

## **Aromatherapy Undiluted- Safety and Ethics**

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[modified from a previous article "A Brief Safety Guidance on Essential Oils" written for IFA, Sept 2004].

### **Intro**

In the last 20 years aromatherapy has spread its influence to the household, toiletries and personal care areas: consumer products claiming to relax or invigorate our psyche's have invaded our bathrooms, kitchen and living room areas. The numbers of therapists using essential oils in Europe and the USA has grown from a handful in the early 1980's to thousands now worldwide. We have had time to add to our bank of knowledge on essential oils from reflecting on many decades of aromatherapeutic development and history, the collection of anecdotal information from practicing therapists, as well as from clinical & scientific investigations. We have also had enough time to consider the risks in employing essential oils in therapy. In the last twenty years, many more people have had accidents, been 'burnt', developed rashes, become allergic, and become sensitized to our beloved tools. Why is this?

In this paper, we hope to shed light on this issue, clarify current safety findings, and discuss how Aromatherapists and those in the aromatherapy trade (suppliers, spas, etc.) can interpret this data for continued safe practice. After a refresher on current safety issues including carcinogenic and toxic oils, irritant and photo-toxic oils, we will look at allergens, oils without formal testing, pregnancy issues and medication interactions. We will address the increasing numbers of cases of sensitization and the effect of diluting essential oils. Last we will discuss the use of neat oils, including legal and ethical issues and offer suggestions for safe practice for therapists as well as commercial businesses (suppliers, spas).

In the last 5 years, some issues (such as anethole toxicity) have become of slightly less concern, others (such as skin sensitization and methyl eugenol carcinogenicity) have become more centre-stage, and many issues more remain unresolved. Toxicological investigation of essential oils is a costly business and there still remain huge gaps in our knowledge. For example we know little about inhalation toxicity, systemic toxicity, genetic effects, toxico-kinetics, sub-chronic effects etc. of many of the commonly used essential oils, and regulatory authorities in many countries are starting to demand this information, under the threat that essential oils may be restricted or withdrawn from sale to the general public if it is not provided. Whilst the aromatherapy profession may be able to negotiate special status under the laws of many countries to continue using these materials, we should, as a profession, at least be aware of current safety issues

affecting essential oils; historically, most of this information has been generated from sister essential oil-using industries, such as perfumery.

Safety has been defined before as freedom from danger, injury or damage (Burfield 1999). Although many essential oils are potentially hazardous materials, if handled in the appropriate manner, the risks involved in their use can be very small. So therefore, most commercially offered essential oils are safe to use for the purpose intended in a domestic/professional/clinical environment, if correctly handled according to the producer's specific directions or the recommendations of appropriate professional bodies. Detailed information on hazards, risks, emergency and first aid measures and detailed toxicological data can be located on the oil suppliers' MSDS's, which you, as an oil customer, have a absolute legal right in law to receive, with the appropriate detail entered into each of the 16 internationally established categories (don't be denied on this!). Brief toxicological information on many individual essential oils in the related field of perfumery can be found on the IFRA website [www.ifraorg.org](http://www.ifraorg.org). Tisserand and Balacs (2000) have written a useful book on *The Safety of Essential Oils*, and Martin Watt has produced a Safety Data Manual called *Plant Aromatics* - details of which are found on his website <http://www.aromamedical.com/paper.html>

**Review of safety:** Use the appropriate personal protection for the situation in which you are working e.g. protective coat, goggles, safety gloves etc. if you are decanting larger volumes of oil. All premises handling essential oils must have an Eye-Wash Station. Determine what is appropriate for your situation via a Safety Audit for your working environment (if in doubt over how to do this consult your local Health and Safety Department). Remember that in any situation, you are your own Safety Officer! You have a duty of care for safety matters both to yourself and to others around you!

N.B. It is not generally appreciated that spilled essential oils wiped up with tissue/rags can autoxidise rapidly, especially in sunlight, posing a distinct combustion hazard. This has led to a number of serious fires within the essential oil trade in recent years. Those oils containing citral are especially predisposed towards this – lemongrass (*Cymbopogon flexuosus*) and *Litsea cubeba* oils on rag or tissue waste are notorious as fire-starters. All oil-containing waste should be placed in a purpose-bought metal bin with an air-tight fitting lid, and the bin contents safely disposed of outside the building, on a nightly basis.

### **Methods of administration**

Essential oils can be administered orally, topically, vaginally, rectally or by inhalation, and different doses, degrees of absorption, metabolic processes and biodegradative outcomes between oil constituents occur between these methods. English/US aromatherapy practice has - up to now - been principally connected to massage (and therefore to topical administration of essential oils), and in many countries the National laws may not legally permit oral (or yet vaginal or rectal)

administration except by a medically qualified person. Nevertheless any professional aromatherapy organisation with an international membership should have a working knowledge base for all these applications. Dose: aromatherapy massage typically uses essential oil concentrations from 1-2.5% v/v in fixed vegetable massage oils in practice, with lower concentrations for children and elderly people. Repeated client treatments with the same essential oil are only recommended for the short to mid-term term period until we know more about sub-chronic toxicity effects etc. of these materials and it is worth remembering that a hard-working therapist or handler (supplier, bottler) may be more exposed to the effects of essential oils than individual clients! **The use of neat essential oils in aromatherapy cannot be supported**, because of the danger of irritation or sensitization reactions and injuries caused to clients as result of this practice may not be covered by the therapist's insurance.

### **Oils that are suspected carcinogens**

A carcinogen is a chemical which may give rise to tumor production, which is an unrestrained malignant proliferation of a somatic cell, resulting in a progressively growing mass of abnormal tissue. Do not confuse with mutagens which are substances which may cause heritable defects arising from their action on mammalian germ cells: here tumor formation may result from their action on somatic cells via cellular disruption. Whereas many mutagens are carcinogens, not all carcinogens are mutagens. Teratogens are different again, being substances that interfere with the normal development of either the embryo or foetus in utero, giving rise to abnormalities in the neonate.

