Fighting acne and more: effective natural approaches to skin care

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Synopsis

Novel natural approaches to comprehensive skin care that target the root causes of acne are presented. Three proprietary extracts are described, Tetrahydrocurcuminoids (a patented extract derived from turmeric roots), *Coleus forskohlii* oil (a patented essential oil composition from the roots of *Coleus forskohlli*), and *Kaempferia galanga* extract (a patent-pending natural extract standardized to contain 98% ethyl–p-methoxycinnamate). The use of these extracts in skin care compositions, with enhanced transdermal permeation of actives (facilitated by a proprietary patent-pending extract derived from black pepper fruit), is detailed.

Introduction

The quest for medications and cosmetic measures to combat acne continues to be a major research and development initiative in the pharmaceutical and personal care industries. Acne is reported to affect about 17 million individuals in the United States alone[1]. Its disfiguring effects have far-reaching socio-psychological consequences, particularly as the majority of sufferers are adolescents and young adults.

Acne, most commonly encountered as *Acne vulgaris*, is a follicular disorder of the skin occurring predominantly in specialized pilosebaceous units on the face and neck. There is excessive secretion of sebum by the sebaceous glands and alterations in the sebaceous ducts, leading to their blockage. Localized sebum accumulation encourages proliferation and colonization by microbes, particularly the anaerobic follicular bacterium *Propionibacterium acnes*, which under normal circumstances, is part of the normal cutaneous microflora. Further action by microbial agents such as Staphylococci results in serious infection, inflammation and lesion formation.

Ultraviolet (UV) rays from sun are a double-edged sword. Although UV-B at carefully controlled levels may have a mild anti-inflammatory and/or antimicrobial effects, and tanning tends to hide acne lesions, exposure may also manifest comedogenic effects in some individuals. UV light is reported to thicken the skin and to promote hyperkeratosis of both the skin surface and the follicle[2], providing an explanation for the observation in clinical dermatological practice that acne patients tend to get worse shortly after returning from summer vacation. Additionally, the action of UV rays on keratinocytes triggers the release of specific inflammatory mediators, which act on melanocytes augmenting the activity of the enzyme tyrosinase. Tyrosinase is a rate-limiting enzyme involved in the synthesis of melanin; excessive tyrosinase activity therefore leads to darkening of the skin.

Conventional treatment agents such as retinoids and benzoyl peroxide frequently have irritating side effects, photosensitization and occasional contact sensitization. Oral isotretinoin treatments are known to be associated with side effects including chapped lips, dry eye syndrome and xerosis of the skin.[3]

In recent years, natural approaches to combating acne and its disfiguring effects have gained popularity. Several botanicals with a history of use in traditional cultures have entered the growing 'cosmeceuticals' market. With fewer adverse side effects and the added advantage of multifunctionality, botanicals are increasingly being used in mainstream cosmetic products, including acne-fighting compositions.

Novel acne-fighting natural ingredients

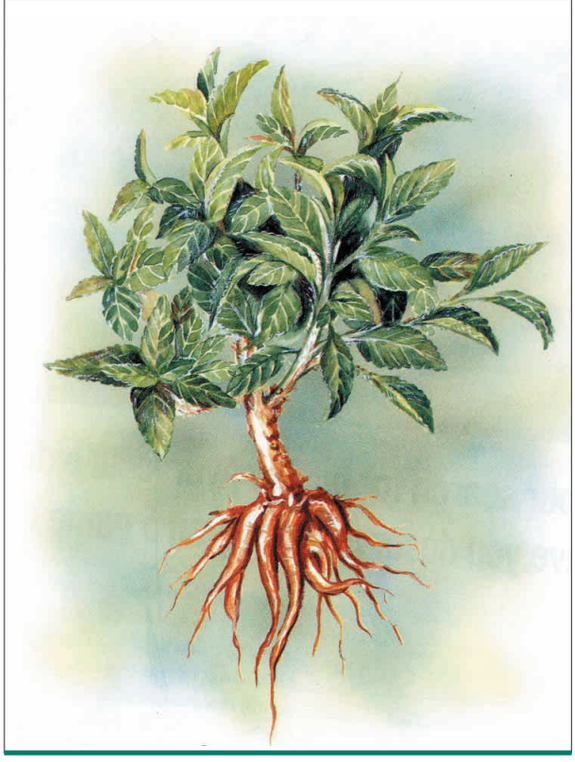
The objective is to attack the known causes and visible effects of acne. This entails antimicrobial, anti-inflammatory, 'protective' and skin lightening segments. A multi-tasking natural extract combination would be the ideal choice for a formulator seeking innovative, safe and efficacious active ingredients.

