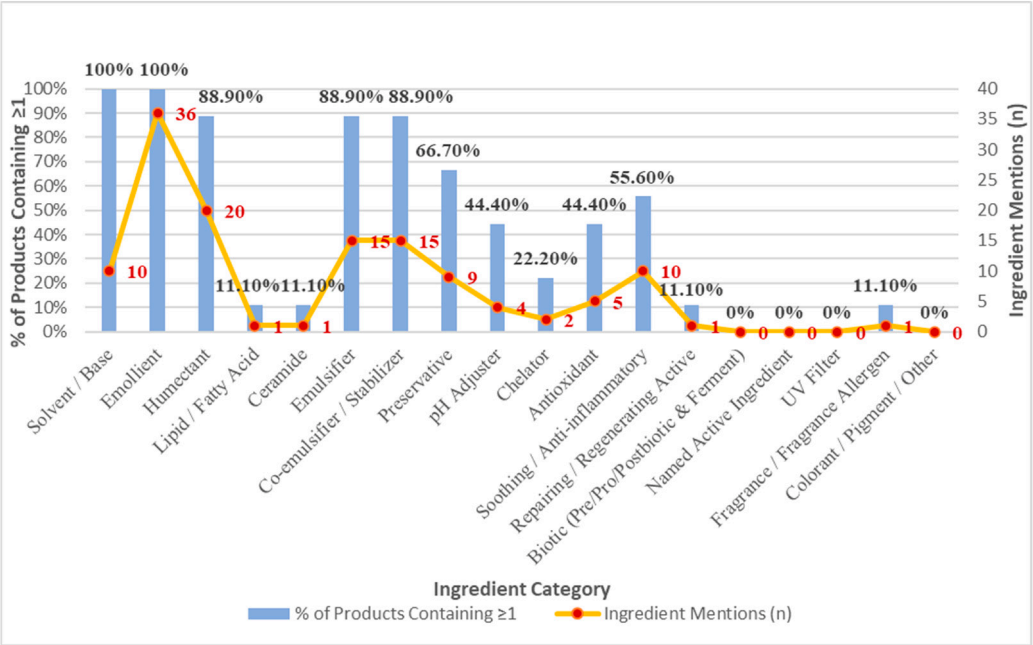


Figure 9. Sensitive skin—ingredient category coverage and ingredient mentions.

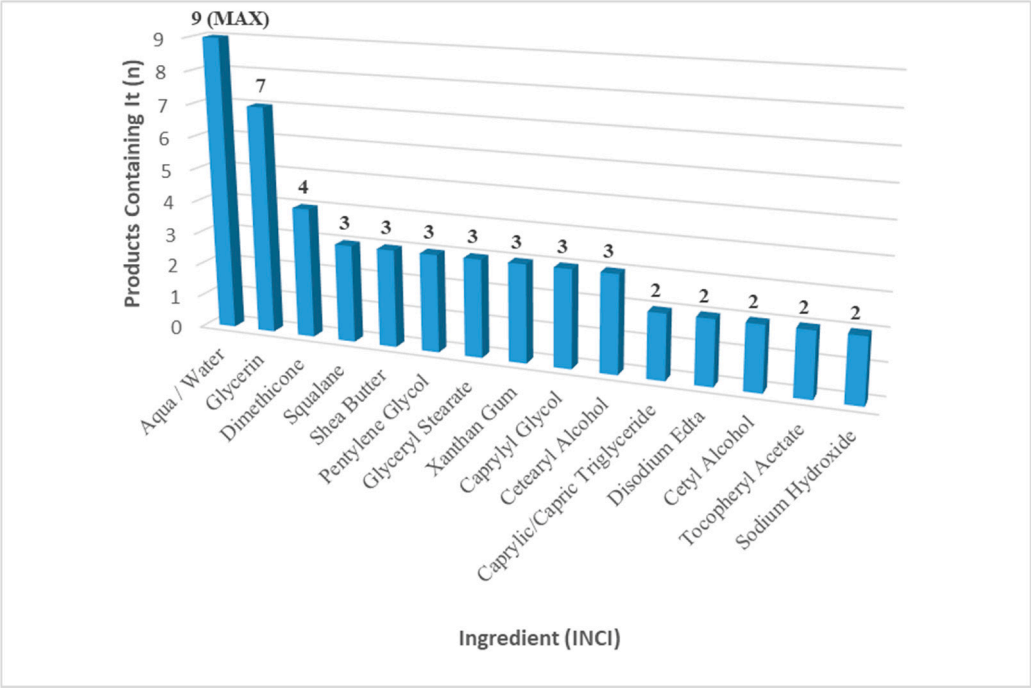


Figure 10. Sensitive skin—common ingredients within this indication.

The group of wound healing products shows the highest repairing/regenerating active coverage (53.8%), driven by Panthenol/Dexpanthenol, Zinc and Copper Gluconate, Madecassoside, and *Centella Asiatica* extract, ingredients with direct re-epithelialization and tissue-repair rationale rather than general barrier maintenance. This indication also shows the lowest chelator (7.7%) and comparatively low emulsifier (61.5%) and co-emulsifier (61.5%) coverage, consistent with several products in this sample being simpler anhydrous or near-anhydrous ointments (e.g., Bepanthen, Dexeryl) rather than complex oil-in-water emulsions [Figures 11 and 12].

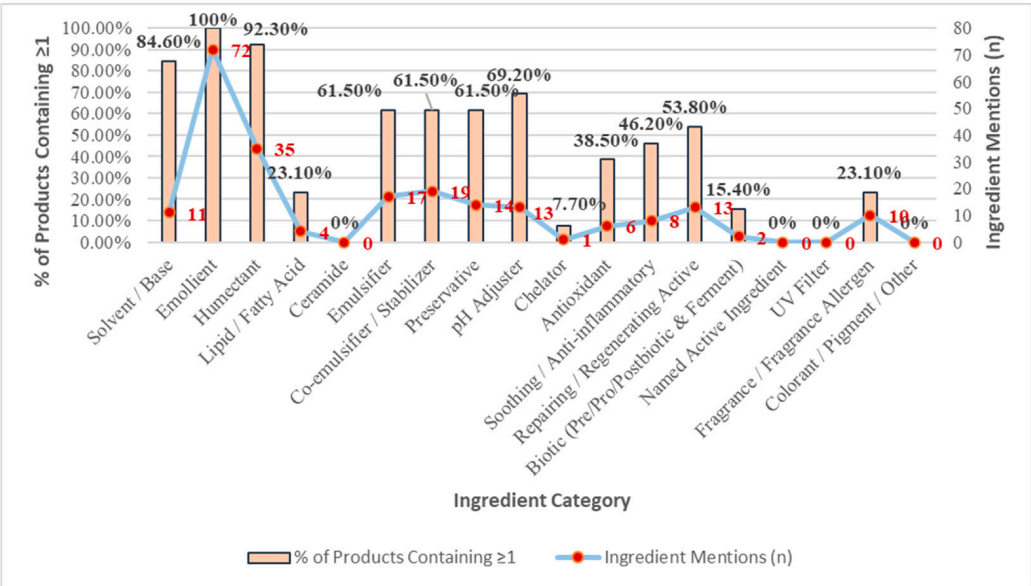


Figure 11. Wound healing—ingredient category coverage and ingredient mentions.

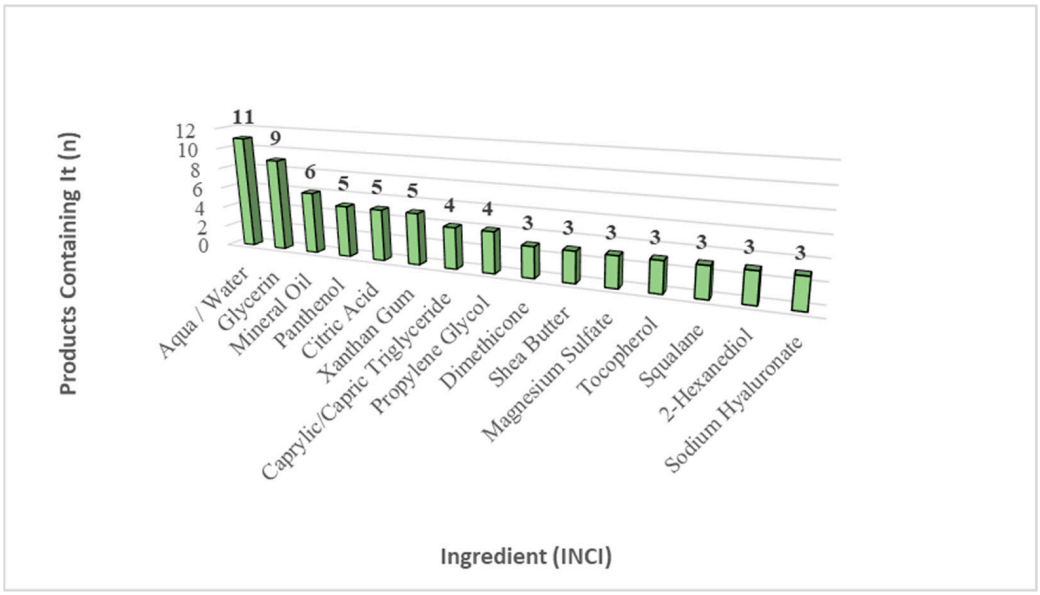


Figure 12. Wound healing—common ingredients within indication.

3.2. Ingredient Mentions

Aqua/Water and glycerin appear in the overwhelming majority of products (70/73 and 62/73, respectively), confirming the "core barrier-support backbone" hypothesis from the formulation-concept framework: a solvent–humectant foundation is close to universal regardless of indication. Dimethicone, Xanthan Gum, Sodium Hydroxide, and Shea Butter follow as the next tier of near-universal functional ingredients, spanning the emollient, stabilizer, pH-adjuster, and lipid-replenishment categories, respectively.