The following **carcinogenic** essential oils should not be used in aromatherapy; the names in brackets refer to the carcinogenic items:

Birch tar oil crude (polynuclear hydrocarbons) *Betula penda* CAS No: 8001-88-5  
Cade oil crude (polynuclear hydrocarbons) *Juniperus oxycedrus* CAS No: 8013-10-3  
Some *Croton* oils such as *C. tiglium* & *C. oblongifolius* CAS No: ---  
Calamus oil ( $\beta$ - asarone type) *Acorus calamus* CAS No: 8015-79-0  
Sassafras oils (safrole): *Sassafras albidum* CAS No: 8006-80-2  
*Ocotea cymbarum* Brazil CAS No: 68917-09-9  
*Cinnamomum porrectum* China CAS No: ---

### **Oils that are Toxic.**

Acute oral (single dose) & dermal limit tests conducted by RIFM constitute much of our knowledge of essential oil toxicity; there is only a much smaller body of information on chronic- (6-30 month duration), sub-chronic- (up to 90 days), inhalatory- and immuno- toxicity. Some oils with LD<sub>50</sub> values of less than 1g/Kg are recommended by IFRA not to be used in perfumery (Boldo, Mustard, Calamus, Chenopodium oils etc).

We are in a Catch-22 position with regard to the animal testing of essential oils. For registration purposes under the existing laws of many countries, toxicological data (including oral LD<sub>50</sub> tests) need to be submitted and assessed for new substances in order for the safety data information profiles to be deemed satisfactory. But many oil-buying customers who are morally opposed to animal testing, will not buy essential oils from companies who have assisted or conducted recent animal testing on these items - this includes many or most of the large International fragrance & flavour houses and many individual aromatherapists. Cropwatch ([www.cropwatch.org](http://www.cropwatch.org)) is campaigning for the law to be changed in this area so that both oil-sellers and their customers are not placed in this dilemma.

The substances in brackets represent particular items of **toxicological** concern:

Almond oil bitter\* (hydrocyanic acid) *Prunus amygdalus* CAS No: 8013-76-1  
Armoise oil (thujones) *Artemisia herba-alba* CAS No: 8008-93-3  
Boldo leaf oil (ascaridole) *Peumus boldus* CAS No: 8022-81-9  
Calamus oil ( $\beta$ -asarone type) *Acorus calamus* CAS No: 8015-79-0  
Chenopodium oil aka Wormseed (ascaridole) *Chenopodium ambrosioides* CAS No: 8008-93-3  
Croton oils with known toxicological properties, such as *C. tiglium* & *C. oblongifolius*  
Horseradish oil (allyl & phenylethyl isocyanates) *Amoracia rusticana* CAS No. 84775-62-2  
Lanyana oil (thujones) *Artemisia afra* CAS No: ---  
Mustard oil (allyl isocyanate) *Brassica* spp. esp. *B. nigra* & *B. juncea* CAS No: 8007-40-7  
Parsley herb oil (dill apiole) *Petroselinum crispum* CAS No: 8000-68-8  
Pennyroyal oil (pulegone) *Mentha pulegium* CAS No: 8007-44-1  
Perilla oil (perilla ketone – lung toxin) *Perilla frutescens* CAS No: 68132-21-8  
Savin oil (sabinyl acetate) *Juniperus sabina* CAS No: 68916-94-9 – see below  
Sassafras oil (safrole) *Sassafras albidum* CAS No: 8006-80-2 – see below  
[Savoury oil, summer *Satureja hortensis* is classified T- toxic in many inventories]  
Tansy oil (thujones) *Tanacetum vulgare* CAS No: 8016-87-3  
Wintergreen oil (methyl salicylate) *Gaultheria procumbens* CAS No: 68917-75-9  
Wormwood oil (thujones) *Artemisia absinthium* CAS No: 8008-93-3

\* Almond oil FFPA is normally traded in aromatherapy = almond oil bitter Free From Prussic Acid (hydrocyanic acid).

Note that Sassafras oils (as safrole) are controlled under the Controlled Drugs (Scheduled Substances used in Manufacture) (Intra-Community Trade) Regulations 1993 and subsequent EU Directive 3677/90 as amended by Council Regulation 900/92 as a Category 1 substance. In other words, Sassafras oil cannot be bought or traded without registering with the Home Office (UK).

### **Oils that are Photo-toxic**

Photo-toxicity is light-related irritation, and involves percutaneous penetration & bio-distribution of a light-activated substance in the dermis, followed by skin exposure to light of the right wavelength and intensity. Therefore if photo-toxic

oils are applied to the skin, and exposure to bright light/UV lamps/sunshine (especially at 312 to 320 nm wavelength) occurs over the next 12- 24 hours, photo-toxic contact dermatitis effects may subsequently occur, due to re-radiation of energy from the inherent furanocoumarin content or other constituents of the oils:

Ford (1991) lists these materials which cause **photo-toxic contact dermatitis**:

Angelica root oil *Angelica archangelica* CAS No: 8015-64-3

Bergamot oil expressed *Citrus aurantium* ssp. bergamia CAS No: 8007-75-8

Cumin oil *Cuminum cyminum* CAS No: 8014-13-9

Fig leaf absolute *Ficus carica* CAS No: 68916-52-9

Lemon oil cold pressed *Citrus limon* CAS No: 8008-56-8

Lime oil expressed *Citrus aurantifolia* CAS No: 8008-26-2

Orange oil bitter *Citrus aurantium* CAS No: 68916-04-1

Rue oil *Ruta graveolens* CAS No: 8014-29-7

Tagete (oil & absolute) *Tagete* spp. CAS No: 8016-84-0

Verbena oil *Lippia citriodora* CAS No: 8024-12-2

Other oils may also be problematic as they also contain bergaptenes:

Amni visnaga oil *Amni visnaga* CAS No: ---

Grapefruit oil expressed *Citrus paradisi* CAS No: 8016-20-4

Mandarin oil cold-pressed *Citrus reticulata* CAS No: 8008-31-9

Opoponax qualities *Commiphora erythrea* oil, absolute, resinoid: CAS No: 9000-78-6

Parsley leaf oil *Petroselinum crispum* CAS No: 8000-68-8

Tangerine oil cold-pressed *Citrus reticulata* CAS No: 8008-31-9

...or because they contain the photo-toxic compound methyl N-methyl anthranilate:

Petitgrain Mandarin oil *Citrus reticulata* var. *mandarin* CAS No: 8014-17-3

...or from the thiophene content (tagete oil– also see addenda).

