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R.G. Harry Cosmeticology 8th. edition
BOTANICALS IN COSMETICS & TOILETRIES

Anthony C. Dweck BSc CChem FRSC FLS FRSH
Consultant, Dweck Data, 8 Merrifield Road, Ford, Salisbury, Wiltshire SP4 6DF, UK

Introduction

From the very beginnings of time Man has been using botanical materials for the beautification and care of the skin. It would be impossible to write about every single botanical extract that is commercially available for use in cosmetics and skin care today. However, it is possible to present a tempting cross-section of the types of materials that are available and to encourage the formulator to explore the treasure chest of Nature's rich bounty.

Definitions of natural

We must first define by what we mean by "natural", and though this is not legally defined, an undisputed description would be "any material that is harvested, mined or collected, and which may have subsequently been washed, decolourised, distilled, fractionated, ground, milled, separated or concentrated in order to leave a chemical or chemicals that would be available and detectable in the original source material". As an additional consideration one should include "the modification of natural material by the action of micro-organisms, enzymes or yeasts in order to modify or increase the yield of material by this process." (The classic example is the production of alcohol by the action of yeast on sugar).

The definition of "naturally derived" would be the use of a natural raw material as the starting point in a chemical process to produce a new chemical or chemicals that in themselves may not be available in nature or in the starting material. An example of this would be the sulphation and ethoxylation of fatty acids obtained from coconut to produce sodium lauryl ether sulphate (CTFA Sodium laureth sulfate).

The definition of "nature identical" is a substance that has been produced synthetically, not usually from a natural starting material, in order to produce a material that is identical to that naturally occurring in nature. An example of this would be Vitamin E from wheat as opposed to that made from a petrochemical starting point. Another example would be the synthesis of α-bisabolol (a component naturally occurring in chamomile). The nature identical materials are considerably cheaper, and often occur as racemic mixtures, whereas the natural form is the single, optically active variety.

Definitions of available sources

Definitions from the European Pharmacopoeia third edition (Council of Europe)

Extracts

Extracts are concentrated preparations of liquid, solid or intermediate consistency, usually obtained from dried vegetable or animal matter. For some preparations, the matter to be extracted may undergo a preliminary treatment, for example, inactivation of enzymes, grinding or defatting.

Extracts are prepared by maceration, percolation or other suitable, validated methods using ethanol or another suit able solvent. After extraction, unwanted matter is removed, if necessary.

Liquid extracts

Liquid extracts may be prepared by the methods described above using only ethanol of suitable concentration or water or by dissolving a soft or dry extract in one of these solvents and, if necessary, filtering; whatever their method of preparation, the extracts obtained have a comparable composition. A slight sediment may form on standing and that is acceptable as long as the composition is not changed significantly. Liquid extracts may contain suitable antimicrobial preservatives.

Soft Extracts

Soft extracts are preparations of an intermediate consistency, between liquid and dry extracts. They are obtained by partial evaporation of the solvent used for preparation Only ethanol of suitable concentration or water is used. Soft extracts generally have a dry residue of not less than 70 per cent by mass. They may contain suitable antimicrobial preservatives.

Dry Extracts

Dry extracts are solid preparations obtained by evaporation of the solvent used for their production. Dry extracts generally have a dry residue of not less than 95 per cent by mass. Suitable inert materials may be added.

Standardised dry extracts are adjusted to the defined content of constituents, using suitable inert materials or a dry extract of the vegetable or animal matter used for the preparation. Where applicable, the monograph on a dry extract prescribe a limit test for the solvent used for extraction.

Tinctures

Tinctures are liquid preparations usually obtained from dried vegetable or animal matter. For some preparations, the matter to be extracted may undergo a preliminary treatment, for example, inactivation of enzymes, grinding or defatting.

Tinctures are prepared by maceration, percolation or other suitable, validated methods, using alcohol of suitable concentration. Tinctures may also be obtained by dissolving or diluting extracts in alcohol of suitable concentration.

Tinctures are usually obtained using either 1 part of drug and 10 parts of extraction solvent or 1 part of drug and 5 parts of extraction solvent Tinctures are usually clear. A slight sediment may form on standing and that is acceptable as long as the composition is not changed significantly.

The definition of plant material to be used

There is a sequence of events that should be followed in the choice of plant material.

- Where it was grown, since the weather can affect the chemical composition of the plant.
- Which part was used in the extraction, i.e. the leaf, flower, whole herb, stems, roots, rhizomes, fruits (seeds), the bark or the sap. The chemical composition varies according to the part of the plant used.
- Whether it was the fresh or dried plant used.
- Whether there are any possible adulterants present, either from 'weeds' growing alongside the plant, or cheaper material that was added to lower costs.
- Whether the species of plant has been validated.
- When it was harvested, e.g. that the plant was ripe..
- How it was harvested.
- How it was processed, i.e. whether it is the aqueous or oil soluble fractions that contain the active constituents.
- How much of the plant was used to produce the final product. It is worthless to use an extract of unknown concentration and one should always work in fresh plant equivalents. If the extract was made from dried plant material, then as a rule of thumb, multiply the figure by a factor of eight.
- The age of the plant material and how it was stored.

TYPICAL NATURAL RAW MATERIALS USED IN COSMETICS AND TOILETRIES

Materials used as excipients

Natural plant waxes

Natural waxes provide an alternative to synthetic waxes obtaned from the petrochemical industry. All plants having the name '*cerifera*' have been used traditionally as sources of wax and used ethnobotanically as a source of fuel for lighting, i.e. as candles or torches.

Carnauba or *Copernicia cerifera*
This is a high melting point wax most commonly found in lipsticks, but it can be emulsified into emulsions when used in combination with lower melting point waxes as co-solvents.

Bayberry or *Myrica cerifera*
This is a wax with a slightly green tinge that can be used as an alternative to ozokerite.

Sunflower seed wax (*Helianthus annuus*)

A source of this wax has recently come onto the market and can be used as a substitute for mineral wax.

Rice Bran Wax or *Oryza sativa*
A lovely white wax, that has excellent properties and is just becoming commercially available.

Avocado Wax or *Persea americana*
Another wax that is now becoming commercially available.

Candelilla or *Pedilanthus pavonis* Boiss.
A wax similar to carnauba in all respects, but of lower melting point.

Coconut Wax or *Cocos nucifera*
Widely available as coconut butter and as the wax.

Oil Palm or *Elaeis guineensis*
Available as the oil, the fat and as various derivatives

Jojoba or *Buxus chinensis* [Syn. *Simmondsia chinensis*]
A fascinating material, which theoretically one would expect to be a solid wax, but in reality is a liquid wax. Well known and respected, widely available commercially.