3.3. Common Ingredients

The common-ingredients findings across this project resolve into a coherent, three-tiered structure [Figure 13]:

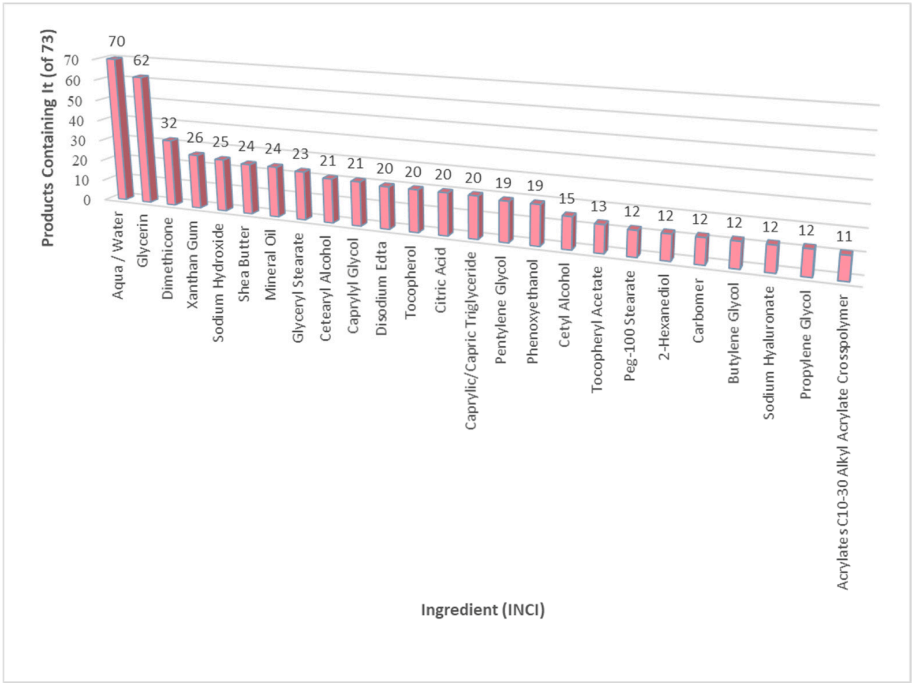


Figure 13. Top 25 most common ingredients across all 73 products.

- A small set of near-universal components—Aqua/Water, glycerin and the solvent, emollient, and humectant categories broadly—anchors nearly every product regardless of indication, matching the statistically confirmed "core" backbone.
- Workhorse/foundational ingredients, (Shea Butter, Dimethicone, Xanthan Gum, Cetearyl Alcohol), recur widely but with uneven weight, heavier in Xerosis and Atopic Dermatitis, lighter in Sensitive Skin.
- The narrowest tier belongs to ingredients common only within a single indication's own logic: Urea and keratolytics in Psoriasis, UV filters and venotonics in rosacea, trace minerals in Wound Healing, the signature of each condition's adaptive strategy.

That structure is itself the clearest evidence for the core-formulation-concept framework this paper has built.

3.4. Cross-Indication Synthesis (All 73 Products): Category Coverage Comparison Across Indications

Two formulation gaps are visible when these five categories are read together rather than individually: the complete absence of Biotic ingredients in Psoriasis (despite an independent psoriasis-microbiome literature), and the complete absence of UV filters outside rosacea (despite UV sensitivity being relevant to barrier-impaired skin generally); both are concrete, evidence-linked recommendations a manuscript can offer to formulators rather than purely descriptive observations [Figure 14].

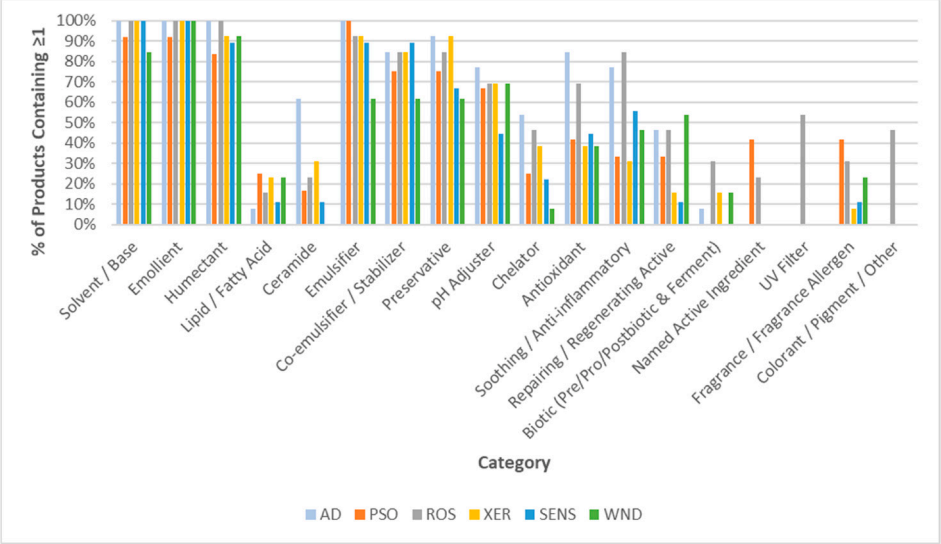


Figure 14. Cross-indication synthesis (all 73 products). Category coverage comparison across indications.

3.5. Formulation Complexity by Indication

The highest average number of ingredients is in the products for rosacea, and the presence of UV filters and pigments could represent an explanation [Figure 15].

3.6. Core Ingredients Within the Analyzed Product Categories

Emollients are universal ingredients but have specific properties related to the skin needs in each pathology. Xerosis carries the heaviest occlusive load (Petrolatum present in 5/13 products, the highest of any indication), consistent with maximal transepidermal water loss reduction as the primary formulation goal. Rosacea shows a distinct shift toward lightweight, non-greasy esters and volatile, lightweight silicones (Isohexadecane, C12-15 Alkyl Benzoate, Cyclopentasiloxane). Wound Healing relies on the most classically pharmacy-derived occlusive base (Mineral Oil, Beeswax, Ceresin, Lanolin), an anhydrous or

near-anhydrous ointment structure that maximizes occlusion for re-epithelialization. Sensitive Skin is treated with Squalane, preferred over heavier butters, due to its biomimetism (structurally close to native human sebum squalene), essentially non-comedogenic and for one of the lowest sensitization profiles of any emollient class [Tables 1–6].

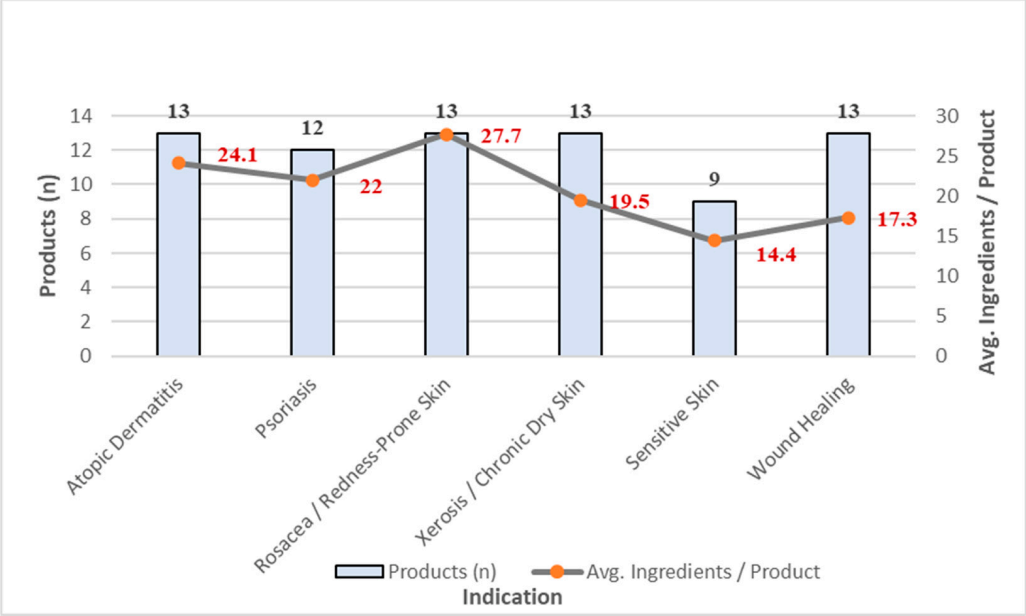


Figure 15. Formulation complexity by indication.

Table 1. Solvent/base.

Indication	Specific Solvent Ingredients Beyond Aqua	Product Count
Atopic Dermatitis	None—Aqua/Water only	13/13
Psoriasis	Alcohol Denat., Ethyl Alcohol (each in 1 product)	2/12
Rosacea	Propylene Carbonate, t-Butyl Alcohol (each in 1 product—UV filter solubilizers)	2/13
Xerosis	Isopropyl Alcohol (1 product)	1/13
Sensitive Skin	Alcohol Denat. (1 product)	1/9
Wound Healing	None identified beyond Aqua	0/13

Table 2. Emollient.

Indication	Top Specific Emollients (Product Count)	Character
Atopic Dermatitis	Shea Butter (7), Mineral Oil (7), Dimethicone (5), Cetearyl Alcohol (5), Caprylic/Capric Triglyceride (5), Evening Primrose Oil (4), Behenyl Alcohol (3)	Rich, occlusive, lipid-diverse
Psoriasis	Cetearyl Alcohol (5), Dimethicone (4), Mineral Oil (4), Shea Butter (3)	Leaner, lower diversity
Rosacea	Dimethicone (7), Caprylic/Capric Triglyceride (5), Shea Butter (5), C12-15 Alkyl Benzoate (3), Cyclopentasiloxane (2), Isohexadecane (2)	Lightweight esters/silicones
Xerosis	Dimethicone (9), Shea Butter (5), Mineral Oil (5), Cetyl Alcohol (5), Petrolatum (5), Cetearyl Alcohol (4)	Heaviest occlusive load of all six
Sensitive Skin	Dimethicone (4), Squalane (3), Shea Butter (3), Cetearyl Alcohol (3)	Biomimetic, low-irritation-focused
Wound Healing	Mineral Oil (7), Caprylic/Capric Triglyceride (4), Beeswax (3), Ceresin (3), Lanolin (3)	Classic anhydrous ointment base

Table 3. Humectant.