The IFRA Standard recommends that for fragrances not washed off the skin and subsequently to be exposed to bright light, the total level of bergapten (5-methoxypsarolen) should not exceed 15 ppm. Typical bergapten contents for a number of the above photo-toxic oils are set out on the IFRA website [www.ifraorg.org](http://www.ifraorg.org).

Citrus oils FCF (FuranoCoumarin Free) are sometimes recommended for aromatherapy, but these oils (usually distilled from the expressed oils or whole fruit slurries) are organoleptically merely pale shadows of the original materials, and have poor keeping qualities.

### **Methyl eugenol containing oils**

Methyl eugenol has been identified as a potent rodent **carcinogen**, and occurs in several essential oils, a few being:

Bay oil West Indian (*Pimenta racemosa*) CAS No: 8006-78-8..... to 12.6%  
Basil oils (*Ocimum* spp.) CAS No: 8015-73-4..... some chemotypes to 65%  
some *Melaleuca* oils (e.g. *Melaleuca bracteata*) ..... to 50%  
Nutmeg oil (*Myristica fragrans*) CAS No: 8008-45-58 ..... to 1.2%  
Pimento oils (*Pimenta officinalis*) CAS No: 8006-77-7.. ..... to 15%  
Rose oils (*Rosa* spp.) CAS No: 8007-01-0..... to 3.0%

### **Oils that cause Irritation.**

An irritant is an agent which can cause cell damage if applied in sufficient concentration and for a long enough period. Immunological processes are not involved, and the chemical insult releases a potent vasodilator called histamine from mast cells producing erythma and increased vascular permeability, accompanied by eventual migration of polymorphonuclear leucocytes to the area. Dermatitis can follow without prior sensitization. Those with fair skin are more easily irritated, but the irritant reaction can also be shown to decline with increasing age, and to increase with increasing temperature, such that irritant dermatitis may only occur in some individuals in summer. The irritant must exceed a certain threshold to produce a reaction, but the dose response curve is less acute for allergens (Burfield 1999). Unlike sensitization, irritation reactions fade when the insult is removed.

The following oils listed below can cause **irritation** effects. It will be noted that a number of phenolic oils are contained in the list. Oils such as clove and may chang are classified as R38: irritating to the skin.

Bay oil West Indian (*Pimenta racemosa*) CAS No: 8006-78-8  
Clove oils (stem, leaf, bud) *Syzygium aromaticum* CAS No: 8000-34-8  
May Chang oil aka *Litsea cubeba* CAS No: 68855-99-2  
Melissa oil *Melissa officinalis* CAS No: 8014-71-9  
Origanum oil *Origanum vulgare* & other spp. CAS No: 8007-11-2  
Pimento berry & leaf oils *Pimenta officinalis* CAS No (berry): 8006-77-7  
CAS No. (leaf): 8016-45-3  
Summer Savoury oil *Satureja hortensis* CAS No: 8016-68-0  
Winter Savoury oil *Satureja montana* CAS No: 8016-68-0  
Tagetes oil *Tagete* spp. CAS No: 8016-84-0  
Tea tree oil *Melaleuca alternifolia* CAS No: 68647-73-4  
Thyme oil *Thymus* spp. CAS No: 8007-46-3  
Turpentine oil *Pinus* spp. CAS No: 9000-64-0

The inclusion of Melissa oil in this list usually raises a few eyebrows; IFRA do not recommend this oil for perfumery use.

## Aspiration Hazards

Materials which can cause lung damage on ingestion are labeled Xn, R65, S62. This applies to essential oils and oil blends containing over 10% hydrocarbons (based on supplier information/analysis) and with a kinematic viscosity of less than  $7 \times 10^{-6} \text{ m}^2/\text{sec}$  and with a surface tension of 33mN/m @25°C (effectively most essential oils with hydrocarbon contents between 10% and 90% unless quite viscous, like vetiver oil from *Vetiveria zizanoides*). Examples of oils labeled R65 are:

Bergamot oil (*Citrus aurantium* ssp. *bergamia*) 55% total hydrocarbons  
Cedarwood oils (*Cedrus* spp.) .....60% total hydrocarbons  
Copaiba oil (*Copaifera* spp.).....80% total hydrocarbons  
Ginger oil (*Zingiber officinalis*).....90% total hydrocarbons  
Manuka oil (*Leptospermum scoparium*).....70% total hydrocarbons.

## Allergens according to the EU 7<sup>th</sup> Amendment to the Cosmetic Act

An allergen is any substance that can trigger an inappropriate immune response, or allergy, in susceptible people. Common allergens include animal fur, dust, pollen and certain foods or medications. Fragrance allergy is believed to occur in the general population at a level of around 1-2% (Nielsen & Menné 1993), but it may be much higher – for example in dermatology patients, where some researchers are indicating an occurrence of 7-8%. There are often problems in attributing reactions to a causative agent.

There is a requirement within the EU to label retailed cosmetic products (including fragrances) that contain fragrances which show concentrations of 26 identified allergens above a certain (very low) limit, according to product. This was derived largely from an SCCNFP Opinion on fragrance allergy in cosmetics and non-food products intended for consumers in 1999, which originally listed these 26 allergens (16 of which are natural and are found in essential oils). These materials are alleged to cause skin sensitivity, or to be harmful in other ways, and many essential oils may be involved by this legislation – in fact many of the essential oils commonly used by aromatherapists to massage into the skins of their subjects will contain levels of several of the 16 allergens identified in SCCNFP opinion. These allergens will be applied to the skin in normal aromatherapy practice at concentrations which are considerably more (often by a factor of over 10 times) than the 0.01% limit identified for labeling under the 7<sup>th</sup> Amendment to the EU Cosmetics Act. A list of these **natural allergens** is set out below, with corresponding levels found in some essential oils (according to the author) given in brackets.