Lavender Wax or *Lavandula angustifolia*
Jasmine Wax or *Jasminium officinale*
Orange Wax or *Citrus aurantium*

These three waxes are available commercially, but are relatively expensive. They are produced from the sludge left behind after distillation of the essential oils from the flowers of these plants and will lend a fragrance to the final product.

Hops or *Humulus* l*upulus*, is not commercially available at the moment, but is part of the by-product thrown away by the hop oil producers. *Ceroxylon andicola*, a tree from the slopes of the Andes, which exudes a wax from the rings of its trunk. A natural wax that is no longer available, or a wax that has never been exploited? The South Americans call the tree 'Palma de cera' (literally wax palm) and this could be a promising lead for a new natural wax. Babassu Palm Fat (*Orbygnia martiana*), Koya wax (*Cinnamomum pedunculatum*), Chinese Vegetable Tallow (*Stillingia sebifera*), Cow Tree Wax (*Galactodendron utile*), Chinese Wax (*Coccus ceriferus*), Ibota Wax (*Lingustrum ibota*) and Sela Wax (*Fraxinus chinensis*) have all been used in the past, but are no longer available commercially, but must be an opportunity for the future as new alternatives to hydrocarbon derived waxes.

Natural insect waxes

Beeswax or *Cera alba*
Widely available and extremely useful in emulsions. Can be used with borax to form a beeswax/borax water-in-oil emulsion, some other mineral salts will also work as an emulsifier in place of borax.

Natural animal waxes

The use of animal fats and waxes will not be included in this chapter, which concentrates primarily on botanical sources. However, lanolin is produced from the wool fats washed out of the sheep's fleece and produces so many natural (cruelty free) derivatives, that it deserves mention. It is highly respected by most dermatologists as a tried and tested emollient and from the formulators point of view provides fatty alcohols, waxes and sterol derivatives of exceptional value in skin care.

Natural fats

There exists in nature an intermediate material to waxes and oils and these are the butters, which by virtue of their blends of different molecular weight fatty materials are soft, spreadable pastes at ambient temperatures.

- Cocoa butter (*Theobroma cacao*)
- Illipe butter, also known as Borneo Tallow (*Shorea stenoptera*)
- Coconut butter (*Cocos nucifera*)
- Shea Butter (*Butyrospermum parkii*)
- Mango Butter (*Mangifera indica*)

All of these butters are widely available, but often have a distinctive odour which may be a problem if used at high levels in the product. The coconut and mango butters have the cleanest smell and colour.

Natural oils

There are so many natural oils available that making a choice may be difficult.

Coconut (*Cocos nucifera*)
An emollient oil, usually water-white and of low odour, that may become solid in the winter months.

Avocado (*Persea americana*)
A rich luxuriant oil, that has the potential to become rancid, if kept for long periods of time in partially empty containers. It is skin substantive and contains high levels of phytosterols.

Wheat germ oil (*Triticum aestium*)
One of the highest natural sources of vitamin E

Sweet Almond oil (*Prumus dulcis*)
A long established and traditional emollient that appears in the earliest pharmacopoeias. An almost odourless, water-white oil, that has good skin penetration and is not tacky on application.

Arachis oil (*Arachis hypogaea*)

A well-respected oil, frequently used in sun tan oils, because it had good UV absorbance and good adhesion to the skin. It was also used in baby care and pharmaceutical preparations, because of its substantive protection of the skin. Now it is less favoured, because it is obtained from peanuts and there is a fear of skin (nut) allergies.

Apricot kernel oil (*Prunus armeniaca*)
Similar in all respects to sweet almond oil

Blackcurrant seed oil (*Ribes nigrum*)
A rich source of GLA (*gamma*-linolenic acid), which has excellent emolliency on the skin

Borage seed oil (*Borago officinalis*)
Another rich source of GLA (*gamma*-linolenic acid), which has excellent emolliency on the skin and which is known more commonly by the name of "Starflower"

Brazil nut oil (*Bertholettia excelsa*)
A rich skin-substantive oil rich in natural phytosterols, but becoming less popular, because of the fear of inducing nut allergies.

Camellia oil (*Thea sinensis*)
A light, fast-absorbing non-tacky oil, that is ideally suited to emulsions and as a component of massage oils. Has a very low odour and is almost colourless.

Castor oil (*Ricinus communis*)
One of the stalwarts of lipstick formulation, since it has the highest gloss of all natural oils when applied to the skin. Occlusive, water-repellant and very protective to the skin, this oil is a major component of zinc and castor oil cream for the prevention of nappy (diaper) rash and appears in nearly all pharmacopoeias.

Cotton seed oil (*Gossypium herbaceum*)
A water-white oil that has a realtivley non-greasy application and is fast absorbing into the skin.

Evening Primrose seed oil (*Oenothera biennis*)
The most popular and most traditional source of GLA, this oil has been used in a pharmaceutically licensed product for atopic eczema and also for mastalgia (breast pain).

Grapeseed oil (*Vitis vinifera*)
A light, fast penetrating oil with excellent odour and colour

Rosehip seed oil (*Rosa rubiginosa*)
This is an exceptional oil that has been extensively examined for its healing and cicatrisation properties.

This list is by no means conclusive and there are many dozens more.

Moisturising agents of the aqueous phase

We now turn our attention to those materials that will act as humectants. Normally we would immediately think of sodium PCA, propylene glycol or other glycols. It is on the idea of glycols that we could turn to glycerine, which is available from natural vegetable sources.

Another naturally occurring material is sorbitol, which is a sugar isomeric with mannitol and dulcitol. It is most commonly found in ripe mountain ash or rowan berries (the name sorbitol is derived from its Latin name *Sorbus aucuparia*), cherries, plums, pears and apples etc.

In some cases one might prefer to use ground up fruits and add them directly to the products. The plant materials might include:-

- cucumber (*Cucumis sativus*)
- avocado (*Persea americana*)
- banana (*Musa paradisica*)
- oatmeal (*Avena sativa*)
- strawberries (*Fragaria vesca*)

Or we might prefer to use the leaf sap of a plant like Aloe vera (*Aloe barbadensis*) Miller (see later).

Emulsifiers

We hit our first major problems when we come to consider what to use as an emulsifier, since the availability of effective materials, though technically feasible, in commercial reality is almost impossible.

The use of beeswax and borax has already been mentioned, but where do we find replacements for our normal pallette of materials to produce oil-in-water emulsions?

For an anionic emulsifier, one would need to produce a natural soap, i.e. by reacting natural fatty acids with caustic soda or potash. However, most sodium and potassium hydroxide is made synthetically and there is no commercial source at the present time, where the material has been extracted from wood ashes. The extraction of caustic potash from wood ash is probably one of the most ancient ethnobotanic traditions (e.g. Quiapo or *Pistia stratiotes* one of the Araceae family, Water Hyacinth or *Eichhornia crassipes* one of the Pontederiaceae family, the Royal fern or *Osmunda regalis*, the fruit of the Prickly Chaff-flower or *Achyranthes aspera* of the Ameranthaceae family.

