

## New Delivery Systems for Topical Nutraceutical (Nutracosmetic) and Cosmeceutical Formulations

a report by

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World consumers are focused on their health, wellbeing and appearance now more than ever before, with such terms as 'natural', 'organic', 'no artificial preservatives', 'no animal ingredients' and 'non-animal tested' drawing formidable attention. This trend is creating heightened demand for products formulated with nature-based cosmeceutical and nutraceutical ingredients. Efficacious ingredients and innovative delivery systems are driving the new product development arena.

An innovative delivery system can improve both the aesthetics and performance of a cosmetic product. Most current delivery systems for nutraceutical products are based on direct ingestion. The oral delivery systems pose issues relative to their unacceptable odour and taste and degradation of nutraceutical itself during its transport from the digestive system to the site of desired action. The topical delivery systems circumvent some of these issues due to their application near or at the site of affliction. Nutraceutical and cosmeceutical ingredients are finding their applications in topical alternative medicine.

Nutracosmetics are an emerging class of health and beauty aid products. They combine the benefits of nutraceutical ingredients with the elegance, skin feel and delivery systems of cosmetics. Nutracosmetics and cosmeceuticals thus differ in the origin of their functional ingredients. Nutraceutical ingredients formulated in cosmetic delivery systems constitute nutracosmetics, whereas cosmeceuticals are cosmetics formulated with pharmaceutical-type ingredients.

The nutraceutical ingredients-based topical delivery systems can be formulated as functional cosmetics (nutracosmetics) to complement the efficacy of their ingestion-based counterparts. However, the product development of these functional cosmetics faces challenges unique to each nutraceutical ingredient and its targeted body organ for specific benefits, for example the inclusion of a dietary fibre in a functional cosmetic to provide reduced cancer risk. Benefits of the fibre are not viable due to insignificant absorption of that fibre through a topical

delivery system. The incorporation of nutraceutical supplements in functional cosmetics requires special considerations relative to the aspects of product appearance, dosage level, cosmetic benefits, storage stability, bioavailability, efficacy and cost. These activities require a combination of cosmetic and pharmaceutical product development technologies.

The US Food and Drug Administration (FDA) regulates the formulation of cosmetic products in the US. Specific product claims may determine their status as either drugs or cosmetics. For example, the FDA may view a topical product that contains both methylsulphonylmethane (MSM) and *Capsicum oleoresin* as a cosmetic if it does not declare claims relative to the arthritis pain-relief function of either ingredient. This same product may be viewed as an over-the-counter drug if pain-relieving action of only *Capsicum oleoresin* is claimed. However, if arthritis pain-relief properties of both MSM and *Capsicum oleoresin* are claimed, a New Drug Application may be required for that combination product by the FDA, since MSM is not currently classified by the FDA as a drug ingredient. The regulatory requirements of other countries vary.

It is envisioned that a combination of popular nutraceutical and cosmeceutical ingredients (see *Box 1*) in bioavailability enhancing topical delivery systems may offer advantages that may surpass their delivery by any single method alone. This aspect could open new marketing concepts to provide increased consumer awareness and appreciation for both nutraceutical and cosmeceutical ingredients in nutracosmetic delivery systems.

### Antioxidants/Anti-ageing

Among more noteworthy ingredients, co-enzyme Q10 (CoQ10) (see *Figure 1*) is a potent antioxidant that is essential for energy production for body functions via its participation in nicotinamide adenine dinucleotide cytochrome C-reductase enzyme-catalysed intracellular electron transport mechanisms. CoQ10 is commonly utilised in combination with other nutraceutical ingredients due to its synergistic action. In the formulation of combination products, it



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**Box 1: Popular Nutraceutical Ingredients****Antioxidants/Anti-ageing**

Co-enzyme Q10  
 Vitamin E  
 Vitamin C  
 Rosemary  
 Turmeric  
 Magnolia bark  
 Artichoke leaf  
 Olive leaf

**Muscle and joint**

Methylsulphonylmethane  
 Chondroitin  
 Glucosamine

**Anti-inflammatory**

Boswellia serrata  
 Ursolic acid/oleanolic acid  
 Rosmarinic acid  
 Ruscogenins  
 Darutoside  
 Asiaticoside  
 Sericoside  
 Harpagoside (devil's claw)  
 Magnolia bark (honokiol, magnolol)

**Body Slimming**

Hydroxycitric acid  
 Forskohlin (*Coleus forskohlii*)  
 Ruscogenins  
 Niacinamide  
 Niacinamide hydroxycitrate  
 Phaseolamine  
 Caffeine

**Diabetes**

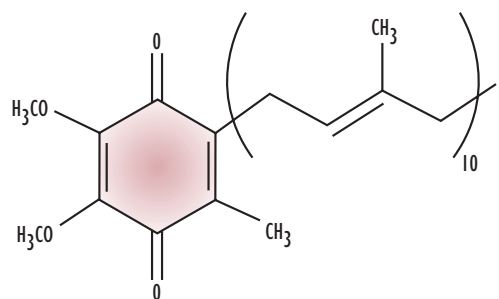
Bilberry  
 Gymnema sylvestre  
 S-adenosyl methionine  
 Momordica charantia  
 Fenugreek  
 Corosolic acid (banaba)  
 Salicinol (salacia)

**Memory Enhancement**

Vincamine  
 Vinpocetin  
 Yohimbine  
 Huperzine  
 Ginkgo biloba  
 Rhodiola  
 Bacopa (brahmi)  
 Citicoline  
 Phosphatidyl serine

is worth mentioning that CoQ10 has a quinone molecular structure that may be reactive towards primary and secondary amine and sulphhydryl (thiol) groups. The combination of CoQ10 and glucosamine (a primary amine), for example, may result in the loss of activity of both ingredients due to their chemical reaction with each other. The use of reduced glutathione (a thiol) with CoQ10 may result in a similar reaction with each other.

The topical formulation of CoQ10 offers significant challenges from a bioavailability point of view. CoQ10 is insoluble in water. It also has poor solubility in many fatty emollients commonly used in topical preparations. The topical formulations that contain CoQ10 in a solid state (powder, micronised powder) usually provide poor absorption and inadequate bioavailability. It is an expensive ingredient with a bright yellow to orange colour. Topical products that contain any significant amount of this ingredient are yellow in colour. The use of a large amount of this ingredient in a topical preparation may lead to staining of the skin and yellowing of fabrics. The development of topical formulations to provide both enhanced absorption and bioavailability, therefore, is of current commercial interest. CoQ10 formulations that incorporate solubilised forms of this ingredient usually provide better absorption and bioavailability.

**Figure 1: CoQ10 (Ubiquinone)**

A number of recently introduced organic solubilising emollients are excellent choices for this function. These solutions of CoQ10 can be formulated in various lotions, creams, clear gels and spray delivery systems to provide a dual performance. Enhanced absorption and bioavailability of CoQ10 and improved skin feel and skin protection action is delivered by these emollients.

The antioxidant applications of vitamin E and vitamin C are legendary. Ample information is available elsewhere also on various derivatives of vitamin C. ■

*This article is continued, with additional graphics and references, on the BBL website supporting this business briefing ([www.bbriefings.com/cdps/cditem.cfm?NID=846](http://www.bbriefings.com/cdps/cditem.cfm?NID=846)).*