**SCCNFP OPINION & EU 7<sup>th</sup> Amendment to the Cosmetics Act.  
(Tony B. additions in parenthesis)**

*para*-Anisyl alcohol (found in *Vanilla tahitensis* beans)  
Benzyl alcohol (to 4.5% in peru oil; also in ylang oils to 0.5%)  
Benzyl benzoate (to 78% in peru oil; in tolu resinoid, ylang & cinnamon leaf oils)  
Benzyl cinnamate (to 0.8% benzoin resinoid)  
Benzyl salicylate (to 5% in ylang ylang oil III)  
Cinnamic aldehyde (to 88% in cassia oil; also in cinnamon bark oil)  
Cinnamyl alcohol (54% in styrax oil)  
Citral (to 75% in lemongrass oils; also *Litsea cubeba*, *Melissa*, *Backhousia citriodora* etc)  
Citronellol (to 43% in geranium oil Chinese)  
Coumarin (to 65% in tonka bean absolute; in deertongue resinoid & to 0.1% in lavender)  
Eugenol (> 90% in clove & pimento oils)  
Farnesol (to 4.5% in neroli oil, 1% in rose oil)  
Geraniol (90% + in palmarosa oil; in geranium oils)  
Isoeugenol (<0.5% in ylang ylang oil extra)  
Limonene (to 96% in sweet orange oil; in citrus, pine & mint oils & many other oils)  
Linalol (98% + in rectified ho oil; in rosewood oil, coriander & linaloe oils; ubiquitous )

**Comment.** This brings us into an interesting area. Palmarosa oil (*Cymbopogon martinii*) for example has a geraniol content of 80% - 90%, listed as a sensitizer above, but was previously found to be non-sensitizing by RIFM. It is postulated by Leopoittevin & Mutterer (1998) that geraniol acts as a pro-hapten (see Sensitization) and is oxidized to the hapten geranial, which may be responsible for sensitizing/allergenic effects. However there is an on-going discussion as to whether there were impurities or oxidation products in the synthetic items used for toxicological testing in the case of benzyl salicylate, coumarin and linalol at least, since 100% pure items do not give these reactions. Further, a number of allergens identified by the SCCNFP may be weak, and/or rarely cause sensitization (see below).

We thus may have a situation where erroneous (extrapolated) conclusions have been made by the dermatologists conducting the tests. This situation leads to doubts about the true allergenicity of essential oils containing these substances. But for now, aromatherapists should be aware of the issue of allergenicity and review their treatment protocols in the light of this information.

### **Hand dermatitis in Massage Therapists**

Crawford *et al.* (2004) investigated the self-reported and symptom based prevalence of hand dermatitis in aromatherapy massage therapists in a 12-month study finding it to occur at 15% and 23% respectively (compared to reported rates of 2-12% in the general population). The study found significant associations



between the reporting of dermatitis and use of aromatherapy products in massage oils and having a history of atopic dermatitis. Dorsal hand dermatitis (49%) as opposed to palmer dermatitis was most prevalent, the latter being typically associated with allergic contact dermatitis. Interestingly the therapists themselves cited frequent hand-washing as the most significant factor.

### **Oils that have not undergone formal safety testing**

Many essential oils used in aromatherapy in a more pan-global context have not undergone formal safety testing, or if they have, the information is not in the public domain which raises questions about ethical use in a professional setting. Examples include those oils from *Amni visnaga* or from Catnip (*Nepeta* spp.), and even more universally from familiar oils such as Niaouli (*Melaleuca quinquenervia*) or Ravensara (*Ravensara aromatica*). Further, many oil chemotypes used in aromatherapy such as Rosemary oil verbenone type (*Rosmarinus officinalis* ct. verbenone) or *Helichrysum italicum* ssp. *serotinum* also remain untested for safety or toxicity.

### **Pregnancy & Effects on the Reproductive System**

Many essential oils are currently under examination for genotoxic effects. We already know that sabinyl acetate is embryotoxic, fetotoxic, teratogenic and abortifacient and is found in the following oils, which should not be used in aromatherapy:

*Plectranthus fruticosus* oil CAS No: ---

Spanish sage oil *Salvia lavandulaefolia* CAS No. 8016-65-7

Savin oil *Juniperus sabina* CAS No. 8024-00-8

Parsley herb and leaf oils and some chemotypes of the seed oil *Petroselinum crispum* contain dill apiole to 20% which is severely hepatotoxic and high dose levels have (endangering the subject) been used to procure an abortion.

*Vitex agnus-castus* berry oil CAS No: ---

Although some other essential oils may show a weakly estrogenic effect, *Vitex agnus-castus* berry oil is sometimes used for 'hormonal balancing' by aromatherapists: especially in post- and peri-menopausal women. There is evidence that diterpenes in the oil cause circulating female hormone levels to change, sometimes dramatically. The oil should therefore only be used under medical monitoring and supervision (Lucks B. 2003-4; Sorenson J. 2003)

Exposure to essential oils generally should be avoided/minimized during pregnancy, especially during the first trimester. Many of the components of essential oils, once they appear in the bloodstream, are probably capable of crossing the placenta. Since we are largely unsure of de-toxicification routes in foetal development, no "expert" is capable of guaranteeing 100% safety following

short or long-term exposures to essential oils.

### Vegetable Massage Oils

It is sometimes forgotten that skin sensitivity can be caused by vegetable carrier oils, just as it can by essential oils. Further, the aromatherapist must always be alert to possible client allergy to nut oils (almond, peanut, macadamia, etc).