Amongst the cationic emulsifiers are lecithin (obtained from soya) and casseine (which can be obtained from milk). This is a promising avenue of research, though the types of emulsion obtained are limited in their scope.

Nature does have one amphoteric route as a possible emulsifier and this could be betaine that is obtained from Beet or *Beta vulgaris*.

There are no nonionic emulsifiers.

Thickeners

Nature is a prolific provider of thickeners and though none of them are as versatile as carbomer, one can produce every viscosity increase from a slight thickening to a gel for a face mask.

One of the most recent to hit the commercial market is a branched polysaccharide (arabinogalactan) which has been obtained from larch (*Larix occidentalis*) - the properties are said to be similar to guar gum. Most cellulose gums are naturally derived as an unwanted part of the wood pulp process to produce paper.

There are also a host of natural gums, which include

- locust bean gum from the carob seed (*Ceratonia siliqua*),
- xanthan gum which is an exocellular biopolysaccharide obtained from a fermentation of *Xanthomonas campestris*
- alginate and carragheenan gums from various seaweeds
- guar gum which is obtained from the Indian Cluster bean (*Cyamopsis tetragonolobus*)

Other gums include: Karaya or Indian Tragacanth (*Sterculia villosa*), Tragacanth (*Astragalus gummifer*), and Gum Arabic (*Acacia senegal*).

Preservatives

There are no commercial sources of legally permitted plant derived natural preservatives, but there is a mimic of a preservative technique used in nature, which is Myavert C.

Benzoic acid and benzyl alcohol both occur in plants and are also on the permitted list of preservatives, thus may be used as ‘nature identical’ preservatives. In a similar vein, sorbic acid occurs in nature, particularly in the rowan berry and this could react with potassium hydroxide to form potassium sorbate, when one would have a naturally derived preservative.

Another commercially available preservative is derived from grapefruit seed, and though the active material was never identified in the literature, it was almost certainly naringenin, a molecule that occurs widely in *Citrus* spp., and is closely related to hesperidin, which also occurs widely in plant materials.

An additional nature identical materials has recently become available called hinokitiol, which has antimicrobial activity. It was originally found in *Chaemycyparis taiwanensis*.

It should not be forgotten that 4-hydroxybenzoic acid is commonly found in a variety of plant materials, such as barley, strawberries, blackcurrants, peaches, carrots and grapes, etc. It is probably one of the most widley distributed aromatic organic acid in

the plant kingdom. The esters are also well represented, for example in Cloudberry (*Rubus chamaemorus*), which was also reported to contain benzoic acid and sorbic acid. Parabens may therefore be called 'nature identical'.

Antioxidant

Antioxidants are also an important part of our claim strategy and though the most publicised antioxidant is vitamin E, which occurs quite abundantly in nature, especially in wheatgerm oil, it is of course, mostly available as a synthetically derived form.

Chelating agent

The most commonly used chelating agent would be ethylene diamine tetraacetic acid (EDTA) and its derivatives. In nature, phytic acid (from Rice bran) is also a very good chelating agent.

Sunscreens

Nature produces an abundance of natural sunscreens, since a plant also needs to protect itself against excessive ultra violet radiation. The legislation is quite clear in those materials that may be used as UV sunscreens and sadly none of the natural plant materials are permitted (in the UK/EEC). However, it is always possible to add a plant extract rich in these UV absorbing phytochemicals for its topical benefits and at the same time bolster the effect of the UV sunscreens that are permitted.

Perfume (Essential Oils)

The product will need to be perfumed and here one should concentrate on the use of essential oils. There are literally hundreds of fragrant materials derived from nature, most of them are extremely expensive and on their own seem rather crude to the nose of the consumer who in the past might have expected a sophisticated smell to their product. However, the growth of aromatherapy has produced a dramatic swing in the fragrance that is acceptable to the user, and there is now a place for pure essential oils.

There are too many oils to cover the entire catalogue, but the following examples will give an idea of the depth and range available. Essential oils used undiluted can be abortifacient, extremely irritant and cause severe erythema. They must always be diluted in a carrier oil before use. The only exception is when the oils are used as room fragrance in scented burners.

Basil (*Ocimum basilicum*) has been used for alleviating mental fatigue and as a first aid treatment for wasp stings. It may also help to clear nasal catarrh.

Bergamot (*Citrus aurantium bergamia*) has been used traditionally for acne, boils, cold sores, eczema, insect bites, insect repellent, oily complexion, psoriasis, scabies, spot varicose veins, ulcers, wounds, thrush, infectious disease and depression. It has a refreshing and uplifting quality, when used in aromatherapy. Choose bergapten-free sources of the oil, since this material is phototoxic on the skin.

Cedarwood (*Cedrus atlantica*) is used for its purifying properties and has been used for the treatment of dandruff, acne, psoriasis, and nervous tension.

Chamomile, Roman (*Anthemis nobilis*) has been used for insomnia, muscle tension, cuts, scrapes, bruises and is anti-infectious. It is a proven anti-inflammatory and skin soothing essential oil. In aromatherapy it encourages positive thinking.

Cinnamon Bark (*Cinnamomum verum*) It has been used for its antimicrobial and antiseptic properties. It is best diluted before being applied on the skin.

Clary Sage (*Salvia sclarea*) is antispasmodic and is used in aromatherapy for its uplifting properties.

Clove (*Eugenia caryophyllus*) is antibacterial, antifungal, antiseptic and has been used for dental infections and for the alleviation of dental pain.

Coriander (*Coriandrum sativum*) has anti-inflammatory and sedative properties.

Cypress (*Cupressus sempervirens*) has been used in cases of oedema, cellulite, varicous veins and water retention. It is anti-infectious, antibacterial and antimicrobial.

Davana (*Artemisa pallens*) has antimicrobial properties, has been used for soothing rough, dry and chapped skin.

Eucalyptus (*Eucalyptus globulus*) is the natural choice for viruses of the respiratory system and for the treatment of catarrh. It is used in products where there is a need to improve the breathing by relieving the symptoms of congestion. It has also been shown to improve the memory.

Fennel (*Foeniculum vulgare*) is antispasmodic, antiseptic and stimulating to the cardiovascular and respiratory systems.

Frankincense (*Boswellia carterii*) is considered the holy oil in the Middle East and was used religiously for thousands of years. It is well known for its healing powers and repair of damaged skin. It prevents scarring, antitumoral, immune-stimulating and antidepressant. It is stimulating and elevating to the mind and helps in overcoming depression.

Geranium (*Pelargonium graveolens*) has been used for centuries for skin care. It has a soothing and healing effect on the skin. It is excellent for the skin of expectant mothers, and it is used in aromatherapy to help release negative memories.

