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THE FIRST TRULY INDEPENDENT WATCHDOG FOR THOSE WORKING WITH NATURAL AROMATIC MATERIALS

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Aroma News 2008: a Catch-Up, & some Cropwatch Comments.

Some contentious regulatory issues, 2008.

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Many contentious regulatory issues concerning Health & Safety in the EU remain unresolved, causing reactions amongst professionals which range between skepticism to deep despair. Many of you reading this Newsletter will have been spending the past 2-3 months battling with EU's **REACH** pre-registration obligations, in order that your aroma company remains in business after 1st Dec 2008. No doubt some of you will have been attempting to use the official user un-friendly software for multiple ingredient registrations, which many have found does not work properly and is difficult or impossible for most companies to network. Meanwhile a proposed act of cultural vandalism against the high art, history & culture of fine fragrance, via some regulatory measures which will ban **citrus oil usage** in cosmetics, is still hanging over the trade in the form of the phototoxic furanocoumarins issue. We can only assume any potential developments on this issue are temporarily held in abeyance whilst Brussels staff holiday-away the summer months. Ironically, recent studies have identified a number of photo-carcinogenic risks associated with several relatively common (non-aromatic) cosmetic ingredients, & it will be interesting to see if these findings are quietly ignored by the Commission in favour of continuing to pursue the existing vendetta against natural aromatic products. A similar situation of unfair ingredient hounding applies to the ubiquitous monoterpene constituent and major component of citrus oils, **limonene**, allegedly a danger to the environment, and therefore classified as an R50/53 material (& also as an R38 irritant & R43 sensitiser). Certain of the more technically adept amongst the regulatory clerks who have been working on limonene's predicament have appealed to Cropwatch for help to overcome the enveloping regulatory madness surrounding this material, whereby a set of archaic chemical tests (which bear no relation to limonene's eventual environmental fate) are used to determine its environmental risk classification. Limonene-containing citrus oils have traditionally been used in many types of perfumes (for example, air freshners, wicks & gels) for their diffusion, lift & character, but perfumers find it difficult or impossible to use them

at useful levels because of obligatory R50/53 labelling (who's labeling incidentally depicts a dead tree, although we challenge anyone to identify any tree killed by limonene). The same situation arguably also extends to pine oils and many other naturals. There is also a knock-on effect with the various **eco-labelling** systems - which are supposed to represent a form of environmental performance labelling. - since to qualify, fragrances would have to be completely free of ingredients with a R50/53 or R51/53 's risk classification. This results in a situation where a good proportion of individual natural ingredients are unable to be used, so that many eco-labelled perfumes are in fact 100% synthetic – possibly the opposite to what customers would expect from this form of labelling.

Meanwhile, we natural ingredient users have another piece of toxicological scare-mongering looming up at us, which is making some parts of the aroma producing industry very, very annoyed, whilst the professional perfumers amongst us wring our hands. This time the 'anti-fragrance brigade' is trying to completely strangle the use of **fragrant lichen products** in cosmetics, via a misconceived 2008 SCCP Opinion (see below).

Tim Denny.

We were sad to hear that Tim Denny, expert & leading authority on the distillation of essential oils, especially lavender & mint oils, died on 24th Feb 2008, aged 87. Denny worked on the Bridstowe Estate in Tasmania from 1947-1973, a lavender plantation established by his father in 1920, where he improved lavender oil-yielding strains, invented the first lavender harvesting machine and designed steam distillation equipment that improved both the yield and quality of lavender oil, eventually quadrupling the daily oil throughput. By 1976, Tim Denny had teamed up with steam engineer Keith McKenzie to begin advising producers of essential oils on the theory and practice of herb distillation. In 1978 Denny realised that the classical take on steam distillation defied the 2nd law of thermodynamics, and was able to show the critical importance surrounding the transfer of latent heat in the recovery of essential oils by steam distillation. A fuller account of Denny's life and achievements can be seen at http://www.telegraph.co.uk/news/obituaries/1581733/Tim-Denny.html. In our own modest way, Cropwatch staff have been privileged to see many first-hand working examples of field stills & processes designed by Denny in their aroma-orientated travels. Denny's books and articles have a valued place in our library.

Further reading:

Denny E.F.K. (1989) "Hydro-distillation of oils from aromatic herbs." *Perf & Flav*. **14**(4), 57-63. .