Three novel botanical approaches to inhibiting acne and diminishing post-acne scarring are described here. The plant sources of these ingredients have a long history of traditional use.

Coleus oil (INCI: Coleus forskohlii oil)

Coleus oil is an essential oil extracted from the roots of *Coleus forskohlii*. The oil finds useful applications in flavor and fragrance preparations as well as in aromatherapy. *Coleus forskohlii* belongs to the natural order Labiatae (Lamiaceae), a family of mints and lavenders. This species is a perennial herb with fleshy, fibrous roots that grows wild in the warm sub-tropical temperate areas in India, Burma and Thailand.

Picture 1: *Coleus forskohlii* roots



In India, the plant is cultivated for use as a condiment or pickle. In recent years *Coleus forskohlii* has gained pharmacological importance as the only known plant source of the adenylate cyclase activating compound, forskolin.[4] Forskolin-rich extracts are commercially obtained from the roots which also yield a viscous, dark brown colored essential oil containing a range of aroma constituents that collectively impart a pleasing delicate aroma with a spicy note. The oil can be obtained as a valuable by-product of forskolin-rich extract production, without detrimental effects on the yield of forskolin. The newly discovered antimicrobial properties of the oil (of specific composition obtained using a proprietary extraction process), render it useful in topical preparations.

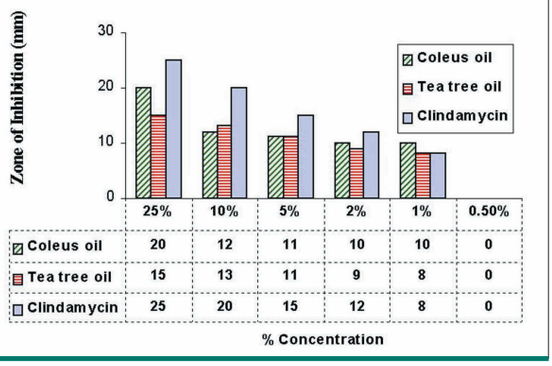
Over forty compounds belonging to four classes of aroma compounds have been recovered from oils obtained from various indigenous genotypes of the *Coleus forskohlii*. These include sesquiterpenes, sesquiterpene alcohols, monoterpenoids and diterpenoids. The presence of compounds such as 3-decanone (about 7%), bornyl acetate (about 15%), sesquiterpene hydrocarbons and sesquiterpene alcohols in major concentrations imparts unique pleasing spicy notes to the essential oil. β-sesquiphellandrene (about 13%) and γ-eudesmol (12.5%) were identified in experimental studies on the oil.[5]

A specific composition of the oil prepared by a proprietary patented process,[6] was found to be particularly effective against *Propionibacterium acnes*, the microorganism implicated in acne. The process used is a carefully controlled solvent-free supercritical extraction technique. In addition, this composition was found to be active against other microbes known to be associated with skin infections and eruptions. Another potential application is in oral care products where the oil was found to be effective in preventing the growth of *Streptococcus mutans*, a causative microorganism for dental caries.

In laboratory studies[6], Coleus oil was found to more effectively inhibit the growth of skin pathogens including *Propionbacterium acnes* (associated with acne)[7], *Staphylococcus aureus* (a bacterial strain found in infected wounds and skin eruptions including acne)[8], *Staphylococcus epidermidis* a bacterial strain occurring in a variety of opportunistic bacterial skin infections and in acne[7], than the well known tea tree oil. Additionally, Coleus oil was found to inhibit the yeast culture *Candida albicans* more effectively than tea tree oil. Mucocutaneous candidiosis is often reported to be

associated with acne[9]. Figure 1 shows the comparative effects of coleus oil, tea tree oil and the conventional antimicrobial, clindamycin against *Propionibacterium acnes*.

