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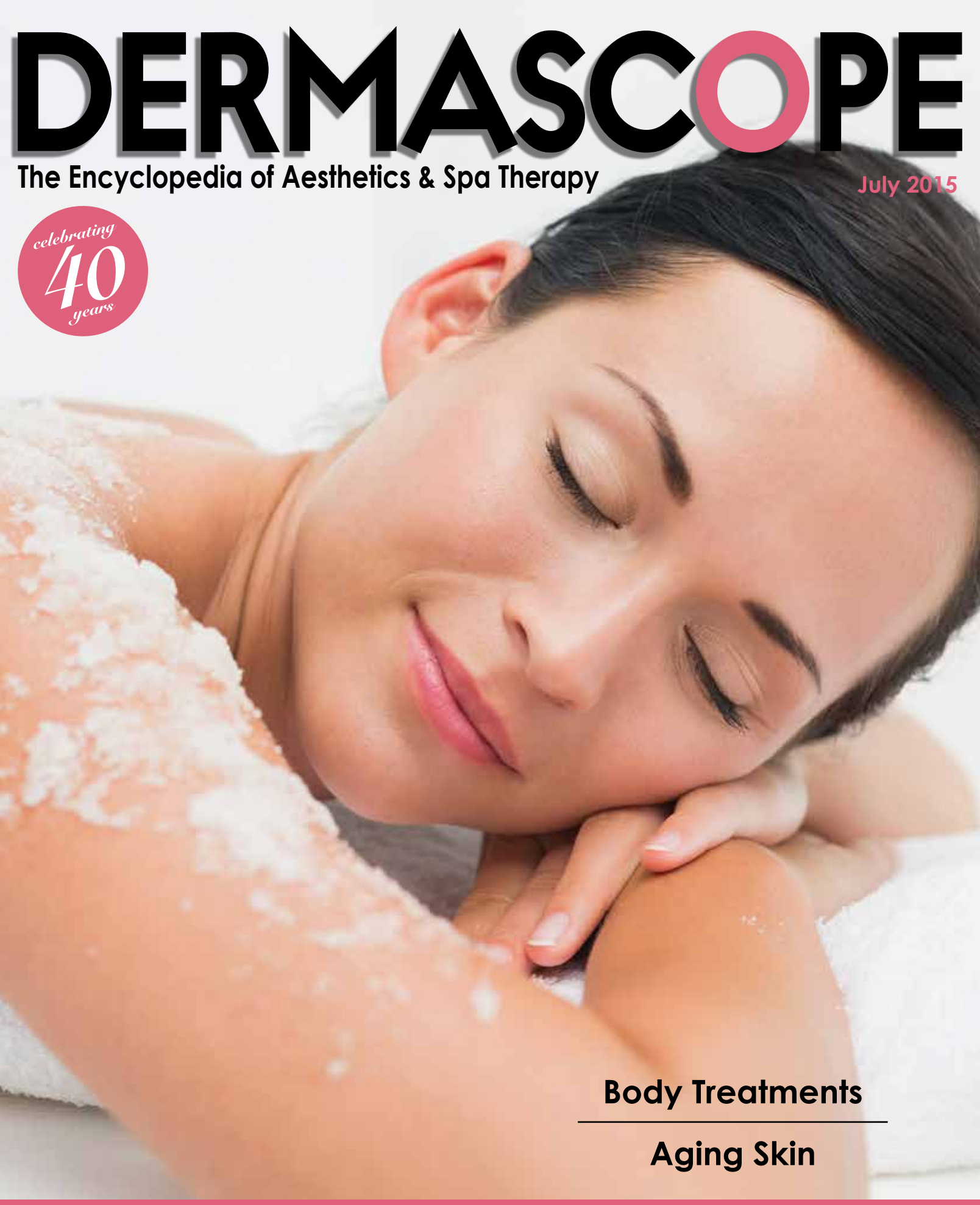

Body Treatments

Aging Skin

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The Ingredients *Column*

Topical Delivery: Are We There Yet?

by Diahne Patnode

Topical delivery platforms in cosmetic formulations can target specific skin layers, improve ingredient stability, reduce the potential for irritation, and enhance ingredient availability to the skin, thus, increasing product performance. These multi-faceted systems have the potential to transform the way cosmetic formulas are put together and drive delivery platform innovation.

While offering additional cosmetic benefits, versatile platforms can be applied as delivery vehicles for high molecular weight and lipophilic and hydrophilic cosmetic ingredients.

Permeability and Penetration

Skin provides a protection barrier via a lipid matrix that is highly organized in lipid bilayers and possesses lipophilic properties in the uppermost layer. The absorption of ingredients is limited by the low permeability of the skin, leaving most ingredient substances unable to penetrate the skin. Most cosmetic ingredients favorably exert their effects on the skin surface, but the functionality of the ingredient depends on its biological activity and the concentration needed to achieve a biological effect. Successful delivery of particular ingredient substances across the skin barrier can result in an increase in function and efficacy of the ingredient.

Cosmetic Ingredient Enhancers

The permeation process involves the diffusion of molecules that move from high concentration areas to low concentration areas. Permeation can occur via transdermal permeation, intercellular permeation, hair follicles, sebaceous glands, and sweat glands. Cosmetic enhancers may act on one or more mechanisms, including interaction with intercellular protein, improved partition of the substance, co-enhancer or solvent into the stratum corneum, and the disruption of the organized structure of the stratum corneum lipids.

Cosmetic enhancers include dimethyl isosorbide, pentylene glycol, ethoxydiglycol, and ethanol. They provide a fast pass to selective ingredients that carry the substances into the skin.