Ginger (*Zingiber officinale*) is used as a rubefacient for relief from arthritis, rheumatism, sprains, muscular aches and pains, catarrh, congestion, coughs, sinusitis, sore throats, diarrhea, colic, cramps, indigestion, loss of appetite, motion sickness, fever, flu, chills and infectious disease.

Grapefruit (*Citrus paradisii*) a most invigourating fragrance that works exceptionally well in shower gels. May have some antibacterial activity.

Jasmine (*Jasminum officinale*) has been shown to enhance creative thought and has been cited as an aphrodisiac. The Hindu name "Moonlight of the Grove" probably alludes to this function and there is evidence that it reduces stress.

Juniper (*Juniperus communis*) is frequently used as a skin detoxifier and cleanser, reducing dermatitis, eczema and acne. It should be used with care as it is an abortifacient.

Lavender (*Lavendula officinalis*) is one of the most useful essential oils. It is beneficial for a great number of skin conditions such as burns, rashes and psoriasis. It has also been used extensively in geriatric institutions to help with sleeping disorders, such as insomnia, where it has proven effect. It is antispasmodic, sedative, hypotensive, calming, anti-inflammatory, analgesic, anti-infectious, cardiotonic, anticoagulant, prevents scarring.

Lemon (*Citrus limonum*) has been found useful in cases of cellulite and increases lymphatic function. It is used in products where a revitalising or freshening claim are required.

Lemongrass (*Cymbopogon flexuosus*) works well for purification. It is a vasodilator and anti-inflammatory.

Melaleuca or Tea Tree Oil (*Melaleuca alternifolia*) is anti-infectious, antibacterial, antifungal, antiviral, antiparasitic, anti-inflammatory, immune-stimulating, decongestant, neurotonic and analgesic. Used in cases of dandruff, hair nits, acne, eczema and medicated products.

Myrrh (*Commiphora molmol*) has been used for skin conditions such as athletes foot, chapped and cracked skin, eczema, wounds and wrinkles. It has a warm balsamic note that is used as a relaxant by aromatherapists.

Orange (*Citrus aurantium*) brings peace and happiness to the mind and body. It is used to reduce a dull, oily complexion.

Patchouli (*Pogostemon cablin*) is very beneficial for the skin and may help prevent wrinkles or chapped skin. It is a general tonic and stimulant and helps the digestive system. It is also anti-inflammatory, anti-infectious, antiseptic, tissue regenerating, and helps relieve itching.

Pepper, Black (*Piper nigrum*) oil is stimulating and helps to increase energy. It is a powerful rubefacient and is used in cases of muscle aches, arthritis, neutralgia and other stresses and strains.

Peppermint (*Mentha piperita*) oil is used for its cooling and refreshing properties.

Rose, Turkish (*Rosa damascena*) The fragrance is intoxicating and harmonising. It is stimulating and elevating to the mind, creating a sense of well-being.

Rosemary (*Rosmarinus officinalis*) is beneficial for problem skin conditions and especially for the treatment of dandruff. It has powerful antibacterial properties and may be of help to fight candida infections. It is anti-catarrhal, anti-infectious, antispasmodic, and helps overcome mental fatigue.

Rosewood (*Aniba rosaeodora*) is the cheaper solution to using rose oils (which are expensive). It has soothing, calming effect to both mind and body. It is a strong antimicrobial agent.

Sage (*Salvia officinalis*) has been used in Europe for skin conditions such as eczema, acne, dandruff and hair loss. It is used by aromatherapists to help in relieving depression and mental fatigue.

Sandalwood (*Santalum album*) is similar to frankincense oil and also relieves the symptoms of sciatica and lumbago. Traditionally, it is used for skin regeneration, yoga, meditation and has to help remove negative thinking.

Thyme (*Thymus vulgaris*) is used to overcoming fatigue and physical weakness after illness. It is antimicrobial, antibacterial, antifungal, and antiviral.

Ylang Ylang (*Cananga odorata*) may be extremely effective in calming and bringing about a sense of relaxation. It is antispasmodic, balances equilibrium, helps with sexual disabilities and frigidity.

Natural water soluble fragrance

There are a limited number of essential oils from which the alcohol soluble components have been extracted (sometimes called hydroessentials). These are limited in their number and also tend to be rather delicate in their performance and are usually very expensive. Examples include rose, rosemary, chamomile and sage.

An alternative technology provides (at the time of writing) water soluble fragrances of Cucumber, Cantaloupe Melon, Green Pepper, Honey, Tomato and Watermelon, which are mouth watering in their aroma.

The traditional way of obtaining water soluble fragrance is to use the condensate from the steam distillation, which provides rose water, elderflower water, chamomile water and lavender water. Thouhg these are by-products from the essential oil production, they still manage to command a high price in the commercial market.

Natural Colours

There are an infinite number of colours in nature and who could not wonder at the bright vibrancy of spring as the dazzling daffodils show their trumpets to herald the coming of summer. Some plants have such spectacular colour that their beauty is legendary, the voluminous surge of colour from the bougainvillea, the velvet coloured softness of roses, the cool hue of a woodland carpet of bluebells or the majesty of a cactus in flower over the arid desert.

Legal status

Despite this potential storehouse of fabulous natural colours, the law is quite specific in those that may be used. However, sometimes a plant containing natural colour, is used for its beneficial properties, and this can carry the penalty of tinting the product in which it is used.

Natural colours

There are a vast number of colours that can be obtained from nature, many of them used today in the cottage textile industry, as would have been used in traditional yarns from the time that man first stopped wearing animal skins and started weaving cloth and spinning wool. The colour adopted by the fibre is be heavily influenced by the other chemicals added to the dye batch (normally called mordants), which is influenced not only the pH, but also by added metal ions which strongly influence the end colour. The list of plants providing colour is so long that it would be impractical to give them all, however, a generous flavour is given in Appendix I. A clue that a plant yields colour often comes from the Latin name "*tinctoria*".

Notice that leaves, roots, flowers, barks, fruits and stems can be used, and surprisingly, it is not always the flowers that deliver the strongest colours. A list of typical chemical entities is given in Appendix II.

It has been said that Man often finds his most useful chemicals in plants and then copies them, the same cannot be said about natural colours. The plant produces natural colour for only one reason (in the most part) and that is to attract insects to them for the purpose of pollination. Once the act of fertilisation has been completed, the need for attraction is redundant and the flower dies so that the fruit can develop. The requirement for colours are therefore only transient and as a result the chemicals responsible for them are generally unstable.

Natural colours when freshly produced are delicious in their richness, and subtle in their tones from delicate pastels to regal purples. Nature does not produce colours that are garish or fluorescent. Many colours are used naturally in the food industry and these have E-numbers assigned to them. A list appears in Appendix III.

