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Green Issues

Natural Ingredients
Low-energy Emulsification
In vitro vs. In vivo Testing

Formulating with Natural Ingredients

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The challenge of formulating a 100% natural product has become the Holy Grail of many natural formulators, and there is no doubt that some products can be made that satisfy this criterion. If the objectives are honestly set and the criteria are rigidly adhered to, however, the resulting product may well be substandard, at least to the extent the emulsifier, the preservative and the fragrance will lack sophistication.

Certain aspects relating to natural formulation have been discussed in the past, particularly natural preservatives^{1,2} and natural color;³ these aspects will not be covered again here.

The Range

Let us suppose that our product range will consist of a cleanser, toner, moisturizer, night cream, eye gel and facial wash. The target skin type is going to be dry, sensitive, and "prone to flare ups and redness." This consumer type is probably everybody's worst nightmare.

Active Ingredients

The first objective is to consider the active materials most likely to be employed in each product. Clearly, those materials that are antipruritic, anti-erythema, and have vulnerary properties are going to be of most use with this skin type. The chances are that such a person will already have a degree of skin damage caused by previous episodes of skin irritability, so the inclusion of cicatrizing materials may be appropriate.

We also need to consider the levels at which these materials are going to be incorporated and the quality of the extract that is going to be employed. If the extract materials are not standardized to an active chemical constituent, then there is no point in using them. Likewise, if you believe that an infinitesimal quantity incorporated into the formula is going to have any benefit, it is clear that the concept of "profit margin" is going to be more important than "product efficacy."

Excipients

The base components should be of natural origin also; this is often the hardest part of the formulation process.⁴

Eye Gel

It is difficult to conceive of an eye gel that does not use carbomer as the primary gellant, but the arrival of a material that is a blend of konjac mannan flour and xanthan gum (Glucovis 50, Chesham Chemicals Ltd, Harrow, UK) has great promise as well as good natural credentials. Its absorption and spreading attributes are also excellent. As with all things, there has to be some pain associated with this gain; here, it comes at the expense of the crystal-clarity possible when using carbomer.

The choice of beneficial ingredients for an eye-area gel is quite extensive. The immediate thoughts would be for eye-bright (*Euphrasia officinalis*), fennel (*Foeniculum vulgare*), cornflower (*Centaurea cyanus*) or cucumber (*Cucumis sativus*). One or more of these should be supplemented with a percentage of vegetable glycerin, and a traditional approach would include a small quantity of rosewater to offset any base odors that might be present.

Toner

Alcohol is a natural product if it is of a fermentation grade, but unfortunately the current denaturant is not. In the old days, alcohol could be denatured with quassia (*Picrasma excelsa*), which was an extremely bitter plant extract that even conferred a degree of antibacterial protection to the skin. One can understand the reluctance of the Customs & Excise to allow it back in to the UK,

Key words

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Abstract

Plant materials can provide the active ingredients and excipients for a range of skin-care products, and their phytochemistry enables them to provide genuine skin-care benefits.

especially as our industry bullied them mercilessly for years to allow us to use Bitrex!

We are drawn towards witch hazel (*Hamamelis virginiana*), a discovery of the North American Indians, which contains natural alcohols and tannins. You are advised to check that the material you are using is pure witch hazel, however. Otherwise, additional alcohol (up to 15%) may have been added to improve the clarity and stability of the extract.⁵ The tannins (hamamelitannin especially) will provide skin-firming properties, but the extract also contains catechin elements normally associated with green tea, such as galloocatechin, epicatechin and epigallocatechin,⁶ so one might reasonably expect some free-radical scavenging activity as well. The skin-repairing properties of witch hazel are legendary, as are its successes in the treatment of hemorrhoids (for which it is pharmaceutically licensed in the UK).

In our scenario, it is unlikely that this eye product is going to need to be too aggressive, so one could use materials like allantoin (a material naturally found in comfrey, *Symphitum officinale*) to help repair skin blemishes. Keep the product on the acidic side, because one source has suggested that allantoin could be unstable at alkaline pH.⁷ The benefits of allantoin are well documented.^{8,9}

Another material that is reliable and safe for eye gels is elderflower water (*Sambucus nigra*). A good quality of this material should provide a sweet and refreshing addition to the product's fragrance as well as contributing a gentle astringency. For the marketing claim and the tonic caffeine, what could be more attractive than the 'Zoom' of guarana (*Paullinia cupana*) from the South American rainforest?

Sorbitol and glycerin are good choices for addition as humectants.

Facial Wash

The search for a truly natural surfactant continues. It was surely a disappointment to learn that betaine (from *Beta vulgaris*, the sugar beet) was not going to be the natural foaming agent of our dreams.¹⁰ However, betaine is a good anti-irritant and conditioner, and it shows

other beneficial skin properties. It would still form a part of the facial wash formula.