Denny E.F.K. (1991) *Field distillation for Herbaceous Oils* 2nd edn private publ. Denny, McKenzie Associates, Tasmania. (N.B. There may be later editions?).

Denny E.F.K. (2002) "Distillation of lavender type oils – theory & practice." In Maria Lis-Balchin *Lavender; the Genus Lavandula* pub CRC Press 2002.

Sale / use of fragrant lichen commodities to become virtually illegal in Europe?

by the Cropwatch Team (with considerable help from those who have to remain anonymous).

Aug 2008.

Executive summary.

SCCP Opinion SCCP/1131/07 'Opinion on Oakmoss/Treemoss' adopted at the 15th Plenary Meeting on 15th April 2008 limits the potent sensitisers atranol & chloroatranol to 2ppm in oakmoss & treemoss (and cedarmoss) products. These SCCP proposal limits are currently unachievable by industry, reported elsewhere as being the result of a mistaken manufacturers claim. Further, they contrast with a forthcoming IFRA Purity Standard (shortly to be introduced under the 43rd IFRA Amendment) which proposes an achievable limit of 100ppm for atranol & chloroatranol respectively. The SCCP proposal drives a stake right through the heart of perfumery art, heritage & culture, since fragrant moss (lichen) extracts are the cornerstones of both the chypre & fougère accords, so important throughout the history of perfumery. It remains to be seen whether this SCCP Opinion will be transformed into an EC edict, and therefore whether fragrant moss products have any future in Europe. Once again, the SCCP, with its impractical Opinions, is in danger of putting European aroma companies at a disadvantage in the global marketplace, unless the Commissioner can be persuaded otherwise.

Oakmoss: importance in perfumery.

Oakmoss products have a solidly established place in perfumery, being the cornerstone of two renowned accords; the ***chypre*** and the ***fougère***. In the classical *chypre* accord, oakmoss is blended with patchouli, labdanum and other woody animalic and ambery notes, and also often with bergamot. These combinations are the foundation of a family of several leading fine fragrances: Chypre (Coty 1917), Mitsouko (Guerlain 1919), Miss Dior (Christian Dior 1919), Ysatis (Givenchy 1984) & in the male category Aramis (Aramis 1965) & Macassar (Rochas 1980) to name but a few. In the *fougère* accord, striking examples of which include Fougère Royal (Houbigant 1882), Drakkar Noir (Guy Laroche 1982), and Jazz (Yves St. Laurent 1998), oakmoss is blended with coumarin, lavandaceous notes and often with salicylates. Oakmoss products also find uses in colognes, pine fragrances, Crepe de Chine, oriental and fantasy bases etc. etc. (Burfield 2000).

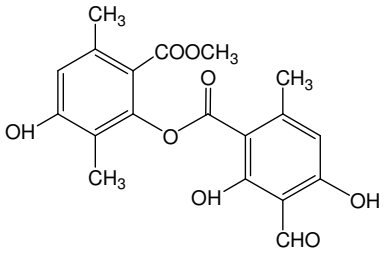
The importance of oakmoss in our perfumery heritage cannot be understated - indeed what are we left with if fragrant moss products are taken away (as nitro-musks and oakmoss have been, in Guerlain's controversially reformulated Mitsouko fragrance, now a shadow of its former self). Well, we are left with a few synthetic oakmoss chemicals, such as *Evernyl* (methyl 2-4-dihydroxy-3-6-dimethylbenzoate) and formerly, the less popularly-utilised *Orcinyl-3* (3-methoxy-5-methylphenol), which the hype from synthetic aroma chemical producers would try to persuade you 'represent the essential character compound of oakmoss'. But, as any practicing perfumer will tell you, there is no way that any single oakmoss synthetic can offer the richness, full body and presence of authentic oakmoss commodities in use, nor approach their superior fixative properties, nor can they duplicate approach the way that oakmoss can radiate and resonate

through the entire body of a fragrance. It should also be mentioned that a range of commercial oakmoss products exists, some offering a warm, leathery-mossy character, whilst others offer have woody, mossy - almost marine-like aspects. When materials like oakmoss extracts are restricted by the exiting culture of toxicological imperialism on dubious safety grounds (and this applies also to other vital perfume ingredients such as coumarin and citrus oils - see elsewhere), the 'art of the possible' in perfumery' dies back even further, with a result that fragrance companies, instead of vigorously opposing regulatory change, end-up producing cheap, conformist and essentially poor-quality perfumes with little consumer re-purchase potential, for a increasingly non-discerning market slot.