Figure 1



	25%	10%	5%	2%	1%	0.50%
Coleus oil	20	12	11	10	10	0
Tea tree oil	15	13	11	9	8	0
Clindamycin	25	20	15	12	8	0

The extract is safe to use in cosmetic formulations, it does not irritate the skin and its pleasant woody aroma blends with a range of compositions.

Kaempferia galanga (INCI: Kaempferia galanga root extract)

Kaempferia galanga (Lesser galangal, kencur), and *Alpinia galanga* (greater galangal) from the Zingiberaceae family are commonly used as spice ingredients and medicinal herbs in South-east Asia and are valued traditionally for their skin protectant action. One patented application of *Kaempferia galanga* pertains to its action against ultraviolet rays and function as a 'booster' that augments the activity of conventional sunscreens. *Kaempferia galanga* rhizome contains about 1.5 to 2% essential oil, whose main components are ethyl cinnamate (25%), ethyl-p-methoxycinnamate (30%) and p-methoxycinnamic acid. *Kaempferia galanga* is a good natural source of a biologically active ester compound ethyl p-methoxycinnamate[10]. The antifungal action of ethyl-p-methoxycinnamate is reported in the literature.[11]

A natural extract obtained from the roots of *Kaempferia galanga* (patent pending) uses a proprietary extraction process to prepare a specific composition. The resultant extract composition has antimicrobial action and tyrosinase inhibitory functions, suggesting its multifaceted benefits in acne fighting formulations. The extract prepared as above was found to be active against *Propionibacterium acnes*, its activity being several-fold greater than that of conventional *Kaempferia galanga* extract.

To test the comparative antibacterial activity of the extracts against *Propionibacterium acnes*, the organism was first cultured in an anaerobic environment, and grown on prepared plates containing reinforced clostridial agar (RCA) with graded amounts of either conventional *Kaempferia galanga* extract or the novel composition. The plates were incubated anaerobically at 37° C for 48 hours and zones of inhibition were measured and compared to untreated control plates. The novel composition was far more effective than conventional *Kaempferia galanga* extract in inhibiting *Propionibacterium acnes*, producing significant zones of inhibition at concentrations even as low as 0.5%.

A tyrosinase inhibiting assay was carried out using standard methods. Briefly, test tubes containing L-tyrosine, tyrosinase, phosphate buffer and graded amounts of the potential inhibitors were incubated at 37°C for 20 min. and absorbance was recorded at 475 nm. Inhibitors were prepared in DMSO (dimethylsulfoxide) in graded concentrations and appropriate control tubes prepared with DMSO alone. On comparing the results, it was found that the inhibitory concentration (IC50) for the proprietary extract was over 5 fold lower than that for conventional *Kaempferia galanga* extract.

These results indicate that the new composition provides enhanced antimicrobial action against *Propionibacterium acnes*, as well as more efficacious tyrosinase inhibition.

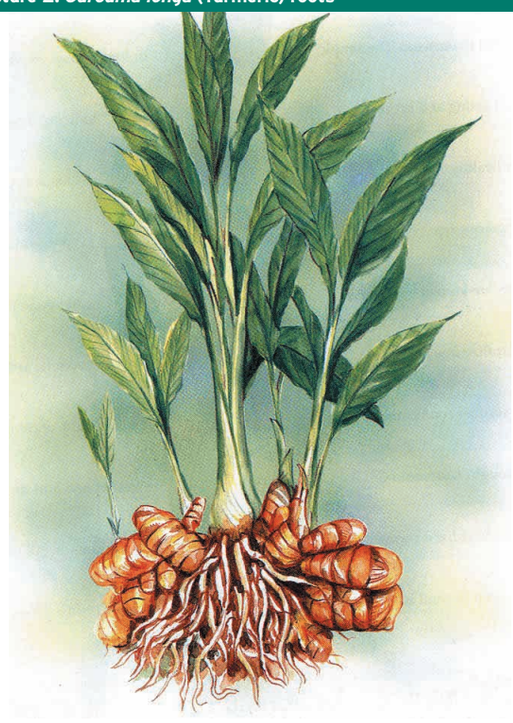
Use of this extract would therefore potentially benefit in the management of acne as well as in reducing post-acne scarring, pigmentation and blemishes.