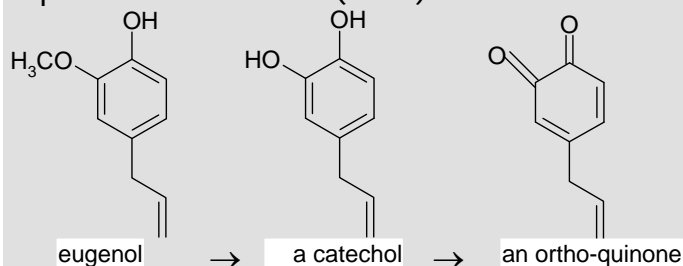
### Interaction with medication

Certain essential oils can cause problems with subjects taking medication, including those taking anti-coagulant and anti-depressive drugs. Problems with grapefruit juice, and by inference, grapefruit oil, and Bitter Orange extracts have been the subject of separate brief reviews by one of the authors (TB). In general, if you are on medication, and until you have consulted your physician, or have otherwise sought expert advice, avoid undue exposure to essential oils.

### Oils that cause Sensitization

Sensitizers can be dermal or respiratory. More usually in aromatherapy a sensitizer is a substance that causes dermatitis only after alteration (sensitization) of the skin by previous exposure to that substance (like a patch test or in food as flavouring). It involves the immune system; the following steps (permeation, metabolism, hapten production, antigen production) typify the skin sensitization process\*:

1. The chemical **permeates the dermis**, and undergoes **bio-distribution**. Permeation is related to lipophilicity & molecular volume.
2. It is either **metabolized** by cutaneous enzymes or other processes to form a reactive metabolite, or often may be chemically modified through the reaction of UV light, or remains unchanged. The rate of conversion of pro-haptens to haptens is important in sensitization. For example for the weak sensitizer eugenol is oxidized to a highly reactive *ortho*-quinone hapten (in mouse skin\*\*) according to Lepoittevin & Mutterer (1998):



3. These so- produced reactive **haptens** bind to dermal proteins (haptens are often electrophilic and can bind covalently with -NH<sub>2</sub> groups and -SH groups on proteins, modifying the protein, which when presented to the immune system, will react with antigen-presenting cells in the dermis).
4. The Langerhans cells react with the allergen (the hapten-protein complex). They then migrate to the thymus.
5. The Langerhans cells teach T-cells to recognize the allergen and when they leave the thymus they are sensitized.

6. When they encounter the allergen they release lymphokines.

\* After Lepoittevin & Mutterer (1998) & Burfield (1999).

\*\* The author does not condone animal testing in any shape or form.

Under EC labeling laws, skin sensitizers are labeled Xi, R43.

According to the IFRA Hazards Working Group opinion (June 2004), "quenching phenomena" effects can still be taken into account (according to Section 3.3 of the EU Dangerous Preparations Directive 88/379/EEC); however quenching phenomena effects between eugenol and cinnamic aldehyde are now unsupported according to the Notification No 4. of 38<sup>th</sup> Amendment to the IFRA Standard (several authorities have questioned the whole concept of quenching and declared the hypothesis as unsafe).

The following oils are responsible for severe **sensitization** effects and should not be used in aromatherapy massage:

Cassia oil (cinnamic aldehyde, coumarin) *Cinnamomum cassia* CAS No: 8007-80-5  
Cinnamon bark oil (cinnamic aldehyde) *Cinnamomum zeylanicum* CAS No: 8015-91-6

Costus oil, abs, concrete (sesquiterpene lactones) *Saussurea lappa* CAS No. 8023-88-9

Elecampne oil (sesquiterpene lactones) *Inula helenium* CAS No: 1397-83-7

Fig leaf absolute *Ficus carica* CAS No: 68916-52-9

Massoia bark oil (massoia lactone) *Cryptocarya massoia* CAS No: 85085-26-3

Melissa oil (citral) *Melissa officinalis* CAS No: 8014-71-9

non-IFRA compliant Oakmoss absolute etc. *Evernia prunastri* CAS No: 9000-50-4

Treemoss abs. *Pseudoevernia furfuracea* CAS No: 68648-41-9

& Cedarmoss *Evernia furfuracea* qualities (resin acids)

Opoponax qualities *Commiphora erythrea* CAS No: 9000-78-6

Oxidized oils especially from *Pinaceae* (*Pinus* & *Cypress* spp.) and *Citrus* oils (hydroperoxides)\*

Peru balsam & oil *Myroxylon pereirae* CAS No: 8007-00-9

Styrax qualities *Liquidamber* spp. CAS No: 232-458-4

resinoid: CAS No: 8046-19-3; oil: CAS No: 8024-01-9

Verbena absolute & oil *Lippia citriodora* CAS No: 8024-12-2

Tea absolute *Camellia sinensis* CAS No: 84650-73-4

Turpentine oil *Pinus* spp. CAS No: 8006-64-2

\*IFRA recommends for example that oils from the *Pinaceae* e.g. Fir needle oil Canada *Abies balsamea* should have a peroxide value of less than 10 millimoles of peroxide per litre.

Some fragrance houses internally restrict the use of bay laurel oil (*Laurus nobilis*) in their fragrances because of customer sensitization issues.

Predictably also these essential oils marketed to aromatherapists are also sensitizers:

*Backhousia citriodora* oil (high citral/citronellal content) CAS No: ---

*Inula graveolens* (sesquiterpene lactones) CAS No: ---

N.B. Some aroma concerns offer low sensitizer ranges of oils where sensitizing constituents have been selectively removed by moved techniques such as spinning cone distillation (also called centrifugal molecular distillation). Of course, selectively removing components can affect their overall physiological effects).