The use of triterpenoidal-saponin-bearing plants remains the only truly 100% natural means of producing a natural foam in our product. The foam thus produced is both delicate and mild enough to clean precious antique laces and tapestries, but saponin-containing extracts are normally quite brown. The main choices would be soapwort (*Saponaria officinalis*), soapberry (*Sapindus indica*) and soap bark (*Quillaja saponaria*), with a first reserve of yucca (*Yucca schidigera*). These plants do have a hemolytic action, but then so do alkyl polyglucosides (APGs), which would be one of the first choices for ingredient compromises to the totally natural concept. Another possible cheat is to go for sugar derivatives, such as methyl gluceth-20 (available as Glucam E-20, from Amerchol), but this does not bring a lot of comfort to the purist. The old "naturally derived" plea used by the coconut brigade is another admission of defeat.

A very recent paper by Mainkar and Jolly (2001) examined a formula for a shampoo based on saponins (10%), APG (10%) and xanthan gum (1%).¹¹ The authors considered this to be "natural," and indeed, that formula may be about the best one can do at this point. Many saponin-bearing plants exist; it is probably only a matter of time until a serviceable material is extracted for use in our industry. However, using large quantities of expensive plant derivatives seems pointless in a product that is destined to go down the drain.

Cleanser

A beeswax-borax emulsifier system produces a water-in-oil emulsion, but these old "cold cream" emulsions are heavy and unsophisticated. The use of lecithin (which could be soy-derived) as an emulsifier offers some promise, as does the use of casein (a milk derivative). Once again, the cheats will win! Ethoxylated olive oil derivatives and the recently launched soya sorbitol (INCI name) yield excellent results as emulsifiers to anyone patient enough to experiment. True, they are not 100% natural, but they are commercially sophisticated. This is a world of compromise.

In a cream cleanser product, one would expect to have a good sebum solvent. In this area, there could be little better than jojoba (*Buxus chinensis*), a liquid wax. Other oils, such as coconut (*Cocos nucifera*) and palm (*Elaeis guineensis*), are perfectly adequate to fulfil the cleansing purpose.

Moisturizer

The emulsifier question does not go away in a moisturizer, but in this leave-on product, one also wants to load materials that are going to provide real benefit. The use of plant actives allantoin (0.2%), α -bisabolol (0.25%) and β -sitosterol (0.25%) will provide anti-inflammatory, healing and soothing effects.

I saw a brand-new emulsifier blend introduced at a launch party in Seoul, Korea in March of this year: Versaflex 175, from ICI (Uniqema), offers a blend of sucrose palmitate, glyceryl stearate, glyceryl stearate citrate, sucrose, mannan, and xanthan

gum, which is completely natural. The recommended use level is 1%.

The addition of materials such as rosehip seed oil (*Rosa aff. rubiginosa*) from the slopes of the Chilean Andes will bring solutions to scarring,¹² ulceration,¹³ and pigmentation effects. The presence of retinoic acid is disputed, however. An analysis sheet from Siber Hegner on "Aceite de Rosa mosqueta Lote 107" by SGS Chile Ltda. states that the analysis of a batch of rosehip seed oil contained 0.83 mg of trans-retinoic acid/100 g of oil. This would explain quite conveniently many of the properties of this oil. Unfortunately, a study later carried out at King's College London University using rosehip seed oil from other sources did not confirm these findings.

The use of German chamomile (*Chamomilla recutita* or *matricaria*) as an extract (with the flavonoid apigenin in it) or as an essential oil (which contains azulene and bisabolol) can reduce erythema, inflammation and skin irritation. Such actions are extremely desirable in skin-treatment products.

Free-radical scavengers such as *Ginkgo biloba* and green tea (*Camellia sinensis*; Syn. *Thea viridis*) would make useful additions to help protect the skin from environmental attack. Zinc oxide would protect the skin from UV damage as well as helping to heal existing skin damage.¹⁴

You might like to check out Neo Heliopan Galanga, a *Kaempferia galanga* extract from Haarman & Reimer, which contains isoamyl *p*-methoxycinnamate, thus offering a naturally occurring organic-chemical sunscreen active.

Night Cream

The night cream should compliment the moisturizer or day cream — and provide additional elements.

Materials like liquorice (*Glycyrrhiza glabra* or *G. uralensis*) provide a source of 18- β -glycyrrhetic acid and glycyrrhizic acid (also available as natural actives), which are highly regarded for their anti-inflammatory and anti-erythema properties.

The use of *Aloe vera* (*Aloe barbadensis*) at a high level (namely 10% of a 10:1 concentrate) has a proven physiological effect on skin that has been compromised by thermal,^{15,16} X-ray¹⁷ or solar¹⁸ radiation. A full review of aloe was recently published.¹⁹

Numerous other materials could be mentioned. Gotu kola (*Centella asiatica*)²⁰ has many soothing, calming, anti-edema skin properties to entice the formulator. Other useful additions would include honey (*Mel*), heart-sease (*Viola tricolor*), and self heal

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(*Prunella vulgaris*). Self heal is particularly useful, because it enables the word "heal" to legally appear in the package copy without invoking product regulation as a drug.

Conclusion

While this article is certainly not a full treatise on the use of natural products in skin care, it should have demonstrated that natural materials can be more than just marketing words to make the sales copy look pretty and

enticing on a package. Good phytochemistry can justify using plant materials for genuine skin benefits.

The old adages apply perfectly in this scenario: "You get what you pay for" and "garbage in, garbage out!"

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