Indication	Top Specific Humectants (Product Count)	Distinctive Feature
Atopic Dermatitis	Glycerin (13), Maltodextrin (3), Sodium Hyaluronate (3), Arginine (2), Glycine (2), Sodium PCA (2), Panthenol (2)	Amino-acid/NMF-mimetic complexity
Psoriasis	Glycerin (9), Urea (5), Pentylene Glycol (4), Propylene Glycol (3)	Urea—dual keratolytic/humectant
Rosacea	Glycerin (12), Pentylene Glycol (7), Butylene Glycol (6), Mannitol (3), Sodium Hyaluronate (3), Xylitol (2), Rhamnose (2)	Sugar-alcohol-rich, lightweight
Xerosis	Glycerin (12), Mannitol (2), Pentylene Glycol (2), Butylene Glycol (2), Sodium PCA (2)	Glycerin-dominant, simple
Sensitive Skin	Glycerin (7), Pentylene Glycol (3), Panthenol (2), Sorbitol (2)	Minimal humectant complexity
Wound Healing	Glycerin (9), Panthenol (5), Propylene Glycol (4), Sodium Hyaluronate (3)	Panthenol-forward (dual repair role)

Table 4. Lipid/fatty acid.

Indication	Specific Free Fatty Acids Identified	Coverage
Atopic Dermatitis	Palmitic Acid, Stearic Acid (1 product each)	7.7%
Psoriasis	Behenic Acid, Lauric Acid, Stearic/Palmitic Acid blend (1 product each)	25.0%
Rosacea	Stearic Acid (2), Myristic Acid (1), Palmitic Acid (1)	15.4%
Xerosis	Stearic Acid (3)	23.1%
Sensitive Skin	Stearic Acid (1)	11.1%
Wound Healing	Stearic Acid (3), Palmitic Acid (1)	23.1%

Table 5. Ceramide.

Indication	Specific Ceramide-System Ingredients (Product Count)	Coverage
Atopic Dermatitis	Ceramide NP (5), Phytosphingosine (3), Ceramide AP (2), Cholesterol (2), Ceramide EOP (2), Ceramide NG (1), Beta-Sitosterol (1)	61.5%
Psoriasis	Ceramide NP (2), Cholesterol (2), Ceramide EOP (2), Ceramide AP (2), Ceramide NS (1), Phytosphingosine (1)	16.7%
Rosacea	Rapeseed Sterols (1), Phytosphingosine (1), Phytosterols (1), Ceramide NP (1)	23.1%
Xerosis	Phytosphingosine (2), Ceramide NP (2), Rapeseed Sterols (1), Ceramide AP (1), Ceramide EOP (1), Cholesterol (1), Ceramide 3 (1)	30.8%
Sensitive Skin	Ceramide 3 (1)	11.1%
Wound Healing	None identified	0.0%

Table 6. Emulsifier.

Indication	Top Specific Emulsifiers (Product Count)	Distinctive Feature
Atopic Dermatitis	Glyceryl Stearate (5), PEG-100 Stearate (4), Sorbitan Isostearate (4), Polysorbate 60 (3)	Classic non-ionic O/W system
Psoriasis	PEG-100 Stearate (3), Glyceryl Stearate (3), Sodium Cocoamphoacetate (3), Sodium Laureth Sulfate (2), Coco-Glucoside (2)	Anionic/amphoteric cleansing surfactants present
Rosacea	Hydrogenated Lecithin (3), Glyceryl Stearate (3), Glycol Palmitate (2), Polysorbate 20 (2), Decyl Glucoside (2)	Biomimetic phospholipid emulsifier favored
Xerosis	Glyceryl Stearate (6), PEG-100 Stearate (3)	Simple, workhorse pairing
Sensitive Skin	Glyceryl Stearate (3), Myristyl Glucoside (1), Polyglyceryl-6 Distearate (1), Polyglyceryl-3 Beeswax (1)	Polyglyceryl-ester diversity (PEG-alternative)
Wound Healing	Glyceryl Stearate (3), Polyglyceryl-4 Isostearate (1), Polyglyceryl-3 Polyricinoleate (1), Polyglyceryl-3 Diisostearate (1)	High polyglyceryl-ester diversity

No set of analyzed products pairs its ceramide/cholesterol system with a deliberate free fatty acid [Figures 16 and 17, Tables 4 and 5]. The dermatology literature's well-established ceramide:cholesterol:fatty-acid biomimetic triad is effectively two-thirds complete across the entire dataset of the study. That is a concrete, citable recommendation for formulators [49–51].

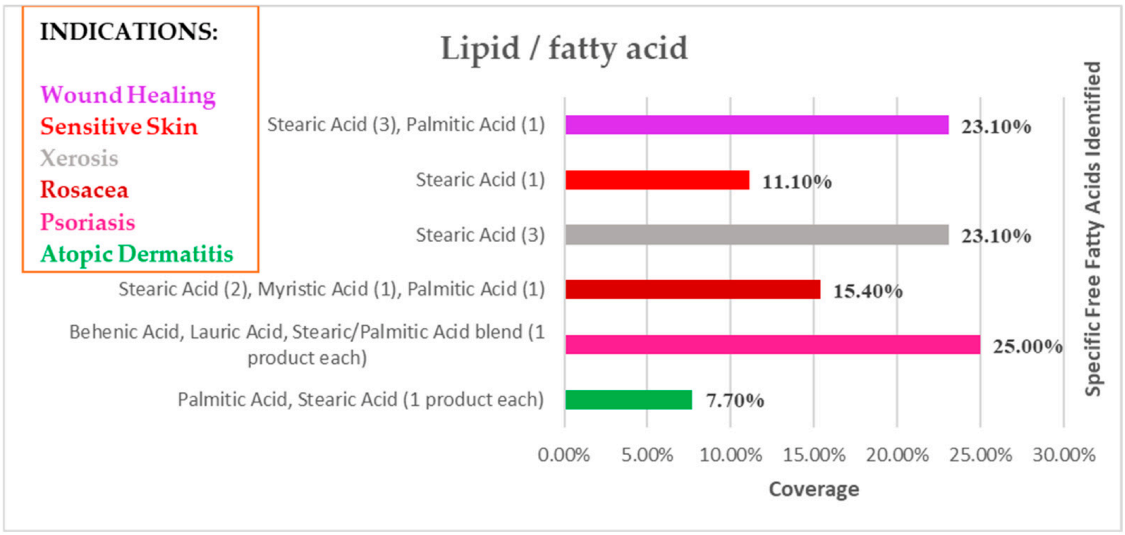


Figure 16. Lipid/fatty acid.

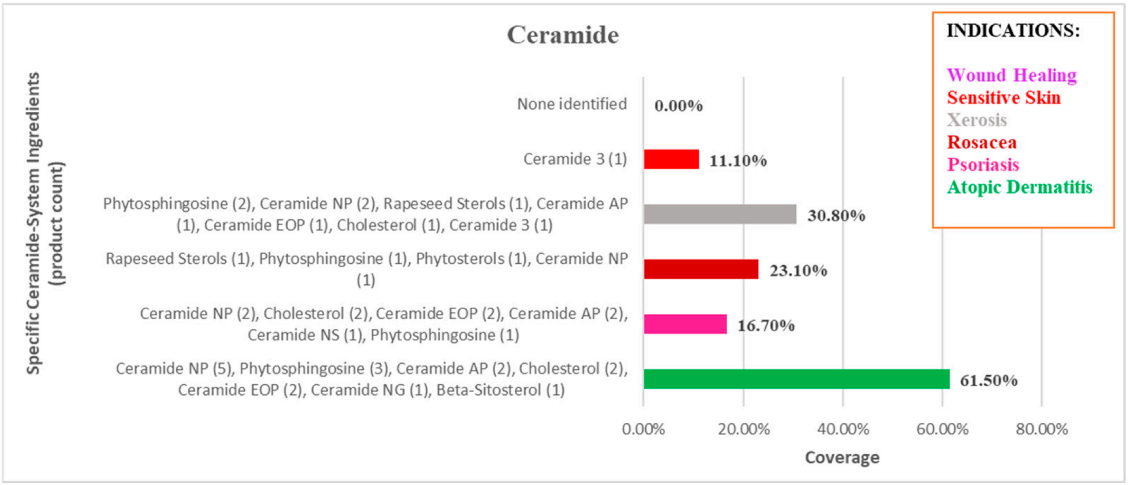


Figure 17. Ceramides.

Alcohol Denat. appears in a sensitive skin product (directly contradicting that category's own minimal-irritant profile), and wound healing shows zero ceramide-system ingredients across all 13 products.

3.7. Active Ingredients Specific to Each Indication

A total of 42 distinct ingredients and 96 total ingredient–product associations were identified using the clear categorization rule: regulatory drug-monograph status OR defined single-molecule mechanism [Tables 7–11].

Table 7. Soothing/anti-inflammatory.

Indication	Representative Ingredients (Product Count)	Diversity
Atopic Dermatitis	*Ophiopogon japonicus* Root Extract (3), Allantoin (2), Licorice Root Extract (2), Colloidal Oatmeal (2), Bisabolol (1)	12 distinct ingredients
Rosacea	Allantoin (3), 4-t-Butylcyclohexanol (3), Glycyrrhetinic Acid (2), Glycine Soja Extract (2), *Laminaria ochroleuca* Extract (2), plus Dextran Sulfate, Hesperidin Methyl Chalcone, *Ruscus aculeatus* (vasoprotective cluster)	15 distinct ingredients—richest and most mechanistically distinct pool
Psoriasis	Cichorium Intybus, Tripterygium Wilfordii, Aloe Vera, Bisabolol, Rosmarinus Officinalis (1 product each)	9 distinct ingredients
Sensitive Skin	Allantoin (2), Bisabolol, 4-t-Butylcyclohexanol, Chamomilla Recutita, Glycyrrhiza Glabra (1 product each)	9 distinct ingredients
Xerosis	Laminaria Ochroleuca, Avena Sativa Kernel Flour/Extract, Allantoin, Eucalyptus Globulus (1 product each)	8 distinct ingredients
Wound Healing	Madecassoside, *Centella asiatica*, Bisabolol, Allantoin, *Calendula officinalis* (1 product each)	8 distinct ingredients

Table 8. Repairing/regenerating active.