Tetrahydrocurcuminoids

A natural "antioxidant" composition offers added benefits in supporting skin texture, appearance and tone.[12] Its multi-faceted effects include overall protective effects, anti-inflammatory, antimicrobial and immune system supporting effects that are particularly relevant in the management of acne.

South Asian women have traditionally used turmeric roots for skin care. The yellow color of turmeric however presents a challenge to current formulators who wish to use this healthful extract. An innovative approach helped develop a colorless (white to very light tan) derivative, tetrahydrocurcuminoids, which retains and in some instances, surpasses the health benefits of yellow turmeric extract. This composition is a colorless hydrogenated derivative of the natural yellow curcuminoids (curcumin, demethoxycurcumin, bisdemethoxycurcumin)*

Picture 2: *Curcuma longa* (Turmeric) roots



from *Curcuma longa* (Turmeric). The controlled process yields a composition containing specific amounts of tetrahydrocurcumin (INCI: tetrahydrodiferuloylmethane), tetrahydrodemethoxycurcumin (INCI: tetrahydrodemethoxydiferuloylmethane), and tetrahydrobisdemethoxycurcumin (INCI: tetrahydrobisdemethoxydiferuloylmethane). These compounds are reported to be major metabolites of curcuminoids *in vivo*, in experimental studies.

A novel composition of tetrahydrocurcuminoids helps to regulate random, intracellular protein cross-linking and to optimize skin cell electric potential. These benefits are manifested in the form of effective tyrosinase inhibition, and in affording protection to the skin against UVB radiation and chemical, physical and biological irritants. The combined effects are described as "bioprotectant"[13] (the ability to prevent free radical formation and scavenge free radicals in biological systems), and Crossregulin®**[14] action (preventing intracellular protein cross-linking). The antioxidant effects of curcuminoids combined with their known inhibitory effects on cyclooxygenase 2 (COX-2) render them useful as ingredients in anti-aging formulations and in topical formulations designed to maintain general skin health and integrity. Tetrahydrocurcuminoids have also been found to inhibit the activity of tyrosinase, an enzyme that participates in melanogenesis, thereby preventing melanin formation with resultant lightening of the skin tone. These biological properties of the tetrahydrocurcuminoids combined with their lack of yellow color, render them useful in achromatic cosmetic applications.

The UV protectant, protein integrity support, tyrosinase inhibitory and antioxidant properties of tetrahydrocurcuminoids would work together in an anti-acne/acne care formulation to provide multifaceted benefits. In standard toxicological and skin irritation potential evaluation studies, Tetrahydrocurcuminoids were found to be safe and well tolerated, producing no irritation or sensitization.

A novel natural extract added in small quantities to formulations containing other natural extracts enhances their transdermal permeation and uptake.[15] Tetrahydropiperine, a compound present in small amounts in black pepper and long pepper extracts, is derived from the pungent compound piperine in these extracts using a proprietary patent pending process. This process produces a concentrate containing 98% tetrahydropiperine in the form of a light tan powder suitable for use in cosmetic formulations and topical delivery systems for drugs, nutrients and other bioactives. When added in low amounts (0.01-0.1%) to such formulations, this product enhances the uptake and bioavailability of actives in the

Picture 3: *Piper nigrum* (Black pepper)

formulations. Enhanced permeation was observed in studies with other active materials including *Coleus forskohlii* extract (forskolin), green tea extract (polyphenols) and tetrahydrocurcuminoids (derived from Turmeric root extract). For example, the permeation of forskolin was enhanced when the concentration of tetrahydropiperine was 5% of forskolin concentration. Similarly, about 30% improvement in bioavailability of the other botanical extracts was observed when they were co-administered with tetrahydropiperine.

In view of these properties, tetrahydropiperine is a potential transdermal 'bioavailability' enhancer when co-administered topically with nutrients or other active compounds. In standard safety evaluations, the extract showed no irritation or sensitization effects.

Conclusion:

Sustained research, innovative technological processes and a focus on safety are targeting botanicals from ancient traditions as effective contemporary skin care ingredients. The result in this case is manifested in gentle, efficacious, natural approaches to fighting acne.

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