### **SENSITISERS & IRRITANTS: essential oil use in aromatherapy**

In other professions, the use of essential oils may be restricted by legislation. The infamous 7<sup>th</sup> Amendment to the EU Cosmetics Act requires a labeling obligation (amongst other things) by March 2005 for a final cosmetic product containing any of the 26 identified allergens present at 0.01% in products rinsed off the skin, or 0.001% in leave-on products. Sixteen of these allergens occur naturally in essential oils, and the SCCNFP in their 2002 Opinion made no distinction between natural and synthetic allergens, a decision which IFRA and the FMA are reportedly unhappy about (Rexpan 2004). In Europe this legislation may therefore affect retailed aromatherapy massage oils and essential oil blends, creams and lotions and bath products intended for a cosmetic purpose, as well as natural and part-natural fragrances. Many fragrance customers work to the principle that fragrance compounds (finished fragrance concentrates prior to dilution in alcohol) should have limits of 1% of R43 sensitizers and 20% of R38 irritants - but since the majority of essential oils have some sort of risk coding under IFRA-IOFI the final risk coding may mean employing sophisticated software to work out the appropriate labeling requirements.

The fall-out from the 7<sup>th</sup> Amendement doesn't apply to aromatherapists in their practices (well not yet anyway) but the therapist practicing anywhere in the world is required to disclose to the subject all possible adverse effects of the proposed treatment and any associated risks under due diligence, and so this area surely must therefore be discussed between therapist and subject in a truly professional approach.

Professor Schnuck (Schnuck 2004) reported on work done by the IVDK, an information network of dermatologists. He concluded that not all the 26 allergens identified by SCCNFP Opinion and enshrined in the 7<sup>th</sup> Amendment to the Cosmetics Act bear the same risk, and criticized the EU Commission for treating them all as equal. The report classified allergens accordingly (those 16 occurring in essential oils and naturally occurring aromatic materials are in blue; synthetic fragrance chemicals are in black):

1. Strong potent allergens: oak moss, tree moss, iso eugenol and cinnamic aldehyde.
2. Less potent allergens: cinnamic alcohol, hydroxycitronellal\*\*, HMPCC.
3. Rarely found as allergens: amyl cinnamic aldehyde, citral, eugenol, farnesol, lillial, methyl heptine carbonate.
4. Risk of being an allergen too small to consider: amyl cinnamic alcohol, benzyl alcohol, benzyl salicylate, geraniol, anisyl alcohol, benzyl benzoate, benzyl cinnamate, citronellol, hexyl cinnamic aldehyde, d-limonene, linalool, coumarin and alpha-keton.

### **Comments on Schnuck's findings**

Oils like cassia and cinnamon bark oil containing strong potent allergens such as cinnamic aldehyde, and materials like oakmoss & treemoss (category 1 above) are not (hopefully!) used in aromatherapy massage; few essential oils contain the less potent allergen cinnamic alcohol (category 2 above). The use of neat cinnamon bark oil on the skin would produce a moderate to severe reaction in most people, which may become increasingly dramatic with successive exposure events – as shown for example by a severe body rash on the neck, face and arms, or via breathing difficulties, just from exposure to the vapor.

In Aromatherapy we might however use a number of oils from the 'rarely found as allergens' category 3 above – for example citral-containing oils such as lemongrass oil (to 90% citral) and *Litsea cubeba* (to 78% citral). Lalko & Api (2004) quote figures on the potency of *Litsea cubeba* and lemongrass oil (*Cymbopogon* spp.) to promote skin sensitivity (at 8.4% and 6.5% respectively) using the Local Lymph Node Assay Test, a result which is not far removed from the figure for citral itself (6.3%). The authors also quote a NOEL for citral of 0.5% for the induction of sensitization in humans. Since citral binds to dermal proteins and stains the skin deep yellow for a number of days, we probably aren't likely to use the undiluted over large exposed areas, especially since citral is also an irritant as well as a sensitizer.

Eugenol also provides us with a particular problem – it is present in phenolic oils such as clove leaf stem & bud oils (to 92% in leaf oil), pimento leaf (to 85%) and W.I. bay leaf oils (to 56%), and again is classified as both a sensitizer, a moderate skin irritant and a severe mucous membrane irritant, and Pederson *et al.* (2004) have already observed the augmentation of the skin's response to allergens in the presence of an irritant. The 38<sup>th</sup> Amendment to the IFRA Standard (Nov 2003) states that the concentration limits for eugenol in skin contact leave-on fragrance products is 0.5%, for rinse-off products (including household cleaning products) is also 0.5% and for non skin contact products 5%. When eugenol was tested recently at 5% on the skin of human volunteers, the number of strong irritation skin reactions became so excessive it was impossible to distinguish irritation from sensitization - twenty six oils that contain eugenol are given in Annex 1 to the

IFRA standard. The use of clove oils at an absolute maximum of more than 0.6% concentration in AT massage would therefore seem advisable – on this evidence the use of higher concentrations would be foolhardy, if not downright dangerous.

Category 4 substances, which Schnuck considers the risk of being an allergen too small to consider, gives us the most grief under EU legislation, since for example limonene and linalol have a widespread, if not ubiquitous occurrence in essential oils. But limonene is classified under UK CHIP regulations as an irritant, sensitizer and as dangerous for the environment. Geraniol comprises 85% of palmarosa oil, and citronellol and geraniol make up a considerable proportion of rose otto, which has been considered safe enough for aromatherapeutic application for pregnant mums and babies up to now. It is also apparent that in the case of coumarin being labeled an allergen, that the science is incorrect and a manufacturer of pure coumarin has just recently sent proof that it is not an allergen back to the SCCP (formerly the SCCNFP) for reconsideration. This situation may apply to other alleged sensitizers. Use of d-limonene and linalol containing essential oils have a reduced risk of adverse skin if your supplier follows Good Manufacturing Procedures and adds an anti-oxidant such as vitamin E to prevent the build up of sensitizing hydroperoxides and their breakdown products.