Indication	Representative Ingredients (Product Count)	Dominant Strategy
Wound Healing	Zinc Gluconate (2), Copper Gluconate (2), Zinc Oxide (2), Manganese Gluconate, Copper Sulfate, Zinc Sulfate, Copper PCA, Zinc PCA, Alanyl Glutamine	Trace-mineral enzymatic-cofactor strategy
Atopic Dermatitis	Niacinamide (3), Capryloyl Glycine, Zinc Gluconate, Palmitoyl Hexapeptide-12, Pantolactone, Aquaphilus Dolomiae Extract	Barrier-support, biotech-leaning
Rosacea	Acetyl Dipeptide-1 Cetyl Ester (2), Niacinamide (2), Zinc Oxide (2), Acetyl Tetrapeptide-15, Capryloyl Glycine	Peptide-forward, matrix support
Xerosis	Niacinamide (2), Capryloyl Glycine	Minimal barrier support
Psoriasis	Capryloyl Glycine (2), 10-Hydroxydecenoic Acid, Niacinamide	Minimal barrier support
Sensitive Skin	Acetyl Dipeptide-1 Cetyl Ester (1 product only)	Negligible presence

This category splits cleanly into two evidence-distinct sub-strategies: barrier-support molecules (niacinamide, capryloyl glycine) used across several indications, and trace-mineral wound-healing cofactors (zinc, copper, manganese gluconate/sulfate/PCA) concentrated almost exclusively in wound healing.

Table 9. Biotic (pre/pro/postbiotic & ferment).

Indication	Representative Ingredients (Product Count)	Sub-Type
Rosacea	Fructooligosaccharides, Sphingomonas Ferment Extract, Biosaccharide Gum-1, Leuconostoc/Radish Root Ferment Filtrate (1 product each)	Full spectrum: prebiotic + 2 postbiotics + fermentation-derived polysaccharide
Wound Healing	Fructooligosaccharides, *Aquaphilus dolomiae* Ferment Filtrate (1 product each)	Prebiotic + postbiotic
Xerosis	Vitreoscilla Ferment, Fructooligosaccharides (1 product each)	Postbiotic + prebiotic
Atopic Dermatitis	Vitreoscilla Ferment (1 product)	Postbiotic only
Psoriasis	None identified	Absent
Sensitive Skin	None identified	Absent

Table 10. Indication-targeted pharmacological active ingredient.

Pharmacological Active (INCI)	Mechanistic Sub-Type	Products Containing It
4-t-Butylcyclohexanol	Vasoconstrictor-mimetic	**ROS**: AntiRedness Night Care Cream, Eucerin (Beiersdorf); ROS: Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre); **ROS:** Rosacure Intensive Cream, Cantabria Labs; **SENS**: Sensitive Skin Soothing Care, Eucerin (Beiersdorf)
Acetyl Dipeptide-1 Cetyl Ester	Biotech peptide, signaling mechanism	**ROS:** Rosaliac AR Intense Serum, La Roche-Posay (L'Oréal); ROS: Toleriane Rosaliac AR Concentrate, La Roche-Posay (L'Oréal); **SENS**: Toleriane Ultra Fluide, La Roche-Posay (L'Oréal); **WND**: Cicabio Crème+, Bioderma (Naos)
Acetyl Tetrapeptide-15	Biotech peptide, signaling mechanism	**ROS**: UltraCalming Serum Concentrate, Dermalogica
Allantoin	Keratolytic-softening, OTC skin protectant	**AD**: Ivahydra A.D. Cream, Ivatherm; AD: Restoraderm Eczema Calming Body Moisturizer, Cetaphil (Galderma); **ROS**: Redness Relieving Daily Facial Moisturizer SPF 20, Cetaphil (Galderma), Sensibio AR BB Cream, Bioderma (Naos); **SENS**: Sensitive Skin Face and Body Lotion, Sebamed (Sebapharma), Ultra Repair Cream, First Aid Beauty; **WND**: Cicastela Repairing Balm, Mustela (Expanscience); **XER:** Intensive Moisture Cream, Curél (Kao Corporation)
Asiaticoside	Centella triterpene, collagen-synthesis mechanism	**AD**: Xemose Cream, Uriage; **ROS**: Roséliane Anti-Redness Cream, Uriage; **XER**: Xemose Cérat Relipidant Anti-Irritations, Uriage
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine	UV Filter, organic	**ROS**: Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre)
Butyl Methoxydibenzoylmethane	UV Filter, organic	**ROS**: Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre), Sensibio AR BB Cream, Bioderma (Naos)
Caffeine	Vasoconstrictor, methylxanthine	**ROS**: Redness Relieving Daily Facial Moisturizer SPF 20, Cetaphil (Galderma)
Capryloyl Salicylic Acid	Keratolytic	**PSO**: SA Smoothing Cream (10% Salicylic Acid), CeraVe (L'Oréal)
Coal Tar	Antipsoriatic—IARC group 1	**PSO**: MG217 Medicated Tar Ointment, MG217
Colloidal Oatmeal	US OTC Skin Protectant Monograph	**AD**: Eczema Therapy Moisturizing Cream, Aveeno (Kenvue), Restoraderm Eczema Calming Body Moisturizer, Cetaphil (Galderma); **SENS**: Ultra Repair Cream, First Aid Beauty
Copper Gluconate	Trace-mineral cofactor—lysyl oxidase	**WND**: Cicaderma Cream, Uriage, Cicaplast Baume B5+, La Roche-Posay (L'Oréal)
Copper PCA	Trace-mineral cofactor	**WND**: Cicastela Repairing Balm, Mustela (Expanscience)
Copper Sulfate	Trace-mineral cofactor	**WND**: Cicalfate+ Restorative Protective Cream, Avène (Pierre Fabre)
Dextran Sulfate	Venotonic/Vasoprotective	**ROS**: Antirougeurs FORT Relief Concentrate, Avène (Pierre Fabre)

Table 10. *Cont.*

Pharmacological Active (INCI)	Mechanistic Sub-Type	Products Containing It
Diethylamino Hydroxybenzoyl Hexyl Benzoate	UV Filter, organic	**ROS**: Rosacure Intensive Cream, Cantabria Labs
Diethylhexyl Butamido Triazone	UV Filter, organic	**ROS**: Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre)
Dimethyl Sulfone (MSM)	Defined anti-inflammatory	**ROS**: Rosacure Intensive Cream, Cantabria Labs
Ethylhexyl Methoxycinnamate	UV Filter, organic	**ROS**: Rosacure Intensive Cream, Cantabria Labs
Hesperidin Methyl Chalcone	Venotonic/Vasoprotective	**ROS**: Antirougeurs FORT Relief Concentrate, Avène (Pierre Fabre)
Hydroxyphenyl Propamidobenzoic Acid	Antioxidant/Photoprotective, defined mechanism	**ROS**: UltraCalming Serum Concentrate, Dermalogica
Ictasol (Ichthammol)	Antipsoriatic	**PSO**: Kertyol P.S.O. Kerato-Reducing Treatment Shampoo, Ducray (Pierre Fabre)
Lauromacrogols	Antipruritic	**PSO**: Balneum Plus Cream, Almirall
Madecassoside	Centella triterpene, re-epithelialization mechanism	**WND**: Cicaplast Baume B5+, La Roche-Posay (L'Oréal)
Manganese Gluconate	Trace-mineral cofactor	**WND**: Cicaplast Baume B5+, La Roche-Posay (L'Oréal)
Methylene Bis-Benzotriazolyl Tetramethylbutylphenol	UV Filter, organic	**ROS:** Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre), Rosacure Intensive Cream, Cantabria Labs
Niacinamide	Vitamin B3, barrier/sebum mechanism	**AD**: Exomega Control Emollient Balm, A-Derma (Pierre Fabre); AD: Lipikar Baume AP+M, La Roche-Posay (L'Oréal), Restoraderm Eczema Calming Body Moisturizer, Cetaphil (Galderma); **PSO:** SA Smoothing Cream (10% Salicylic Acid), CeraVe (L'Oréal); ROS: Toleriane Double Repair Face Moisturizer, La Roche-Posay (L'Oréal); **ROS:** UV Clear Broad-Spectrum SPF 46, EltaMD; **XER:** Atoderm Ultra-Nourishing Balm, Bioderma (Naos), Lipikar Baume AP+ Relipidant Body Lotion, La Roche-Posay (L'Oréal)
Octinoxate	UV Filter, organic	**ROS**: UV Clear Broad-Spectrum SPF 46, EltaMD
Octocrylene	UV Filter, organic	**ROS**: Rosacure Intensive Cream, Cantabria Labs, Sensibio AR BB Cream, Bioderma (Naos)
Palmitoyl Hexapeptide-12	Biotech peptide, signaling mechanism	**AD**: Emotopic Emollient Barrier Cream, Pharmaceris
Panthenol/Dexpanthenol	Vitamin B5 precursor, OTC-relevant	**AD:** Eczema Therapy Moisturizing Cream, Aveeno (Kenvue), Restoraderm Eczema Calming Body Moisturizer, Cetaphil (Galderma); **ROS:** AntiRedness Night Care Cream, Eucerin (Beiersdorf); **SENS**: Kind to Skin Soothing Facial Moisturizer, Simple (Unilever), Sensitive Skin Soothing Care, Eucerin (Beiersdorf); **WND:** Aquaphor Healing Ointment, Eucerin (Beiersdorf); WND: Cicaderma Cream, Uriage, Cicaplast Baume B5+, La Roche-Posay (L'Oréal), Cicastela Repairing Balm, Mustela (Expanscience), Wound Healing Ointment, Hansaplast (Beiersdorf)
Ruscus Aculeatus Root Extract	Venotonic/Vasoprotective	**ROS:** Antirougeurs FORT Relief Concentrate, Avène (Pierre Fabre)