Products that give pink to red.

<u>Amaranthin</u>

This chemical is found in the leaves of *Amaranthus candatus* and *A. tricolor* in the inflorescenses of *Celosia cristata* (Amaranthaceae) and in the leaves of *Atriplex hortense* and *Chenopodium amaranticolor* (Chenopodiaceae).

<u>Anthocyanidins</u>

A typical example can be obtained from *Hibiscus sabdifera*, which has bright red blossoms and yields an anthocyanidin known as delphinidin or cyanidin, it also has another colour chemical which is the glucoside hibiscin..

Anthocyanins

Cherries, plums, blackberries, black carrot, blueberries, cranberries, grapes, elderberry, mulberry, purple corn, rosehips, red cabbage, redcurrant. Cyanidin is found specifically in Purple Corn.

Betalaines

These are extracted from red beetroots (*Beta vulgaris*). It also occurs with isobetanidin in the flowers of *Mesembryanthemum edule* (Aizoaceae) and *Portulaca grandiflora* (Portulacaceae).

Another related compound is betanin or phytolaccanin. This colour occurs in the fruits of *Phytolacca americana* (Phytolaccaceae) and in *Portulacagrandiflora* (Portulacaceae). It is a purple pigment. Other places where it may be found are *Carpobrotus acinaciformis*, *Drosanthemum floribundum*, *Mesembryanthemum* spp. and *Opuntia bergeriana* and other *Opuntia* spp. (Cactaceae).

Carmine

Aluminium complexes (lakes) can be prepared with varying ratios of alumina to give shades varying from pale yellow to violet with all shades of red in between.

Carminic acid

This extract is associated with the protein material of the beetles and gives red, yellow and orange colours depending on the products and pH.

Lac

A material obtained from shellac is lal, which has a deep pink red colour. Other chemicals that are found include Laccaic acid A and Laccaic acid B

Lawsone

A colour used frequently in hair care is from Henna or *Lawsonia alba* and is present in the leaves. It is the chemical lawsone that is responsible for the red colour. This colour has been used for nearly five thousand years and was used by the ancient Egyptians for dying their hair and nails.

Lycopene

An extract from tomatoes, this gives a red to orange colour. It has a similar structure to the other carotenes.

Madder

There are two red chemical entities derived from the roots and tubers, which are known as alizarin and purpurin.

Monascus derivatives

The use of *Monascus* microorganisms is also a rich source of natural colour and produces chemical species that give a red colour. These include monascin, ankaflavin, rubropunctatin and monascorubrin, which have the following molecular skeleton. This is traditionally grown on rice in the Orient and is said to have an antibacterial efffect.

Santalin

The red obtained from *Pterocarpus santalinum* or red sandalwood is a complex molecule known as santalin. There are a number of forms of this basic structure, which all give rise to quite intense red colours. The stability of this red is quite good compared to the others. It has been traditionally used for many centuries.

Products that give yellow to orange colour shades.

Annatto

Annatto or norbixin is extracted from the *Bixa orellana* tree; it gives a yellow to deep orange colour. Another chemical found in the plant that is responsible for some of the colour is bixin.

Apigenin

This flavonoid, which occurs widely in plants gives a dull, golden yellow and is usually obtained from German Chamomile or *Matricaria recutita.*

Canthaxanthin

This is a carotenoid that naturally occurs in fungi but is more usually produced by "nature identical" synthesis. Colour can be yellow to an almost orange red.

Capsanthin and Capsorubin

Capsanthin and the related capsorubin are most commonly found in paprika or *Capsicum annuum.*

Carotenes

This is a group of yellow/orange colours extracted from such diverse sources as algae, carrots and palm oil. Also available as a "nature identical" product.

Carthamin

The flowers of *Carthamus tinctoria* or safflor (Bastard saffron) yield a pigment carthamin, which is a yellow-orange colour.

Crocin

A bright yellow colour that has been in use for over a thousand years. Extracted from the fruit of *Gardenia jasminoides*. Another colour found in the plant is crocetin, where the most common source is found in *Crocus sativus* (styles) and better known as saffron. In other *Crocus* spp. the colour is often found in the petals. This material has been used for over two thousand years as a food colour.

Curcumin

This is the pigment of the spice turmeric and will give a range of colour from yellow to a deep orange. This has been in use as a food ingredient for over 2,000 years. It also contains a closely related chemical called desmethoxycurcumin, where one of the methoxy groups is replaced with a hydrogen atom.

Lutein

An extract from *Tagetes erecta* (the Aztec Marigold). This is a xanthophyll which occurs naturally in all green leaves, green vegetables, eggs and some flowers. Exhibits egg to lemon yellow colours.

Luteolin

The colour luteolin is found in Dyer's Rocket (also known as Weld) or *Reseda luteola*. It is one of the oldest yellow dye plants and is found in many parts of Central Europe. The leaves and seeds are used, which contain more dye than the stems. An infusion of the plant has been used for treating wounds. This dye is also present in Dyer's Broom, Dyer's Greenweed or *Genista tinctoria*, where the colour is a more green-yellow. An infusion of the plant has been used for chronic skin disorders. It has anti-inflammatory and antibacterial properties. The 7-glucoside and 7-glucuronide is found in the petals of *Antirrhinum majus* (Scrophulariaceae). The 7-galactoside and 7-rutinoside occur in *Capsella bursa-pastoris* (Cruciferae) and the 3'-glucoside in *Dracocephalum thymiflorum* (Labiatae).

Paprika

The major colouring pigments of paprika are capsanthin and capsorubin. These are extracted from the red paper (*Capsicum annum*). The colour can vary from a golden yellow to a red/orange.

Pratol

From clover or *Trifolium pratense* one can obtain a natural colourant called pratol, which is a dull, golden yellow. There are a number of flavonoids that can be used from plant sources. Clover has been traditionally used for eczematous skin conditions, especially where the skin is pruritic. It is also useful for boils and pimples.

Products that give orange to brown shades.

Caramel

E150 caramel is produced by heating food grade carbohydrates in the presence of selected accelerators. Caramelised sugar or burnt sugar is formed by heating sugars without a catalyst.

Cocoa

Extracted from cocoa beans and used in both food and drink products.

Products that give green and blue colours

Azulene

Probably the most famous of all the blue dyes that comes from German Chamomile or *Matricaria recutita*, Roman Chamomile or *Anthemis nobilis*, Yarrow or *Achillea millefolium* and Wormwood or *Artemisia absinthum*. This oil is responsible for the brilliant dark blue colour of the essential oils distilled from the fresh flowers. The azulenes are generally accepted as being anti-inflammatory and healing in their action.