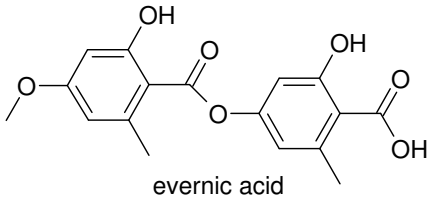
It is also important to remember, as Joulain (2002) pointed out, that many in the US did not distinguish botanically between the lichen sources of oakmoss (*Evernia prunastri* (L.) Arch), and the source for treemoss & cedarwood (*Pseudevernia furfuracea* (Fr.). This may account for the confusion on various perfume blog sites which have discussed the exact identity of the listed fragrant lichen ingredients employed in a number of classic fragrances, although, to be fair, it should also be remembered that previously oakmoss extracts have invariably been extended with synthetics, and mixed in with treemoss extracts either intentionally, or unintentionally when harvested together..

Cedarmoss growing on *Cedrus atlantica* in High Atlas, Morocco.
Picture: T. Burfield

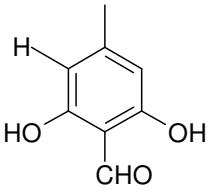
Oakmoss products have been identified amongst the most frequent fragrance contact sensitizers (Schnuch *et al*. 2007), although the exact chemical identity of the major allergens has been elusive. Gonçalo (1988) for example, considered that that the major sensitisers in oakmoss included atranorin, followed by usnic, evernic and fumarprotocetraric



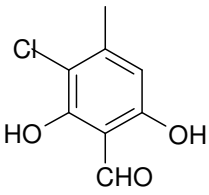
atranorin



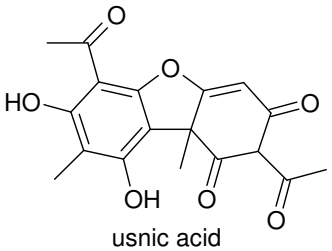
evernic acid



atranol



chloroatranol



usnic acid

acids, but Bernard *et al*. (2003) note that sensitivity to oakmoss has been associated with components which hold the phenylbenzoate molecular fragment in common, including atranorin & evernic acid. In particular, Bernard *et al.* identified atranol & chloroatranol as strong elicitants in most patients sensitized to oakmoss, and that the oakmoss character compound methyl β-orcinol carboxylate (Evernyl) is also capable of eliciting a reaction in most patients.

How widespread is our exposure to atranorin and other lichen sensitizers? Atraric acid, produced by the hydrolysis of atranorin, has been found in low concentrations of the heartwood from oak species *Quercus robur* & *Quercus petraea* used for staves in the production of **oak barrels used for storage of wine & sprits** (Bourgeois *et al.* 1999). It is likely that colonizing species such as *Parmelia olivetorum* and/or *P. perlata* produce depsides in the wood leading to atranorin accumulation.

It is also worth mentioning, as many of the more travelled amongst you will know, that according to some estimations, up to 1,000 tons/year of *Parmelia nepalensis* (Taylor) Hale ex Sipman is processed into lichen oil, absolute or extract in Western Nepal, and exported for global perfumery and incense use (although the lichens are also used in traditional systems of medicine). Other species such as *Parmelia tinctorum* Delise ex Nyl. & *Usnea* spp. may be co-gathered at the point of harvesting. Moxham (1986) notes the use of *Parmelia nepalensis*, *P. nilgherrensis*, *Ramalina subcomplanata* & *Usnea lucea* in India. Kumar & Muller

(1999) have identified the depsides atranorin & diffractaic acid in *Parmelia nepalensis* & *Parmelia tinctorum* extracts. (N.B. note that *Parmelia furfuracea* is a synonym for *Pseudervenia furfuracea*).

A brief regulatory history of fragrant lichen products.

1. An IFRA Standard was introduced for oakmoss extracts in April **1991**; the updated IFRA Standard (2001) limits oakmoss extracts to 0.1.% concentration for finished cosmetic products either left on or washed off the skin, but if oakmoss products are also present in the preparation, the combination of both must not exceed 0.1%. As the presence of resin acids seem to be unavoidable in oakmoss products, IFRA `also imposes an interim limit of 0.1%`dehydroabietic acid for oakmoss extracts.