Table 10. *Cont.*

Pharmacological Active (INCI)	Mechanistic Sub-Type	Products Containing It
Salicylic Acid	Keratolytic	**PSO:** Dercos PSOlution Kerato-Reducing Treatment Shampoo, Vichy (L'Oréal), Kertyol P.S.O. Kerato-Reducing Treatment Shampoo, Ducray (Pierre Fabre), SA Smoothing Cream (10% Salicylic Acid), CeraVe (L'Oréal)
Sodium Dextran Sulfate	Venotonic/Vasoprotective	**ROS:** Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre)
Titanium Dioxide	UV Filter, physical	**ROS:** Antirougeurs Day Redness-Relief Soothing Cream, Avène (Pierre Fabre), Redness Relieving Daily Facial Moisturizer SPF 20, Cetaphil (Galderma), Roséliane Anti-Redness Cream, Uriage, Sensibio AR BB Cream, Bioderma (Naos), Toleriane Rosaliac AR Concentrate, La Roche-Posay (L'Oréal)
Urea	Keratolytic/Humectant, dual-mechanism	**PSO:** Balneum Plus Cream, Almirall, Dercos PSOlution Kerato-Reducing Treatment Shampoo, Vichy (L'Oréal), Excipial U Lipolotio, Galderma, Iso-Urea MD Baume Psoriasis, La Roche-Posay (L'Oréal), SA Smoothing Cream (10% Salicylic Acid), CeraVe (L'Oréal); **XER:** UreaRepair PLUS 10% Urea Lotion, Eucerin (Beiersdorf)
Vitamin A (Retinyl Palmitate)	Vitamin A/Retinoid	**PSO:** MG217 Medicated Tar Ointment, MG217
Vitamin D3 (Cholecalciferol)	Vitamin D	**PSO**: MG217 Medicated Tar Ointment, MG217
Zinc Gluconate	Trace-mineral cofactor—MMP/collagen	**AD:** Atoderm Intensive Baume, Bioderma (Naos); **WND**: Cicaderma Cream, Uriage, Cicaplast Baume B5+, La Roche-Posay (L'Oréal)
Zinc Oxide	OTC Skin Protectant/UV Filter	**ROS:** Redness Relieving Daily Facial Moisturizer SPF 20, Cetaphil (Galderma), UV Clear Broad-Spectrum SPF 46, EltaMD; **WND:** Cicalfate+ Restorative Protective Cream, Avène (Pierre Fabre), Sudocrem Healing Cream, Sudocrem (Teva)
Zinc PCA	Trace-mineral cofactor	**WND**: Cicastela Repairing Balm, Mustela (Expanscience)
Zinc Sulfate	Trace-mineral cofactor	**WND:** Cicalfate+ Restorative Protective Cream, Avène (Pierre Fabre)

AD = Atopic Dermatitis, **PSO** = Psoriasis, **ROS** = Rosacea/Redness-Prone Skin, **XER** = Xerosis/Chronic Dry Skin, **SENS** = Sensitive Skin, **WND** = Wound Healing.

Table 11. UV filter.

Filter Type	Representative Ingredients (Product Count)	Category
Inorganic (mineral)	Titanium Dioxide (6)	Physical/mineral—also serves a tinting/pigment function
Organic (chemical)	Octocrylene (2), Butyl Methoxydibenzoylmethane (2), Methylene Bis-Benzotriazolyl Tetramethylbutylphenol (2), Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine, Diethylhexyl Butamido Triazone, Diethylamino Hydroxybenzoyl Hexyl Benzoate, Ethylhexyl Methoxycinnamate, Octinoxate	Chemical/organic—broad-spectrum multi-filter blends

The **most frequent in the INCI lists and clinically relevant** ingredients within each dermocosmetic category were ranked in Table 12.

Table 12. Frequency and ranking of ingredients by functional category across 73 dermocosmetic products [4,18,41–47].

Functional Category	Ingredient (INCI)	Origin	Key Advantages	Key Limitations
Solvent/Base	Aqua/Water	Natural (purified)	Universal vehicle, non-irritating, essential solvent	Requires robust preservation system
Emollient	Paraffinum Liquidum (Mineral Oil)	Synthetic	Strong occlusion, excellent TEWL reduction, inert	Greasy feel; perception and environmental concerns
	Dimethicone	Synthetic (silicone)	Light sensory, protective film, non-comedogenic	Limited lipid replenishment; silicone residue feel
	Caprylic/Capric Triglyceride	Semi-synthetic	Light, good spreadability, skin-compatible	Milder occlusion than mineral oil
	Butyrospermum Parkii Butter (Shea)	Natural	Rich unsaponifiables, nourishing, anti-inflammatory	Can feel heavy; potential comedogenicity
Humectant	Glycerin	Natural/synthetic	Proven NMF component, strong hydration, well tolerated, accessible	Sticky feel at high concentrations
	Propanediol/Butylene Glycol/Pentylene Glycol	Synthetic/ bio-based	Dual humectant + solvent/preservative booster. Concluded to be safe for use in cosmetic formulations at their currently reported concentrations of use, based on the absence of systemic toxicity findings in the reviewed data	Possible mild irritation on compromised skin
	Urea	Synthetic/natural-identical	Keratolytic + humectant (especially 5–10%)	Can sting on inflamed or broken skin
Lipid/Fatty Acid	Plant oils (Helianthus, Oenothera, Brassica, Cannabis, etc.)	Natural	Essential fatty acids, barrier support	Oxidation risk; possible allergenicity
	Stearic/Palmitic Acid/Cholesterol	Natural/synthetic	Structural lipids supporting lamellar organization	Limited alone without ceramides
Ceramide	Ceramide NP/AP/EOP	Synthetic (skin-identical)	Direct barrier-lipid replenishment, strong evidence	High cost; requires optimized delivery system
Emulsifier	Glyceryl Stearate + PEG-100 Stearate	Semi-synthetic	Reliable O/W emulsification, good stability	PEG-related purity concerns (1,4-dioxane potential)
	Cetearyl Alcohol/Cetearyl Glucoside	Natural-derived	Mild, skin-friendly co-emulsifier	Weaker emulsification alone
Co-emulsifier/ Stabilizer	Xanthan Gum/Carbomer/ Acrylates copolymers	Natural/synthetic	Rheology control, suspension, improved sensory	Carbomers may leave residue if poorly neutralized
Preservative	Phenoxyethanol (+Caprylyl Glycol/Ethylhexylglycerin)	Synthetic	Broad-spectrum efficacy, relatively low irritation	Concentration limits; occasional sensitization
	Sodium Benzoate/Potassium Sorbate/ Chlorphenesin	Synthetic	Suitable for milder or natural-leaning formulas	Narrower spectrum; pH-dependent activity

Table 12. *Cont.*

Functional Category	Ingredient (INCI)	Origin	Key Advantages	Key Limitations
pH Adjuster	Citric Acid/Sodium Hydroxide/ Lactic Acid	Natural/synthetic	Precise acid-mantle matching (pH 4.0–5.5)	Over-acidification can cause stinging
Chelator	Disodium EDTA/Trisodium Ethylenediamine Disuccinate	Synthetic	Formula stabilization, prevents metal-catalyzed oxidation	Environmental persistence (especially EDTA)
Antioxidant	Tocopherol/ Tocopheryl Acetate	Natural/synthetic	Protects formula and skin lipids from oxidation	Acetate form less bioactive than free tocopherol
Soothing/Anti-inflammatory	Niacinamide	Synthetic	Multi-functional (barrier, anti-inflammatory, sebum)	Possible flushing at higher concentrations
	Panthenol/Allantoin/ Bisabolol	Synthetic/natural	Calming, supports barrier recovery, well tolerated	Mild efficacy when used alone
Repairing/ Regenerating Active	Panthenol, Madecassoside/Centella extracts, Zinc/Copper salts	Mixed	Support re-epithelialization and antioxidant defense	Variable standardization of plant extracts
	Colloidal Oatmeal	Natural	FDA-recognized skin protectant, anti-itch	Limited to specific eczema-oriented products
Biotic (Pre/Pro/Postbiotic & Ferment)	Vitreoscilla Ferment, *Aquaphilus Dolomiae*, Fructooligosaccharides, ferment filtrates	Biotechnological	Emerging microbiome and barrier-support evidence	Higher cost; variable standardization
Named Active Ingredient	Niacinamide, Urea, Salicylic Acid, Colloidal Oatmeal	Mixed	Targeted therapeutic effects	Indication-specific; concentration-dependent safety
UV Filter	Titanium Dioxide/Zinc Oxide	Mineral (processed)	Broad-spectrum, photostable, preferred for reactive skin	White cast if not optimized
	Chemical filters (Octocrylene, etc.)	Synthetic	Elegant sensory profile	Higher irritation/ sensitisation potential
Fragrance/Fragrance Allergen	Parfum/Fragrance + listed allergens (Limonene, Linalool, etc.)	Mixed	None for impaired skin	High sensitization risk; best avoided
Colorant/Pigment/ Other	Iron Oxides, CI pigments, Titanium Dioxide (pigment grade)	Mineral	Optical correction of erythema (mainly rosacea)	Potential residue or mild irritation if poorly dispersed

At the ingredient sub-type level, each indication still draws on a mechanistically distinct pharmacological profile: Psoriasis on keratolytics, Rosacea on UV filters/venotonics, Wound Healing on trace minerals.

Based on standard cosmetic ingredient function classifications, Zinc Gluconate, Copper Gluconate, Manganese Gluconate, AND Copper PCA are compounds with recognized antioxidant function, essential in facilitating wound healing processes [52].

Although still underrepresented in the analyzed products, pre-, pro-, and postbiotic ingredients are increasingly strongly supported by scientific evidence to complement treatment of inflammatory skin disorders by restoring microbial balance, strengthening epithelial barrier integrity and modulating innate immune responses to dampen excessive inflammation. These microbial-derived components further facilitate healing through

competitive exclusion of pathogens, induction of antimicrobial peptides and promotion of keratinocyte migration in conditions such as atopic dermatitis and psoriasis [45,53,54].

3.8. Frequency and Ranking of Ingredients by Functional Category Across 73 Dermocosmetic Products

As an overall ranking insight, the most frequent and functionally critical ingredients across the entire dataset form a clear hierarchy: Aqua > Glycerin > Mineral Oil/Dimethicone > Glyceryl Stearate systems > Phenoxyethanol systems > Tocopherol > Niacinamide/Panthenol > Ceramides (selective) > Biotics (emerging) [Table 12].

Paraffinum Liquidum (Mineral Oil), Dimethicone, Caprylic/Capric Triglyceride and *Butyrospermum pParkii* (Shea) Butter are each well tolerated as constituents of topical emollient formulations, having been used safely and without significant adverse reactions across multiple randomized, controlled clinical trials in patients with atopic dermatitis.

3.9. Plant Extracts in the 73 Analyzed Dermatocosmetics

The safety assessment of botanical ingredients remains disproportionately difficult, because their composition is inherently variable, depending on plant species, geographic origin, harvest timing and extraction method [Table 13]. The inconsistent characterization of these variables is what most often leaves plant ingredients without a definitive safety conclusion [55]. This variability directly undercuts a common consumer assumption: botanical origin confers no inherent safety advantage over synthetic ingredients, since natural sourcing says nothing about a compound's toxicological profile at the concentrations actually used in formulation [55,56].