Chlorophyll

Extracted from grass and alfalfa, this is present in all green plants and has always been a part of man's diet. Gives a moss green colour. Naturally oil soluble. It is also found in green vegetables such as spinach or *Spinacia oleracea* and the common stinging nettle or *Urtica dioica*.

Copper chlorophyll

Derived from the plants as above, but gives a brighter more intense green colour due to the replacement of the naturally occuring magnesium in the chlorophyll by copper. Naturaly oil soluble.

Copper chlorophyllin

This is produced as the copper chlorophyll but a saponification process renders this form water soluble. The colour is a bright green to green/blue.

(Blue) Gardenia

An extract obtained from the gardenia fruits, modified by reacting with an amino acid. A dull navy blue, to a rich azure blue colour.

Indigo

Extracted from the fermented leaves of the plant *Indigo fera.* This produces a blue to mauve colour called indigotin (an indigoid structure).

Phycocyanobilin

An extract from a blue algae, often from spirulina. A colour shade similar to the blue gardenia. The chemical species responsible for this colour is one of the phycocyanobilin molecules, one of the structures of which is shown below. A rich blue colour obtained from the fermented leaves of the plant *Isatis* spp (probably better known to most as woad). Used for many years for dying fabrics. Has been used in conjunction with herbs for colouring use. This has identical structure to the indigotin found in indigo (above). There are similar structures called indirubinoids, specifically 6,6'-dibromoindigotin, which can be obtained from whelks (*Murex trunculus*, *Murex brandaris* and *Thais haemastoma*), normally common to the Mediterranean region. This colour is a regal purple.

Zi Cao

Zi Cao (Mandarin or Chinese name) or *Lithospermum erythrorhizon*.

The main derivatives in the roots are acetyl shikonin, shikonin, alkanin and other shikonon derivatives. Shikonin and alkanin are naphthaquinone dyes, with an intensive red colour. The water soluble extract has remarkable properties. It can be used as a natural colour having an anti-inflammatory and calming effect too. Depending on pH value and solvent system extracts of Lithospermum occur in various colours: below a value of pH 7 the extract is intense red, in the neutral range it is purple and in weak alkalic medium it is bluish-purple. Where the pH value exceeds 10 it is deep blue.

Natural alcohol

Natural fermentation alcohol is widely available, but will require the customs and excise duty to be paid on it. The customs and excise will not allow you to use Quassia (*Picrasma excelsa*) as a denaturant in the UK (which used to be one of the natural denaturants allowed), to provide a tax exemption.

Of course, you may want to consider Witch Hazel or *Hamamelis virginiana* as a source of natural alcohol, and incidentally as a source of some very beneficial properties. The benefits include anti-inflammatory, healing and antipruritic. Be warned, there are many sources of witch hazel that have additional alcohol (often 5% or more) added in order to improve the clarity of the product.

Solubilisers

High alcohol levels could be used (see earlier).

Natural saponins might be helpful, but since it is not possible to obtain pure triterpenoidal saponins commercially and the fact that they are haemolytic in nature at high concentrations might make the idea unwise. There are a number of natural sources of saponins, namely Soapwort (*Saponaria officinalis*), Soapberry (*Sapindus*

indica), Soap Bark, Panama Bark or Quillaia (*Quillaja saponaria*), Yucca (*Yucca brevifolica, Yucca baccata, Yucca glauca* etc.)

Beneficial additives

Plants materials can provide a plethora of useful attributes to a product. These include anti-inflammatory, soothing, anti-erythema, toning, healing, anti-pruritic, skin whitening, removal of skin blemishes, etc., etc.

It has already been mentioned that it is important to add enough plant material to be of benefit. This should be qualified by adding the requirement, that one must know what active plant phytochemical is responsible for the desired effect and to ensure that it is present in the purchased plant extract at a standardised level.

Comfrey (*Symphitum officinale*)
Thus if we were looking at comfrey or *Symphitum officinale*, then we should be concerned about the level of allantoin that is contained within the extract. Allantoin is excellent for wounds and ulcers and is defined in Merck as vulnerary or wound healing.

Common Plantain (*Plantago lanceolata*)
If we were looking at the Common Plantain (*Plantago lanceolata*), then we should concentrate perhaps on the level of aucubin, which is soothing, anti-inflammatory and anti-erythema.

Sage (*Salvia officinalis*)
With Sage (*Salvia officinalis*), we should be concerned with the level of tannin present in the extract, which would be responsible for the skin firming effects and astringency that we might want in our toner.

German Chamomile (*Matricaria recutita*)
With German Chamomile (*Matricaria recutita*), we should be concerned with whether we are using an aqueous extract or the essential oil, since in the aqueous extract we are looking at the flavonoid level of apigenin and apigenin-7-glucoside, whereas in the oil we could either be concerned with the α-bisabolol content, or indeed, with the chamazulene content, since both entities have beneficial effects. Those effects are soothing, healing and anti-inflammatory.

Aloe vera (*Aloe barbadensis* Miller)
In the Aloe vera (*Aloe barbadensis* Miller), it is the trace amount of barbaloin and high levels of mannose and mannose-6-phosphate levels, that should be of interest. Though there is growing evidence that the major material responsible for the beneficial effects of aloe vera is an acetylated mannose derivative called acemannan, which is also present in the gel.

The major efects of aloe are to soothe the skin and reduce erythema. Numerous studies have shown that aloe vera is an excellent remedy for radiation burns, both from solar and radiotherapy treatment, furthermore, that the aloe vera may be used as

a prophylactic to ablate the reaction of the skin to radiation-induced erythema. The effects are to stimulate fibroblast activity and improve the rate of wound healing.

Conclusions

This has been a brief overview of natural products, in which it has been demonstrated that with the commercial products available today, it is almost possible to develop a product that is 100% natural. The shortfalls are in the area of preservation and in the poor performance of natural colours. Nonetheless, the excellent range of natural products currently available and the knowledge that this number is forever increasing, makes an exciting prospect for the formulator.

Useful reading

There are hundreds of excellent books on the market, that deal with the use of plant materials, the volumes chosen have been selected because of their excellent value for money and for the number of plants they cover.