Cosmetic ingredient enhancers also include occlusive ingredients such as dimethicone. Used as a method to enhance penetration, occlusion is created by a depositing effect into the specific location in the stratum corneum.

Encapsulation

Encapsulation systems allow for increased skin absorption, prolonged active effect, and controlled release of actives. Encapsulation technologies serve as a cornerstone for major advances in the performance of formulations with a plethora of ingredient types used, such as actives, performance, functional ingredients, fragrance, and sensory agents.

Mechanism of Liposomes

With a long history of use in cosmetics that spans 40 years, liposomes are used as carriers that keep active substances from being limited by their physico-chemical characteristics. The basic liposome molecule is one part water-loving (hydrophilic) and one part lipid-loving (lipophilic). Liposomes have the unique ability to compartmentalize and carry hydrophilic, lipophilic, and amphiphilic active substances. This feature, coupled with biocompatibility and biodegradability, make liposomes very attractive as a delivery platform.

A unilamellar phospholipid liposome technology by the Lonza Group is commonly applied to increase the stability and functionality of vitamins, including retinyl palmitate, tocopherol, ascorbyl palmitate, and beta-carotene. Additionally, the phospholipid portion of the liposomes imparts positive skin benefits.

Next-Generation

A new generation of liposome derivatives present a vast area where advances have already been achieved and continue to expand. The benefits and limitations of liposomes, that influence the behavior in biological systems, are based on characteristics such as size, composition, loading efficiency, and stability.

New generation technology includes nanoparticle spheres for specific ingredient retention, release ability based on ionic strength for targeted delivery, and rigid microspheres for optical blurring. Lipid forming liposomes may be natural or synthetic; liposome constituents are not exclusive of lipids.

Air Products has next-generation delivery platforms that increase ingredient availability to the skin by utilizing highly purified phospholipids with a high content of linoleic acids to

form flexible membranes. The high linoleic acid component of the delivery system also helps to provide positive cosmetic benefits, including improvement in skin smoothness and feel. Air Product's expanded library also includes delivery technology that encapsulates ultraviolet filters in a hydrophilic medium, enabling it to be added to the water phase of a formula to provide long-lasting adhesion.

Sytheon offers a next-generation liposomal delivery system specifically designed to rebuild extracellular matrix proteins with a unique bi-pyramidal structure liposome.

Kobo Products' various delivery systems are differentiated for targeting specific skin layers. Other platform attributes include protection of ingredients, protection of formulas, and the reduction of irritation potential with lower use levels of the key claim ingredients.

Time Release versus Rapid Transport

Modification of liposomes with next-generation technology permits a passive and active targeting that enables a more rapid transport with focus on the particular ingredient substance. Rapid transport can also decrease irritation potential of the encapsulated ingredient by reducing prolonged contact with the skin surface.

Via encapsulation, a controlled delivery can be achieved by several mechanisms. Salvona's technologies concentrate on controlled diffusion and release for applications such as fragrance, antimicrobials, and other ingredients requiring triggered, targeted, or multiple release points from the encapsulated spheres. One Salvona system, a double-layered encapsulation of the active, provides a unique liposome structure to protect the encapsulated active from oxidation, heat, and premature release.

Lonza's controlled release polyurethane encapsulates are temperature and dissolution resistant with the benefit of selecting a lipophilic or hydrophilic active.

Formula as a Carrier

Kemin Industries' latest platform is a natural, plant-based lysophospholipid. The micelle structure of the single-chain fatty acid molecules forms tight emulsions that facilitate delivery of particular performance ingredients. Clinical studies indicate successful delivery of niacinamide and CoQ10 across tissue culture barriers.

A liquid crystal-promoting ingredient by HallStar is a complex combination of fatty acids that are olive-oil derived. Liquid crystals are formed from alternating layers of fatty acids and water that mimic the stratum corneum's intercellular lipid matrix tridimensional organization. Liquid crystals have the ability to penetrate the inner layers of the stratum corneum, integrate into the stratum corneum's intercellular lipid lamellar matrix, and become part of the barrier layer. With occlusive emolliency and dermo-compatibility, liquid crystals can stabilize lipophilic ingredients and create an area of adhesion that leads to the physiological delivery of water-soluble active ingredients.

Multiple phase emulsion technology, such as water-in-silicone-in-water, is often integrated as a delivery system for a variety of polar and non-polar ingredients, including emollients, moisturizers, sunscreens, antiperspirant actives, and pigments.

Micro-emulsions are also emerging as a delivery system. These clear, colorless emulsions are at a disadvantage due to the high proportion of emulsifiers. Although they are currently difficult to incorporate into final formulations, innovation continues in this platform.

Hydrogels consisting of humectants, a solvent, and a polymer are clathrates of glyceryl acrylate and polyacrylic acid that enclose water molecules and release them upon exposure to the skin's pH, surface moisture, and temperature.

More Delivery

Novel platforms continue to be explored and StarletDerma's out-of-the-box innovation is via the mechanism from sea anemones. Within the array of tentacles that cover the sea, anemone are nematocysts, or micro-injectors. When in contact with water-based formulations, the high levels of osmotic pressure trigger the "firing" of the nematocysts. Clinical results indicate rapid and effective delivery to the epidermal layer of the skin for both small and large molecular ingredients.

While most cosmetic ingredients are able to exert their effects on the skin surface, various delivery technologies are applied to overcome particular ingredient substance challenges. Encapsulation technology can be applied to stabilize sensitive ingredients, such as retinol, and can encompass a wide array of potential cosmetic benefits. Delivery platforms and ingredient enhancers allow formulators to achieve high performance cosmetic formulations.

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