Table 13. Vegetal extracts in the 73 analyzed dermatocosmetics and their known biological effects.

Ingredient (INCI)	Botanical Source	Category	Known Role/Biological Effect
Almond Oil	*Prunus dulcis* (kernel)	Emollient	Rich in oleic/linoleic acid and vitamin E; softens and re-lipidizes skin, reduces transepidermal water loss (TEWL).
***Avena sativa* Kernel Oil**	Oat (kernel)	Emollient	Occlusive lipid film rich in ceramide-precursor lipids; restores barrier lipids, reduces dryness in AD/xerosis.
Avocado Oil	*Persea gratissima* (fruit)	Emollient	High in sterolins/unsaponifiables; promotes collagen synthesis, occlusive and re-lipidizing action.
Borage Seed Oil (as aminopropanediol amides)	*Borago officinalis* (seed)	Emollient	Very high gamma-linolenic acid (GLA) content; replenishes essential fatty acids deficient in atopic-prone skin, supports barrier lipid synthesis.
***Borago officinalis* Seed Oil**	Borage (seed)	Emollient	Same GLA-rich mechanism; anti-inflammatory *via* eicosanoid pathway modulation, softens sensitive skin.
***Brassica campestris* (Rapeseed) Oil**	Rapeseed/Canola (seed)	Emollient	Oleic-acid-rich triglyceride oil; occlusive emollient, improves skin softness and suppleness.
***Cannabis sativa* Seed Oil**	Hemp (seed)	Emollient	Balanced omega-3/omega-6 fatty acid profile; anti-inflammatory and barrier-restorative, well tolerated in atopic-prone skin.
***Cocos nucifera* Oil**	Coconut (fruit/kernel)	Emollient	Medium-chain triglycerides with antimicrobial lauric acid; strong occlusive, reduces S. aureus colonization relevant to AD.
Evening Primrose Oil/Palm Oil (as aminopropanediol esters)	*Oenothera biennis*/ *Elaeis guineensis*	Emollient	GLA and palmitic-acid-derived esters combine essential-fatty-acid replenishment with enhanced spreadability/occlusion.
***Helianthus annuus* Seed Oil**	Sunflower (seed)	Emollient	Linoleic-acid-rich; accelerates barrier repair and improves stratum corneum hydration, well-documented in neonatal/AD skin care.
Hydrogenated Castor Oil	Castor (seed, hydrogenated)	Emollient	Waxy, highly occlusive lipid; forms a protective film reducing water loss, texturizing co-emollient.

Table 13. *Cont.*

Ingredient (INCI)	Botanical Source	Category	Known Role/Biological Effect
Hydrogenated Rapeseed Oil	Rapeseed (seed, hydrogenated)	Emollient	Solid-state occlusive lipid; contributes to balm/ointment consistency and barrier occlusion.
***Oenothera biennis* Oil**	Evening primrose (seed)	Emollient	GLA-rich; corrects essential fatty acid deficiency characteristic of atopic skin, reduces inflammatory eicosanoid production.
***Olea Europaea* Fruit Oil**	Olive (fruit)	Emollient	Squalene- and polyphenol-containing; occlusive with mild antioxidant contribution, softens and conditions skin.
***Persea gratissima* Fruit Oil**	Avocado (fruit)	Emollient	See Avocado Oil; sterolin content supports fibroblast collagen synthesis alongside occlusive action.
***Prunus amygdalus* Dulcis Oil**	Sweet almond (kernel)	Emollient	See Almond Oil; classic re-lipidizing emollient for dry/xerotic skin.
***Prunus armeniaca* Kernel Oil**	Apricot (kernel)	Emollient	Oleic/linoleic-acid-rich; lightweight emollient, improves elasticity and softness.
***Ricinus communis* Seed Oil**	Castor (seed)	Emollient	Ricinoleic-acid-rich; humectant-emollient hybrid, forms a glossy occlusive film, used in balm formulations.
***Sesamum indicum* Seed Oil**	Sesame (seed)	Emollient	Sesamin/sesamol antioxidant lignans plus emollient triglycerides; mild anti-inflammatory and re-lipidizing action.
Shea Butter (*Butyrospermum parkii*)	Shea tree (nut)	Emollient	Triterpene-rich (cinnamic acid esters); potent occlusive and anti-inflammatory, among the most clinically documented barrier-repair emollients across AD/psoriasis/xerosis/rosacea.
***Simmondsia chinensis* Seed Oil**	Jojoba (seed)	Emollient	Liquid wax ester structurally similar to human sebum; non-occlusive emollient, restores lipid balance without pore-clogging.
***Vitis vinifera* Seed Oil**	Grape (seed)	Emollient	Linoleic-acid- and proanthocyanidin-rich; emollient with secondary antioxidant/free-radical-scavenging contribution.
Aloe Vera	*Aloe barbadensis* (leaf)	Soothing/Anti-inflammatory	Polysaccharides (acemannan) and anti-inflammatory compounds; hydrates, soothes irritation, supports wound/barrier repair.
Asiaticoside	*Centella asiatica* (isolated triterpenoid)	Soothing/Anti-inflammatory	Stimulates collagen synthesis and re-epithelialization; wound-healing and anti-irritant action, reduces inflammatory mediators.
***Avena sativa* (Oat, whole)**	Oat	Soothing/Anti-inflammatory	Avenanthramide-driven anti-inflammatory and anti-pruritic action via NF-κB/IL-8 inhibition.
***Avena sativa* Kernel Extract**	Oat (kernel)	Soothing/Anti-inflammatory	Same avenanthramide mechanism; reduces itch and redness, well-established in AD/xerosis care.
***Avena sativa* Kernel Flour**	Oat (kernel, milled)	Soothing/Anti-inflammatory	Colloidal-forming flour delivering avenanthramides and beta-glucan; soothing and film-forming protective action.
***Avena sativa* Leaf/Stem Extract**	Oat (aerial parts)	Soothing/Anti-inflammatory	Polyphenol/flavonoid content contributes antioxidant and anti-irritant activity, complementary to kernel-derived avenanthramides.
***Boerhavia diffusa* Root Extract**	Punarnava (root)	Soothing/Anti-inflammatory	Hydroxybenzoic-compound-rich; inhibits NF-κB translocation and PGE2 release, limits neurogenic inflammation via α-MSH induction—restores normal skin sensitivity threshold.
***Calendula officinalis* Flower Extract**	Marigold (flower)	Soothing/Anti-inflammatory	Triterpenoid- and flavonoid-rich; classic wound-healing and anti-inflammatory botanical, used in pediatric/sensitive formulations.
***Centella asiatica* Leaf Extract**	Gotu kola (leaf)	Soothing/Anti-inflammatory	Triterpenoid saponins (asiaticoside, madecassoside precursors) stimulate collagen synthesis and re-epithelialization; core wound-repair botanical.
***Chamomilla recutita* Flower Extract**	Chamomile (flower)	Soothing/Anti-inflammatory	Alpha-bisabolol and apigenin content; well-documented anti-inflammatory/anti-irritant, reduces erythema in sensitive skin.

Table 13. *Cont.*

Ingredient (INCI)	Botanical Source	Category	Known Role/Biological Effect
***Chrysanthemum parthenium* Extract**	Feverfew (plant)	Soothing/Anti-inflammatory	Typically parthenolide-depleted for cosmetic use; retains anti-inflammatory flavonoid activity while minimizing sensitization risk.
***Cichorium intybus* Root Extract**	Chicory (root)	Soothing/Anti-inflammatory	Sesquiterpene lactone and inulin content; anti-irritant, used to offset keratolytic irritation in scalp/psoriasis formulations.
***Citrus limon* Peel Powder**	Lemon (peel)	Soothing/Anti-inflammatory	Flavonoid/Limonene content contributes mild anti-inflammatory and antioxidant action alongside gentle exfoliation.
***Citrus medica limonum* Extract**	Citron/Lemon	Soothing/Anti-inflammatory	Vitamin C and flavonoid-rich; antioxidant support with mild anti-inflammatory contribution.
Colloidal Oatmeal	Oat (finely milled, whole)	Soothing/Anti-inflammatory	Avenanthramides inhibit NF-κB and reduce IL-8 release; among the most clinically validated anti-pruritic/anti-inflammatory botanicals in AD.
Dipotassium glycyrrhizate	Licorice (*Glycyrrhiza glabra* root, salt form)	Soothing/Anti-inflammatory	Glycyrrhizic acid salt; inhibits 11-β-hydroxysteroid dehydrogenase and COX pathways, reduces erythema—used in rosacea/redness formulations.
Eucalyptus Globulus Extract/Leaf Extract/Leaf Oil	Eucalyptus (leaf)	Soothing/Anti-inflammatory	Cineole and flavonoid content; anti-inflammatory and mild antimicrobial, cooling sensory effect supports irritation relief.
***Glycine soja* Germ Extract**	Soybean (germ)	Soothing/Anti-inflammatory	Isoflavone (genistein) content; antioxidant and anti-inflammatory, supports barrier lipid synthesis in redness-prone skin.
***Glycyrrhiza glabra* Root Extract**	Licorice (root)	Soothing/Anti-inflammatory	Glycyrrhizin/liquiritin inhibit inflammatory mediators and tyrosinase; soothing plus mild brightening action.
***Glycyrrhiza inflata* Root Extract**	Chinese licorice (root)	Soothing/Anti-inflammatory	Licochalcone A is a potent anti-inflammatory/antioxidant flavonoid, specifically reduces sebum oxidation and redness.
***Helianthus annuus* Seed Extract**	Sunflower (seed, aqueous extract)	Soothing/Anti-inflammatory	Vitamin E and phenolic content contribute antioxidant and mild anti-inflammatory support alongside the seed oil's emollient action.
***Laminaria ochroleuca* Extract** *	Brown algae (kelp)	Soothing/Anti-inflammatory	* Marine algal extract, not a vascular plant—included in source data as a botanical-adjacent soothing agent; polysaccharide/mineral content supports hydration and calming.
***Lonicera caprifolium/Japonica* Flower Extract**	Honeysuckle (flower)	Soothing/Anti-inflammatory	Chlorogenic acid and flavonoid content; anti-inflammatory and mild antimicrobial, traditional skin-calming botanical.
Madecassoside	*Centella asiatica* (isolated triterpenoid)	Soothing/Anti-inflammatory	Purified saponin; stimulates collagen I/III synthesis, reduces inflammatory cytokines, supports barrier repair—the primary active behind many post-procedure/redness-relief formulas.
***Ophiopogon japonicus* Root Extract**	Mondo grass/lilyturf (tuber root)	Soothing/Anti-inflammatory	Traditional Chinese Medicine botanical rich in saponins and polysaccharides; hydrating and anti-inflammatory, used to calm redness-prone and atopic skin.
***Panax ginseng* Root Extract**	Ginseng (root)	Soothing/Anti-inflammatory	Ginsenosides exhibit anti-inflammatory and antioxidant activity, support microcirculation—relevant to redness-reduction formulas.
***Persea gratissima* Fruit Extract**	Avocado (fruit, aqueous extract)	Soothing/Anti-inflammatory	Complementary to avocado oil; polyphenol content contributes antioxidant/anti-inflammatory support.
***Peumus boldus* Leaf Extract**	Boldo (leaf)	Soothing/Anti-inflammatory	Alkaloid (boldine) and flavonoid content; antioxidant and mild anti-inflammatory, used in xerosis balms.
***Portulaca oleracea* Extract**	Purslane (whole plant)	Soothing/Anti-inflammatory	Omega-3 fatty acids and flavonoids; anti-inflammatory and antioxidant, supports barrier lipid replenishment.
***Rosmarinus officinalis* Extract**	Rosemary (leaf)	Soothing/Anti-inflammatory	Carnosic acid and rosmarinic acid are potent antioxidants with anti-inflammatory activity and contribute to formula stability.