1. R.C.Wren, rewritten by E.M. Williamson and F.J. Evans: Potter's New Cyclopaedia of Botanical Drugs and Preparations, 1994, published C.W.Daniels. ISBN 0-85207-197-3.
2. M.Grieve: A Modern Herbal, 1984 Savvas Publishing. ISBN unknown. (see also Penguin Books, ISBN No. 014-046-440-9).
3. A.Y.Leung and Steven Foster: Encyclopedia of Common Natural Ingredients used in food, drugs and cosmetics. 2nd. edition. John Wiley 1996 ISBN No. 0-471-50826-8.
4. Carol A. Newall, Linda A. Anderson and J. David Phillipson: Herbal Medicines - a guide for health-care professionals. London. The Pharmaceutical Press. 1996. ISBN No. 0-85369-289-0.
5. Max Wichtl, editor Norman Grainger Bissset.; Herbal drugs and Phytopharmaceuticals - a handbook for practice on a scientific basis. Medpharm Scientific Publishers. 1994 English edition. ISBN No. 3-88763-025-4. Also CRC Press ISBN No. 0-8493-7192-9.
6. Malcom Stuart: Illustrated guide to Herbs. CPG (Cambridge Physic Garden) Edgerton International Ltd. 1994 (originally published 1979) see also M.Stuart: The Encyclopaedia of Herbs and Herbalism. 1986. Orbis ISBN 0-85613-700-6.
7. Council of Europe. Plant Preparations used as ingredients of cosmetic products. 1st. edition. Strasbourg 1989. HMSO. ISBN No. 92-871-1689-X.
8. Penelope Ody: The Herb Society's Complete Medicinal Herbal - a practical guide to medicinal herbs, with remedies for common ailments. Dorling kindersley. 1993. ISBN No. 0-7513-0025-X.
9. P.Schauenberg, F.Paris: Guide to Medicinal Plants. 1990 First paperback edition (Paris 1974). Lutterworth Press ISBN No. 0-7188-2820-8.
10. Hans Fluck: Medicinal Plants, 1988 W.Foulsham & Co. Ltd. ISBN 0-572-00996-8.

APPENDIX I

A selection of plants that can provide natural colour

Agrimony stalks	*Agrimonia eupatoria*	yellow
Agrimony leaves	*Agrimonia eupatoria*	yellow
Alkanet root	*Alkanna tinctoria*	grey
Annatto seed	*Bixa orella*	orange
Annatto	E-160b	dark orange
Anthocyanins	E-163 d,e,f	blue-red
Barberry bark	*Berberis vulgaris*	yellows
Bayberry leaves	*Myrica pensylvania*	grey-black
Bearberry leaves	*Arctostaphlos uva-ursi*	grey-black
Bearberry berries	*Arctostaphlos uva-ursi*	blue
Bearberry	*Arctostaphylos uva ursi*	khaki
Birch leaves	*Betula* sp	yellows
Black Oak bark	*Quercus velutina*	yellow
Black Walnut hull	*Juglans regia*	tan-brown
Black Walnut leaf	*Juglans regia*	khaki/tan
Blackberry shoots	*Rubus* spp.	grey-black
Bloodroot root	*Sanguinaria canadensis*	orange
Blueberry fruit	*Vaccinium* spp.	blue/lavender
Brazilwood	*Caesalpinia* sp	reds
Buckthorn bark	*Rhamnus frangula*	rusts
Buckwheat stalks	*Fagopyrum esculentum*	blue
Buffalo fruit	*Sheperdia argene*	pink
Buffalo berry	*Sheperdia argene*	pink
Butternut rootbark	*Juglans cinerea*	browns
Camomile flower	*Anthemis tinctoria*	yellow
Canthaxanthin	E-161g	red (quite bright)
Caramel	E-150	umber brown
Carmine	E-120	red
Cedar (red) root	*Juniperus virginiana*	lavender purple
Chamomile	*Matricaria recutita*	yellows
Chlorophyll	E-140	bright green
Chlorophyllin	E-140	yellow-green
Cochineal	*Dactylopius coccus*	pinks/reds
Cochineal	dried insect	pink
Coffee beans	*Coffea arabica*	green/tan-brown
Copper chlorophyll	E-141	dull green
Coreopsis flower	*Coreopsis tinctoria*	yellow/orange
Curcumin	E-100	orange
Cutch	*Acacia catechu*	browns
Dahlia	*Dahlia* spp	orange
Dock root	*Rumex obtusifolius*	yellow
Dyer's Broom flora	*Genista tinctoria*	yellow
Dyer's Broom	*Genista tinctoria*	yellows
Elderberries	*Sambucus nigra*	browns
Elderberry fruits	*Sambucus nigra*	blue/lavender
Eucalyptus leaves	*Eucalyptus* sp	khaki/tan
Fustic	*Chlorophora tinctoria*	yellow/golds

Goldenrod	*Solidago* spp	yellow
Grape juice	E-163 d,e,f	grey-blue
Grape fruits	*Vitis* spp	blue/lavender/purple
Heather flowers	*Calluna vulgaris*	golds/rusts
Henna powder	*Lawsonia inermis*	rusts/tans
Hibiscus	*Hibiscus rosa-sinensis*	red
Indigo	*Indigofera* sp	blues
Indigo balls	*Lonchocarpus cyanescens*	blues
Indigo leaves	*Indigofera tinctoria*	blue
Juniper berries	*Juniperus communis*	tans
Kola nuts	*Cola nitida*	browns
Lady's Bedstraw	*Galium verum* roots	pink
Lady's Bedstraw	*Galium verum* tops	yellow
Lily-of-the-valley	*Convallaria majalis* leaves	green/yellow
Logwood	*Haematoxylon campechianum*	purples
Madder	*Rubia tinctorium*	red/corals
Madder root	*Rubia tinctorium*	pink
Marigold	Calendula officinalis	fawns/creams
Marigold flower	*Tagetes* spp	yellow
Mulberry fruit	*Morus* spp	blue/lavender/purple
Natural carotene	E-160a	orange
Onion	*Allium cepa*	orange/yellow
Orchil litchens		pink/lavender/purple
Paprika oleoresin	E-160c	orange-red
Persian berries	*Rhamnus* sp	yellows/gold
Pokeweed fruit	*Phytolacca decandra*	pink/orange/lavender
Purple Corn	*Mais morado*	dark pink
Rhubarb root	*Rheum* sp	yellows/golds
Riboflavine	E-101	yellow-orange
Riboflavine-5-phosphate	E-101a	orange
ß-carotene	E-160a	orange
Safflower flowers	*Carthamus tinctorius*	pink/orange/yellow
Safflower	*Carthamus tinctorius*	yellow/pinks
Sandalwood	*Santalum album*	fawns
Sanderswood	*Pterocarpus santalinus*	rusts
Scotch Broom	*Cytisus scoparius* flowering tops	yellow
Spinach green	*Spinacia oleracea*	bright green (very)
St. John's Wort	*Hypericum perforatum* flowers	yellow/pink
Sticklac	*Laccifer lacca* Kerr	reds/pinks
Sumac flower tops	*Rhus glabra*	yellow
Tea leaves	*Thea sinensis*	tan-brown
Tomato	*Solanum lycopersicum*	slightly blue-red
Turmeric	*Curcuma longa*	yellows/golds
Walnut hulls	*Juglans regia*	browns
Weld	*Reseda luteola*	yellows
White Birch	*Betula alba*	yellow/tan-brown
Wild Cherry bark	*Prunus serotina*	pinky tans
Xanthophylls	E-161b	orange
Zinnia flowers	*Zinnia elegans*	yellow