### **NEAT OILS or UNDILUTED USE**

Because of the rapid growth of aromatherapy practices since the internet has arrived, the use of undiluted essential oils has increased dramatically – especially amongst holistic therapists and lay people who use oils without any safety training. Uninformed people at trade shows, fairs, and hundreds of entrepreneurial single trader businesses on the internet sell concoctions of essential oils without a thought about any possible risks. Natural perfumers ('botanical formulators'), untrained therapists, even consumers are using undiluted oils on the skin without knowing they could be setting up the conditions for sensitization to occur. Sensitization is becoming the principle problem of this profession, and the aromatherapy profession is largely in denial over it.

One reason is that therapists were badly instructed by mentors or suppliers at trade shows and conferences, or they may have read a popular high-street book and decided that since oils are natural they will not be harmful. One acupuncturist in her twenties that I (SSH) spoke to recently said that she routinely puts several drops of some 2 or 3 neat essential oils directly onto her hands and runs down the clients spine with this mixture first, before working on the feet (still applying undiluted oils) - prior to commencing acupuncture treatment. Since she learned the risks of this approach, she now dilutes her oils, saving money, and achieving the same therapeutic effects (thus far), keeping everyone safer and avoiding lawsuits.

Others are involved in the growing phenomenon called "Raindrop Therapy", which uses seven single neat oils (4-6 drops each: thyme, oregano, followed by of cypress, birch, basil, and peppermint) neat, and 3 essential oil blends (only 2 are diluted in almond oil). This concoction represents a huge dermal insult from several milliliters of undiluted oils that are known-irritants being dripped onto the spinal area of subjects' backs. After working the oils in with the fingertips along the spine, the area is covered with a warm towel "while they rest" (Stewart, 2003). The diluent ("V-6 mixing oil") was used only if the "burn gets too bad". This is followed by neat application again on the both legs of 2-3 each drops of these 4 oils (in this order): cypress, birch, basil, and peppermint ([http://www.uniquelyyoublend.com/White\\_Paper.htm](http://www.uniquelyyoublend.com/White_Paper.htm)). These treatments have become quite common in homes, spas, and treatment offices, as they claim to cure everything from brain injury to scoliosis (which is "due to a virus"). Testimonials abound for this miraculous cure, as they tend to do in multilevel businesses, and the use of undiluted oils sells a lot of product up and down line. Unfortunately horror stories also are emerging, as injured folks seek relief and want to finally tell their story. Often the business owner trusts the therapists and has no idea this is even being performed. Many injured parties don't want to admit they got burnt (no pun intended), so few get reported to the authorities, but it won't be long before someone gets sued over this. An excellent overview is given in the White Paper mentioned above, which asserts an opinion **against the use of a technique using undiluted known-irritant oils** called "Raindrop Therapy", as it currently cannot be supported as a recognized aromatherapy "best practice."

As an addenda, a manager of a high end resort/day spa and was horrified to find out how their favorite (money-making) treatment could hurt someone, saying "no one has ever complained" (SSH: private communication 2005). But as we know, it is often difficult to establish legally the direct cause of irritation/sensitization, and many are dissuaded from taking it further. A positive development as a result of this episode is that the spa in question still offers the same treatment but now dilutes the oils, reducing overheads, and achieving the same results, so everyone rests easier at night. A simple and safe solution.

Aromatherapists are reported as applying undiluted essential oils to the skin in certain 'minor emergency' situations – tea tree oil for small skin traumas, lavender oil for *very minor* burn areas, cajuput or niaouli oils for insect bites, stings etc. etc. Some people think if we have a question as to use an oil or not, to do a patch test (which few carry out), which now we know can actually set up a sensitization reaction. Some think since they have "never had a reaction", it's not a problem, or with "hundreds of clients we've not had any problems". Yet how would they know? With many sensitization reactions it may be hard to determine the exact origin of the problem.

Long ago many of us were poorly advised on how to use oils undiluted before we knew better. Some of us saw Dr. Daniel Penoel apply oils neat to someone's spine in a demo, even using a hair dryer to "help absorb" with no warnings about adverse reactions. Qualified medical practitioners may prescribe essential oils for neat use or orally (in capsules) or larger than normal doses, but legally they are qualified to practice medicine. We hear charismatic speakers at conferences touting wondrous healings with massive doses of irritant oils for clinical cases of severe infection or chronic diseases. But for the majority of us using essential oils for health, very few are appropriately qualified in appropriate disciplines, or even need to use essential oils this way. And in light of the previous information available, in doing so is endangering ourselves as therapists, endangering our clients and promoting more reported skin problems from our oils in the world. At some point we have to 'get real' and admit we have been misled - the evidence from dermatologists is already making us look unprofessional and I repeat, in denial.

If you think about it, if relatively high amounts of essential oils are absorbed and localized in the dermis as we claim, and can also enter the bloodstream via inhalation, then the oils are physiologically active, and few of us are qualified to predict the consequences of this phenomena. In the case of birch, methyl salicylate is quickly absorbed and large or repeated exposures may constitute a toxic dose, especially to children. Do we know all medications our clients are taking and the possible reactions? And do we really need to? Many ailments only require a change of attitude, and just the exposure to low doses via the sniffing of oils works well in that way!! Some with a more spiritually based approach believe dropping the oils through the "aura" affects the person, and it may well do so, but if it's a frequency based phenomena at work, then the diluted oils will theoretically work just as well as we see in homeopathy? (see *What the Bleep do we Know?*)

Undiluted oils should not normally be used topically especially on sensitive areas like the eyelids, on diseased skin, mucous membranes etc. due to the risk of inflammation. It is conceded that many essential oils will contain individual chemicals which have been separately shown to contain individual irritants and sensitizer chemicals. Work is going on to establish when these chemicals naturally occur in essential oils, they are equivalently adversely active. It is fairly safely presumed in the meanwhile, that these substances may only show their adverse effects if applied at a concentration above the NOEL. So in other words, dilution is the safest method to proscribe.

### **In summary**

Safety- armed with the forgoing information, we know that undiluted oils can be inflammatory; and the use of undiluted essential oils is not safe. Not only do they bring risks like burns and injury if undiluted, but also the risks of sensitizing both your subject and yourself. Remember the healer's rule to first "do no harm". Why risk it?