[*The forthcoming 43rd IFRA Amendment (2008) will introduce a QRA-based system of concentration limits for oakmoss extracts across 33 different fragrance product categories. Purity criteria for oakmoss products are also introduced in the 43rd IFRA Amendment in the form of limitations on the concentrations of the strong sensitizers, atranol & chloroatranol to 100ppm each*].

2. The existing IFRA Standard (**1991**, 2001) limits treemoss extracts to 0.1.% concentration for finished cosmetic products either left on or washed off the skin, but if oakmoss products are also present in the preparation, the combination of both must not exceed 0.1%. The IFRA Standard limits dehydroabietic acid (DHA) to 0.8% in treemoss extracts as a marker of 2% of total resin acids, determined by a routine analytical method using HPLC Reverse Phase -Spectrofluorimetry method apparently available from IFRA, according to their website.

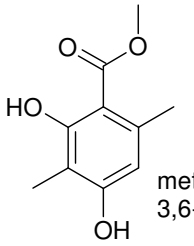
[*The forthcoming 43rd IFRA Amendment (2008) will introduce a QRA-based system of concentration limits for treemoss extracts across 33 different fragranced product categories*].

3. Under the 5th EC Framework Program. the EC launched a Quality of Life Initiative & Management of Living Resources key action (**1999**) which included a study of "*Fragrance chemical allergy: a major environmental and consumer health problem in Europe*" Contract No: QLK4-CT-1999-01558 (copy available from Cropwatch in case of difficulty locating it). This project led by J.P. Leppoittevin employed a number of leading institutions & scientists in the field, including I.R. White (chairman of SCCP) & S.C. Rastogi (member of SCCP). This project completed in March 2003 at total cost of cost of 1, 927,280 Euros; the major part found by the EU. The project included the development and validation of a method for the identification of sensitisers in complex mixtures using the model of oak moss.

4 The SCC(NF)P at its 14th plenary meeting (24 October **2000**) accepted an Opinion (SCCNFP/0421/00) concerning Oakmoss/Treemoss, that "… *oakmoss/treemoss extracts, present in cosmetic products, have a well-recognised potential to cause allergic reactions in the consumer as fragrance*

ingredients..." The Opinion can be seen in full at http://ec.europa.eu/health/ph_risk/committees/sccp/docshtml/sccp_out124_en.htm

5. A scientific paper identifying atranol & chloroatranol as strong elicitants in most patients sensitized to oakmoss was released by Bernard *et al.* (**2003**)**.** Methyl β-orcinol carboxylate (= Evernyl or methyl atrarate), a



methy 2,4-dihydroxy-
3,6-dimethylbenzoate

principle odourant of oakmoss absolute, was also identified as an elicitant in most oakmoss sensitized patients. One of the paper's authors (S.C. Rastogi) is an SCCP committee member.

6. A scientific paper by Bossi *et al.* (**2003**) describes the analysis of atranols in perfumes, employing LC-MS-MS with electrospray ionization (ESI) in negative mode One of the authors (S.C. Rastogi) is an SCCP committee member.

7. A scientific paper Rastogi *et al*. (**2004**) describing the analysis of 31 commercial perfume found that half the perfumes, & some eau de toilettes contained significant amounts of atranol & chloroatranol.. The author, S.C. Rastogi, is an SCCP committee member).

8. Filho *et al* (2004) comment that the present volume of lichen extraction is (ecologically) irreversible given the slow growth of lichen.

9. The SCCP at its 2nd plenary meeting (7 December **2004**) accepted an Opinion (SCCP/0847/04) on atranol and chloroatranol present in natural extracts (e.g. oakmoss and treemoss extracts) with the conclusion: "…*Chloroatranol was shown to cause elicitation of reactions by repeated open exposure at the ppm level (0.0005%) and at the ppb level on patch testing (50% elicit at 0.000015%.). As chloroatranol and atranol are such potent allergens (and chloroatranol particularly so), they should not be present in cosmetic products."* ***Cropwatch comments***: We understand that the robustness of certain parts of the scientific evidence in this Opinion is being queried...

S.C. Rastogi & I.R. White were listed as member & chairman respectively of the above SCCP committee.