Table 13. *Cont.*

Ingredient (INCI)	Botanical Source	Category	Known Role/Biological Effect
***Ruscus aculeatus* Root Extract**	Butcher's broom (root)	Soothing/Anti-inflammatory	Ruscogenin/steroidal saponins exhibit venotonic and anti-edema (vasoconstrictive) action—specifically targets capillary fragility in rosacea/redness.
***Salvia officinalis* Oil**	Sage (leaf, essential oil)	Soothing/Anti-inflammatory	Rosmarinic acid and terpene content; antioxidant and mild anti-inflammatory, astringent/toning sensory contribution.
***Schisandra sphenanthera* Fruit Extract**	Schisandra (fruit)	Soothing/Anti-inflammatory	Lignan content (schisandrin) exhibits antioxidant and adaptogenic anti-stress activity relevant to redness-reduction formulas.
***Tambourissa trichophylla* Leaf Extract**	Ambora (leaf, Madagascar)	Soothing/Anti-inflammatory	Polyphenol-rich (epicatechin, rutin); modulates microcirculation (VEGF ↓, decreased thrombospondin-1 ↑ increased) and inflammatory mediators (PGE2, LTB4 ↓ decreased)—clinically shown to reduce microcirculation/redness by ~42% on rosacea-prone skin at 0.3%.
***Tripterygium wilfordii* Callus Extract**	Thunder god vine (plant cell culture)	Soothing/Anti-inflammatory	Immunomodulatory diterpenoid content; anti-inflammatory synergist used alongside keratolytics in psoriasis-targeted scalp care.
***Uncaria tomentosa* Extract**	Cat's claw (bark/root)	Soothing/Anti-inflammatory	Oxindole alkaloids inhibit TNF-α and other inflammatory cytokines; supports wound repair and anti-irritant formulations.
Viola Tricolor Extract	Wild pansy (flower/herb)	Soothing/Anti-inflammatory	Flavonoid and saponin content; traditional anti-inflammatory/anti-pruritic botanical used in atopic skin care.
***Zanthoxylum bungeanum* Fruit Extract**	Sichuan pepper (fruit)	Soothing/Anti-inflammatory	Hydroxy-alpha-sanshool content provides a cooling/counter-irritant sensory effect alongside mild anti-inflammatory activity.
***Zingiber officinale* Root Extract**	Ginger (rhizome)	Soothing/Anti-inflammatory	Gingerol/shogaol compounds inhibit COX-2 and inflammatory cytokines; warming sensory profile paired with anti-inflammatory action.

3.10. Botanical Diversity and Functional Stratification

Thirty-three soothing and anti-inflammatory extracts, spanning traditional emollient-adjacent botanicals (oat, calendula, chamomile) alongside pharmacologically narrower actives such as *Centella asiatica* derivatives, are ingredients in the 73 dermocosmetic formulas. Eighteen distinct plant oils and butters, serving a predominantly emollient function, represent the next largest category of plant extracts. *Butyrospermum parkii* (Shea Butter) emerged as the single most prevalent botanical ingredient across the entire 33 products dataset, exceeded in overall frequency only by aqua and glycerin. The third group of botanically derived actives possessing more circumscribed pharmacological rationale is represented by asiaticoside, madecassoside, dipotassium glycyrrhizate, and hesperidin methyl chalcone.

3.11. The Necessity of Preparation-Level Verification: The Tripterygium Wilfordii Case

Tripterygium wilfordii callus extract, identified in a psoriasis-indicated formulation, shares its botanical origin with "thunder god vine," whose crude root preparations contain triptolide, a diterpenoid epoxide with well-documented hepatotoxic potential under systemic and prolonged medicinal use [57,58]. Ingredient-level verification matters, not just INCI-name matching, so a closer examination of the preparation reveals a materially different substance: a tissue-cultured callus extract, structurally and phytochemically distinct from the intact root from which triptolide-associated toxicity has been characterized.

3.12. Divergence Between Marketing Positioning and Evidentiary Strength

A further pattern, emerging from comparison against manufacturer communications, concerns the disjunction between commercial positioning and underlying evidence quality. Botanical actives are marketed with near-uniform emphasis on "natural" positioning. Oat-derived ingredients, for instance, are consistently anchored as hero ingredients for itch- and barrier-related claims. Yet, the underlying evidentiary strength varies considerably by botanical family. Support is comparatively strong for oat, Centella and licorice derivatives. The marine and algal group remains preliminary, resting predominantly on in vitro rather than clinical evidence. This variation in the strength of supporting evidence cannot be detected from marketing claims alone, which shows that product terminology is a poor substitute for real mechanistic or clinical proof.

3.13. Structural Continuity Across Analytical Frames

The botanical ingredients do not constitute an independent dataset but represent the same underlying ingredients previously examined through cosmetic-functional classification. The eighteen emollient oils and butters correspond directly to entries already documented within the Emollient category of the earlier comprehensive analysis, with Shea Butter's prevalence consistent across both framings.

A partial exception is fructooligosaccharide, which, despite its chicory-root origin, was consistently filed under "biotic" rather than "botanical extract", in a prioritization of functional role (prebiotic) over botanical source.

The allergen and irritant screen provides the clearest demonstration that a single ingredient may occupy two simultaneously valid, non-redundant analytical positions. *Pelargonium graveolens* oil, *Salvia officinalis* oil and *Eucalyptus globulus* each appear in both analyses. This dual appearance reflects the duality of botanical actives, which frequently carry both a sensitization risk profile and a therapeutic mechanism of action.

3.14. Controversial/Carcinogenic Ingredients

- The discrepancy in "Tier 1-coal tar" reflects an unresolved regulatory divergence between major jurisdictions rather than a settled scientific consensus [Table 14].
- Tier 2-PEG compounds appear as a manufacturing quality-control issue, not an inherent property of the finished ingredient. 1,4-dioxane is regulated to trace limits ($\leq$10 ppm under several national cosmetic safety frameworks) precisely because it is a removable process contaminant, not a structural component of PEG compounds [Table 15].

Table 14. Tier 1—established carcinogen classification.

Ingredient	Products (*n*)	Evidence and Regulatory Status
Coal tar	1 (MG217 Medicated Tar Ointment, Psoriasis)	- Classified by IARC as a Group 1 human carcinogen, largely on the basis of historical evidence from high-dose, prolonged occupational exposure. - European Union has restricted its use in cosmetics - US FDA OTC monograph permits concentrations of 0.5–5% (including the 2% level declared in the single product identified in this dataset) for intermittent treatment of dandruff, psoriasis and seborrhoeic dermatitis.

Table 15. Tier 2—contamination or degradation-pathway risk.

Ingredient/Class	Products (*n*)	Evidence and Mechanism
PEG-compounds (ethoxylated ingredients: PEG-100 Stearate, PEG-40 Hydrogenated Castor Oil, Polysorbates, and ~25 related entries)	~40+ occurrences across most indications	- PEG/polyethylene glycol molecule itself is not classified as carcinogenic. - Trace contamination with 1,4-dioxane (IARC Group 2B, "possibly carcinogenic to humans"), a by-product that can form during the ethoxylation manufacturing process
Octocrylene	2 (UV Clear SPF46, Rosacea)	- Recent analytical chemistry research (French ANSES investigation, 2021 and subsequent studies) has demonstrated that octocrylene can degrade into benzophenone (IARC Group 2B) over time under UV exposure and elevated storage temperatures, with degradation increasing with product age. - This is a shelf-life/storage-dependent finding, not a property of freshly manufactured product.
Triethanolamine (TEA)	5 (see pH Adjuster report)	- Can react with nitrosating agents (potentially present as trace contaminants from certain preservative systems) to form nitrosamines, several of which (e.g., N-nitrosodiethanolamine) are classified by IARC as Group 2B and listed by the US National Toxicology Program as "reasonably anticipated to be a human carcinogen."