Efficacy- is neat really better? We know that 'more' is not always 'better', and that diluted oils work just as well. It is also true that some essential oils show one set of physiological properties at lower concentrations and another set of effects at higher levels - for example 1,8-cineol-containing oils can show this effect under certain conditions. It's also true that essential oils can produce psycho-physiological effects at concentrations below odor threshold or odour recognition levels.

Legal perspective- if we use oils undiluted, do they (as we say), "penetrate the skin" which could legally be considered administering a drug, and if so are we practicing medicine without a license here? Not everyone agrees that diluted oils necessarily penetrate faster or yet permeate the bloodstream. Some would say they are held in the dermis as a 'reservoir' and may be acted on by P450 enzymes in the dermis, or meet other biological fates. We also don't know much about toxio-kinetics - this being one of the areas that the SCCP have criticized essential oil toxicology studies as being deficient in. So if we accept we have progress to make in toxicological understanding, it makes sense to err on the side of caution with sensible measures to protect ourselves, and to be aware.

We do however know which oils should not be used on the skin, and how to dilute them. If someone has a problem after a treatment you have given with your product, and decides to sue you, do you have liability insurance? Is it up to date? Do you really think you would stand a chance if you knowingly put a well-known irritant/sensitizer on a client, who then develops a severe reaction and decides to sue you? Would it be worse if you didn't dilute? Do you think it matters to a judge if you have never seen or known of anyone who'd have a bad reaction and therefore assumed it was safe? These are issues that should be addressed if one chooses to use neat oils or an irritant/sensitizer.

Ethics- This topic is the crux of this entire paper and the take home message. If the reader did not understand anything else, please understand this. Ignorance is not an excuse and will not hold up in a court of law (at least in the USA). When we use oils undiluted, or any of the toxic oils, or the known irritant/sensitizers we break the first rule of healers: "do no harm", because we are a danger first to ourselves, secondly to our clients and third, our profession. If you don't care about yourself, please care about your clients and the entire aromatherapy profession, not to mention the health of the world.

#### Disclaimer:

As far as is known, this document has been assembled from current data sources which are believed to be accurate and reliable, but the authors do not claim that the information above is complete, and this data is supplied without warranty, either expressed or implied, regarding its' correctness or accuracy. It is the user's responsibility to determine safe conditions for the use of the essential oils described above, and to assume liability for loss, injury, damage or expense arising from improper use of these products.

#### Glossary:

Aka: also known as

CAS No: Chemical Abstracts Services number

CEFS: Committee of Flavour Experts

CHIP: Chemicals (Hazard Information and Packaging for Supply) Regulations

EU: European Union

FMA: Fragrance Manufacturers Association

IFRA: International Fragrance Research Association

FCT: Food & Cosmetics Toxicology

LD<sub>50</sub>: The dose (usually expressed in g/Kg) that kills 50% of a group of matched animals (that were administered different doses).

MSDS: Material Safety Data Sheet

NOEL: no-observed-effect-level

Quenching: a phenomena whereby in predictive human skin sensitization human testing, the expected sensitization effects of a fragrance allergen on skin contact are reduced or nullified by the simultaneous presence of another chemical.

REXPAN: RIFM's expert panel

RIFM: Research Institute for Fragrance Materials

SCCNFP: Scientific Committee on Cosmetic and Non-Food Products

SCCP: Scientific Committee on Consumer Products

[Note: all CAS Nos. quoted above for essential oils are in the form of a US CAS No].

#### References:

Bertrand F. *et al.* (1966) "Skin sensitization to eugenol and iso-eugenol in mice: possible metabolic pathways involving ortho-quinone and quinone methide intermediates" *Chem Res Toxicol* **10**, 335-343.

Burfield T. (1999) Safety Lecture to Aromatherapy Organisations Council. July 1999 available at:  
<http://www.users.globalnet.co.uk/~nodice/new/magazine/magsafetylecture.htm>

Burfield T. (2004) *Cropwatch 3* – see <http://www.users.globalnet.co.uk/~nodice/>

Crawford G. *et al.* (2004) "Use of Aromatherapy Products and Increased Risk of hand Dermatitis in massage Therapists". *Arch Dermatol* **140** (Aug 2004) 991-996.

Ehlers D. & Fister M. (1997) "Compounds of Vanillons (*Vanilla pompona* Schniede)" *J. Essen Oil Res.* **9**, 427-431.

Ford R. (1991) The toxicology and safety of fragrances. In Muller PM, Lamparsky D. (eds) *Perfumes, Art, Science & Technology*, pub. Elsevier New York pp441-463.

Leopoittevin J.P. & Mutterer V. (1998) "Molecular Aspects of Fragrance

Sensitization" in P.J. Frosch, J.D. Johansen, I.R. White (eds) *Fragrances: Beneficial & Adverse Effects* pub Springer-Verlag 1998.

Lalko J. & Api A. "Potency of Citral in the Local Lymph Node Assay" RIFM (Abstract No. 144).

Lucks, Barbara (2003-4): aromatherapy newsgroup mails.

Nielsen N.H. & Menné T. (1992) "Allergic contact sensitization in an unselected Danish population. The Glostrup Allergy Study, Denmark." *Acta Dermatol Venereol* **120**, 33-36.

Pederson L.K., Johansen J.D., Held E. and Agner T. (2004) Augmentation of Skin Response by Exposure to a combination of allergens and irritants – a review. *Contact Dermatitis* **50**(5), 265-273.

Rexpan (2004) RIFM Expert Panel Opinion on Essential Oils (internal document) *Rexpan Final* Oct 4, 2004.

Schnuck (2004) *Öko-Test* No. **7**/2004, 55.

Sorenson, Janina (2003): aromatherapy newsgroup mails.

Stewart, David, (2003), *A Statistical Validation of Raindrop Technique*, Care Publications, marble Hill, Missouri

Tisserand R. & Balacs T. (2000) *Essential Oil Safety – a Guide for Health Professionals*. Churchill-Livingstone.