APPENDIX II

COLOUR SOURCE	LATIN NAME	MAJOR PIGMENT
Tumeric	*Curcuma longa*	Curcumin
Saffron	*Crocus sativus*	Crocin
Gardenia fruit	*Gardenia jasminoides*	Crocin
Marigold (Tagetes)	*Tagetes erecta*	Lutein
Alfalfa	*Medicago sativa*	Lutein
Carrots	*Daucus carota*	B-carotene
Algae	*Dunallella salina*	B-carotene
Annatto	*Bixa orellana*	Bixin
Annatto	*Bixa orellana*	Norbixin
Paprika	*Capsicum annuum*	Capsanthin
Paprika	*Capsicum annuum*	Capsorubin
Black Grapes	*Vitis vinifera*	Anthocyanin
Elderberries	*Sambucus nigra*	Anthocyanin
Hibiscus	*Hibiscus sabdariffa*	Anthocyanin
Beetroot	*Beta vulgaris*	Betanin
Cochineal insect	*Coccus cacti*	Cochineal carmine
Cochineal insect	*Coccus cacti*	Carminic acid
Grass	*Graminae* sp	Chlorophyll
Spinach	*Spinacia oleracia*	Chlorophyll
Alfalfa/lucerne	*Medicago sativa*	Chlorophyll
Vegetable material Carbonised (Peat)		Carbon Black
Caramelised sugar	(sugar, sucrose)	Melanoidin pigments
Malt extract	*Hordeum distichum*	Melanoidin pigments

APPENDIX III

C.I. Number	Name	E No.	Common name
14720	Azorubine, carmoisine	E122	
16185	Amaranth	E123	
40800	beta-carotene	E160a	Food Orange 5
40820	beta-apo-8'-carotenal	E160e	Food Orange 6
40825	Ethyl ester of beta-apo-8'-carotenal	E160f	Food Orange 7
40850	Canthaxanthin	E161g	Food Orange 8
73000	Indigo		Vat Blue 1
75100	Saffron, crocetin		
75120	Annatto, bixin, norbixin	E160b	Natural Orange 4
75125	Lycopene	E160d	
75130	Mixed carotenes	E160a	Natural Yellow 26
75135	Marigold	E161d	
75140	Saffron		Natural Yellow 6
75300	Curcumin, turmeric	E100	Natural Yellow 3
75470	Cochineal, carminic acid	E120	Natural Red 4
75486	Henna, lawsone		
75520	Alkanet		Natural Red 20
75530	Alkanet		Natural Red 20
75540	Sandalwood, santalin		Natural Red 22
75550	Isosantalin		Natural Red 22
75560	Camwood, deoxyisosantalin		Natural Red 22
75570	Clover, pratol		Natural Yellow 10
75580	Chamomile, apigenin		Natural Yellow 12
75590	Luteolin		Natural Yellow 2
75660	Osage orange, morin		Natural Yellow 8, 11

75780	Indigo		Natural Blue 1
75810	Chlorophyll, chlorophyllins	E140	Natural Green 3
75815	Copper complex of chlorophyll, chlorophyllins	E141	
-	Paprika, capsanthin, capsorubin	E160c	
-	Lutein	E161b	
-	Beetroot,betanin	E162	
-	Anthocyanins	E163	
-	Flavine		Natural Yellow 10
-	Caramel	E150	Natural Brown 10
-	Plain caramel	E150a	
-	Caustic sulphate caramel	E150b	
-	Ammonia sulphate caramel	E150c	
-	Sulphite ammonia caramel	E150d	
-	Vegetable carbon	E153	Pigment Black 7
-	Charcoal		Pigment Black 8
-	Persian berry		Natural Yellow 13
-	Riboflavin	E101	
-	Riboflavin-5'-phosphate	E101	
-	Monascus		Natural Red 2

APPENDIX IV
PLANTS COVERED BY LEGISLATION

According to the 1989 Cosmetic Products (Safety) Act

Schedule No.	Name of Substance	Common name
11.	Aconitine and its salts	
12.	*Aconitum napellus* (leaves,roots and galenical preps)	Monkshood
13.	*Adonis vernalis* and its preparations	Adonis
43.	*Ammi majus* and its galenical preparations	Bishopsweed
51.	*Anamirta cocculus* (fruit)	
57.	*Apocynum cannabinum* and its preparations	Cannabis
62.	*Aristolochia* species and their preparations	
63.	*Atropa belladonna* and its compounds	Belladonna
129.	Calabar bean (see 547)	
130.	*Cantharis vesicatoria* and cantharides	
144.	*Chenopodium ambrosioides* (essential oil)	American wormseed oil Mexican goosefoot
145.	Cherry laurel water (see 577)	
180.	*Claviceps purpurea* its alkaloids and galenical preparations	Ergot
187.	*Colchicum autumnale* and its galenical preparations	Autumn Crocus or Meadow Saffron
193.	*Conium maculatum* (fruit, powder, galenical preparations)	Hemlock
197.	*Croton tiglium* (oil)	Croton
198.	Curare and curarine	
212.	*Datura stramonium* (and its galenical preparations)	Thornapple or Jimsonweed
243.	*Digitalis purpurea* (digitaline and all of its heterosides)	Foxglove
379.	*Hyoscyamus niger* (leaves, seeds powder and galenical preparations)	Henbane
386.	*Cephaelis ipecacuanha* and related species (roots, powder and galenical preps.)	
396.	*Juniperus sabina* (leaves, essential oil and galenical preparations)	Savine
397.	Laurel oil	
398.	*Laurus nobilis* (oil from seeds)	Laurel
402.	*Lobelia inflata* and its galenical preparations	Lobelia
486.	*Nux vomica* and its preparations	Quaker Buttons Poison nuts
547.	*Physostigma venenosum*	Calabar bean
549.	*Phytolacca* spp and their preparations	Poke Root
553.	*Pilocarpus jaborandi* Holmes and its galenical preparations	Jaborandi

577. *Prunus laurocerasus*	Cherry Laurel
579. *Pyrethrum album* and its galenical preparations	Pyrethrum
585. *Rauwolfia serpentina* alkaloids and their salts	Indian Snakeroot
589. *Schoenocaulon officinale* Lind. (seeds and galenical preparations).	Sabadilla
596. *Solanum nigrum* and its galenical preparations	Black Nightshade
600. Squill and its preparations (see 649)	
603. Stropanthus species and their galenical preparations	Strophanthus
605. *Strychnos* species and their galenical preparations	
649. *Thevetia neriifolia* Juss. glycoside extract	Thevetia tree nut
696. *Urginea scilla* Stern. (see 600) and its galenical preparations	Squill
700. *Veratrum* spp and their preparations	Hellebores