- Octocrylene—Octocrylene itself is an approved UV filter with an extensive efficacy/safety record. However, recent analytical chemistry research (French ANSES investigation, 2021 and subsequent studies) has demonstrated that octocrylene can degrade into benzophenone (IARC Group 2B) over time under UV exposure and elevated storage temperatures, with degradation increasing with product age. This is a shelf-life/storage-dependent finding, not a property of freshly manufactured product, and has prompted some regulatory reassessment discussion in the EU without a current formal restriction.
- TEA itself is not classified as a carcinogen, but can react with nitrosating agents (potentially present as trace contaminants from certain preservative systems) to form nitrosamines, several of which (e.g., N-nitrosodiethanolamine) are classified by IARC as Group 2B and listed by the US National Toxicology Program as "reasonably anticipated to be a human carcinogen." This risk is again process/formulation-dependent (co-occurrence with a nitrosating agent) rather than an inherent property of TEA used alone.
- Tier 3 [Table 16].
- Parabens have documented weak estrogenic activity in vitro. A frequently cited 2004 study [59] reported paraben detection in breast tumor tissue samples, which received extensive media coverage but did not establish causation and has been substantially criticized on methodological grounds (no control/non-tumor tissue comparison, no dose–response data). Current major regulatory positions (EU SCCS, US FDA) consider methylparaben and propylparaben safe at their currently regulated concentrations, though propylparaben and butylparaben face tighter EU restrictions than methylparaben/ethylparaben specifically. This remains a genuinely active area of toxicological research rather than a settled question in either direction.

Table 16. Tier 3—contested/actively debated evidence.

Ingredient	Products (*n*)	Evidence and Context
Methylparaben/Propylparaben	7 (Wound Healing, Xerosis)	- Weak estrogenic activity in vitro. - Reported paraben detection in breast tumor tissue samples without established causation. - Current major regulatory positions (EU SCCS, US FDA) consider methylparaben and propylparaben safe at their currently regulated concentrations. - Propylparaben and butylparaben face tighter EU restrictions than methylparaben/ethylparaben specifically.
BHT/Butylated Hydroxyanisole (BHA)	6	- Classified by IARC as Group 2B, based substantially on rodent forestomach tumors observed at high dietary doses; - BHT's evidence is comparatively weaker and less consistently classified. - Permitted at current cosmetic-use concentrations by EU and US regulators. - Flagged in consumer advocacy contexts as ingredients warranting continued monitoring.
Titanium Dioxide	6 (all Rosacea)	- IARC classifies titanium dioxide as Group 2B specifically for inhalable powder form under occupational exposure conditions - The classification does not extend to dermal application in a cream/lotion vehicle.
Retinyl Palmitate (Vitamin A)	1 (Psoriasis)	- Photocarcinogenicity concern: accelerated skin tumor development in UV-exposed mice treated with topical retinyl palmitate - The evidence remains genuinely unresolved rather than either confirmed or dismissed.

- BHA is classified by IARC as Group 2B, based substantially on rodent forestomach tumors observed at high dietary doses (the rodent forestomach is an anatomical structure with no human equivalent, which limits the direct relevance of this specific finding to human dermal cosmetic exposure). BHT's evidence is comparatively weaker and less consistently classified. Both remain permitted at current cosmetic-use concentrations by EU and US regulators, though both are frequently flagged in consumer advocacy contexts as ingredients warranting continued monitoring.
- Titanium dioxide—IARC (the International Agency for Research on Cancer—the specialized cancer research agency of the World Health Organization) classifies titanium dioxide as Group 2B specifically for inhalable powder form under occupational exposure conditions (relevant to manufacturing/industrial settings and loose cosmetic powders), a classification that does not straightforwardly extend to dermal application in a cream/lotion vehicle, where inhalation exposure is not a relevant pathway. This is one of the clearest examples in this dataset of a classification being decontextualized from its actual exposure-route basis when cited in general "carcinogen ingredient list" consumer content.
- Retinyl palmitate—A 2009 US National Toxicology Program draft study raised a photocarcinogenicity concern, accelerated skin tumor development in UV-exposed mice treated with topical retinyl palmitate, that received significant media attention. Subsequent independent review (including by the FDA and academic dermatology groups) has not consistently replicated or confirmed this finding as directly applicable to human use at cosmetic concentrations, and no regulatory restriction has resulted. The evidence remains genuinely unresolved rather than either confirmed or dismissed.

3.15. Guidelines Concordance

Sources informing the comparative analysis include the American Academy of Dermatology (AAD) Guidelines of Care and their 2025 focused updates, the European Task Force on Atopic Dermatitis (ETFAD)/EuroGuiDerm consensus, the National Psoriasis Foundation (NPF) and International Psoriasis Council (IPC) joint statements and the global consensus recommendations on rosacea (ROSacea COnsensus, ROSCO) and sensitive skin. Each section follows a stepwise, severity-adapted therapeutic ladder, moving from foundational skin-barrier care through topical, procedural and systemic/biologic interventions. There are also statements that clinical judgment, patient comorbidities, cost and access to therapy must always modulate application of these recommendations to the individual patient.

Atopic dermatitis has the strongest guideline alignment, on both the criteria the guideline states explicitly (fragrance avoidance) and the criterion implied by its stated disease mechanism (ceramide-relevant barrier lipid repair).

The psoriasis group is concordant with modern therapy, except for one legacy active, coal tar.

Xerosis has good alignment with one clear, actionable gap—the guideline specifically and explicitly names Urea (at 10–20%) as strong-evidence therapy for xerosis.

Rosacea is directionally correct but incomplete in its adherence. The guideline states sunscreen as foundational therapy "across all phenotypes," not as an optional adjunct, yet nearly half (46.2%) of the Rosacea products sampled contain no UV filter at all.

Sensitive skin has the weakest guideline alignment despite "minimal" positioning. A low average ingredient count (14.4/product, the lowest of all six indications) does not guarantee guideline-concordant formulation: three separate guideline-named avoid-ingredients appear in this sample, ceramide-based barrier support is nearly absent and photoprotection, specifically flagged by the guideline as the preferred, better-tolerated mineral type for this population, is entirely missing.

This article does not aim to evaluate the selected products in terms of specific recommendation or non-recommendation of any individual product or brand. Likewise, the authors do not intend, in any form, to rank the selected products relative to one another.

These findings describe the pharmacy-distributed, dermatologist-recommended dermocosmetic segment specifically, and should not be extended without qualification to prestige or general-retail cosmetic lines, which follow a different formulation logic and serve a different consumer need. This scope is considered a clarification of relevance rather than a constraint on it: by focusing on the segment clinicians and pharmacists directly engage with, the findings are positioned to support more informed, evidence-grounded exchanges between physicians, pharmacists and the medical representatives who supplement clinical guidance within pharma-physician collaboration, an application a broader, less clinically anchored sample would not support as directly.

At the same time, we draw a distinction between therapeutic performance—ensured by the presence of certain essential ingredients, recognized in clinical guidelines and guaranteed by the quality and verified provenance of the declared ingredients—and the subjective preference of each consumer, which is shaped by sensory experience, texture, personal perception, and association with other products within their individual routine.

Taken together, this work identifies compositional patterns, statistical associations, and points of alignment or divergence with clinical guidelines. It does not adjudicate formulation performance, delivery efficiency or superiority between individual products. That determination rightly belongs to continued, constructive dialog between manufacturers, who bring formulation and delivery-system expertise, and dermatologists, who bring direct clinical observation and the individualized judgment each patient's presentation

demands. Within this framing, the present findings serve as a rigorous, evidence-anchored starting point.

4. Conclusions

This study offers one of the first attempts to quantitatively examine alignment between marketed dermocosmetic formulation practice and current evidence-based guidelines for patients with skin barrier disorders, within the specific product sample analyzed.

Across 73 dermocosmetic products, [Tables S1–S6] spanning six chronic inflammatory and barrier-impaired indications, ingredient-category coverage confirms a statistically stable core: solvent, emollient and humectant categories approach universal presence, providing the empirical foundation for a genuinely shared formulation logic rather than an assumed one.

Common-ingredient analysis resolves into a coherent three-tiered structure: near-universal anchors, broadly recurring staples and indication-specific clusters, demonstrating that formulation "commonality" is layered rather than uniform.

Cross-indication comparison of formulation complexity reveals meaningful divergence in philosophy: Rosacea formulations trend most elaborate and multi-active, while Sensitive Skin formulations trend leanest, reflecting distinct, defensible approaches to managing reactive versus multifactorial skin conditions.

Mechanism-based classification of pharmacological actives shows these ingredients to be substantially more prevalent (63.0%) than function-based labeling alone would suggest, yielding a more scientifically defensible picture of how actives are actually distributed across the category.

Controversial and carcinogen-related ingredient screening, applying an evidence-tiered framework, identifies only one substance (Coal Tar) with unambiguous Group 1 carcinogen status among hundreds of unique ingredients, a reassuring, precisely bounded finding that resists both alarmist overstatement and complacent dismissal.

Plant-derived ingredients constitute a substantial share of the formulation landscape, with evidentiary strength ranging from well-characterized to preliminary, underscoring the value of evidence-tiered rather than uniformly favorable treatment of "natural" ingredients.

Biotechnologically derived actives, though still a minority presence, show uneven adoption across indications, concentrated in Rosacea, nearly absent from Psoriasis, pointing to a genuine, evidence-linked opportunity for future formulation innovation.

Benchmarking marketed formulation practice against current international dermatology guidelines uncovers both reassuring alignment and concrete, actionable gaps, most notably the under-utilization of guideline-recommended Urea in xerosis products and the presence of guideline-flagged irritants in a meaningful share of sensitive-skin formulations, demonstrating that real-world product design does not uniformly track clinical consensus and identifying precisely where formulation practice would benefit most from closer evidence alignment.

Safety tiering and guideline-concordance benchmarking together elevate this work beyond description, establishing a reproducible, falsifiable methodology capable of distinguishing robust indication-specific adaptation from formulation patterns that merely appear distinctive.

Collectively, these findings offer direct, actionable value across the field: a rational formulation foundation for manufacturers, a mechanism-based reference for clinicians, and a transparent, evidence-anchored basis for consumer product selection, positioning this study as both a descriptive account and a practical tool for evidence-based advancement of the dermocosmetic sector.

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Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/cosmetics13050260/s1, Table S1: Atopic Dermatitis; Table S2: Psoriasis; Table S3: Rosacea/Redness—Prone Skin; Table S4: Xerosis/Chronic Dry Skin; Table S5: Sensitive Skin; Table S6: Wound Healing/Skin—Repair Care.

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Abbreviations

The following abbreviations are used in this manuscript:

AD	Atopic Dermatitis
PSO	Psoriasis
ROS	Rosacea/Redness-Prone Skin
XER	Xerosis/Chronic Dry Skin
SENS	Sensitive Skin
WND	Wound Healing

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