10. SCCP Opinion SCCP1131/07 (15th April **2008**) describes an achievable reduction of atranol & chloroatranol in oakmoss extracts to <2ppm according to an analysis method (which is not disclosed), by two different preparative methods (details of which are not disclosed either). S.C. Rastogi and I.R. White were listed as member & chairman respectively of the SCCP committee. .***Cropwatch***

***comments*:** Data from LLNA tests is set out in the Opinion which **did not show** that reduction of atranol & chloroatranol contents in treated (but un-analysed) lichen extracts (of unknown purity) affected the LLNA results. Not withstanding this setback which the SCCP puts down to interlaboratory variation (!), the Opinion calls for a 2ppm limit for atranol & chloratranol in fragrant lichen products which would represent a level **50 times lower** than the proposed IFRA Standard in its forthcoming 43rd Amendment. Evidence showing that treemoss & cedarmoss extracts deserve to be treated in a similar manner to oakmoss extracts is lacking, and Joulain (2002) has previously argued that the principal sensitisation risks in treemoss absolute prepared as described in his presentation, may centre around 7-oxo-dehydroabietic acid (from oxidized pine resin), rather than the atranols. The SCCP's acceptance of claims for achievable atranol & chloroatranol concentrations of <2ppm in treated lichen extracts, via unidentified process(es) from an unidentified source, is typical of the secrecy which pervades the working of Brussels' committees, and we believe contravenes the existing EU guidelines for transparency. Further, contrary information on this matter has been widely circulated in the trade (e.g. in a perfumery professional members communiqué seen by Cropwatch), which alludes to a mistaken claim made by an unidentified company who directly or indirectly have submitted data to the SCCP. This data, we are lead to believe, initially indicated that the 2ppm limit for atranol & chloratranol was achievable. The company involved however, was reported to have later **withdrawn the claim** when it realised that this experimental research result was not reproducible in a commercial production scenario. Who knows where the truth in this matter lies, but because of the lack of Brussels transparency, Cropwatch can only assume that the SCCP had already seized upon the 2ppm level finding, and, over-hasty as ever, have wrongly adopted the 2ppm limiting level for each sensitizer in the SCCP/1131/07 'Opinion on Oakmoss/Treemoss adopted at the 15th Plenary Meeting on 15th April 2008). If Cropwatch has misunderstood any of the above facts, we can point to the fact that much of the aroma trade has as well. As it is, the situation appears to be a complete shambles.

The Commission is of course not obliged to act on an SCCP Opinion, but as close followers of Brussels affairs will know, finding reverse gear in these situations has proven to be an unlearnt skill, and although they make enough mistakes, we have yet to see the SCCP 'experts' actually own up to an error. As it is, the result may end up in the effective banning of fragrant moss usage in European cosmetics, unless industry lobbyists can persuade the Commissioner otherwise. .

Further background.,,,,,
Interestingly, the scientific literature is pretty scanty on the details of fragrant lichen processing & chemistry, and for this reason Cropwatch has started a fragrant lichen bibliography, in the *Cropwatch Files* section of its website at http://www.cropwatch.org/oakmossbib.htm. This file will be continually updated - contributions, suggestions, & corrections should be directed please to info@cropwatch.org

Oakmoss absolute (Mousse de chêne), concrete, resinoid etc. are derived from the lichen *Evernia prunastri* (L.) Arch. (Fam. Usneaceae) which grows mainly on the bark of oak trees, but also to some extent on spruces & pine trees. Nine thousand tons of oakmoss lichen is gathered annually in S. Europe, in France (formerly in the forests around Fontainebleau), as well from Calabria, Bohemia, Morocco, Algeria, and the area of former Yugoslavia & Bulgaria (Burfield 2000); however this figure may be overstated – Joulain (2002) mentions a figure of 3,000 tons, and Huneck (2001) reported that for the year 1997, 1900 tons of *Pseudevernia furfuracea* and 700 tons of *Evernia prunastri* were processed at Grasse...Some harvested *E. prunastri* lichen has been co-gathered with the lichen *Pseudevernia furfuracea* throughout Europe, but other accounts relate that *Striata pulmonacea, Usnea ceratina, Ramalia farinacea, Ramalia fraxinae, Ramalia pollinaria* and *some Alectoria and Parmelia* species are also mixed in from batch to batch (Burfield 2000). Chinese oakmoss, similar in quality to European oakmoss, is reportedly produced from *Evernia mesomorpha*, and is also commercially available.

Oakmoss preparation. Oakmoss lichen is not fragrant of itself, and it is only the solvent processing operation which generates the fragrant artifacts which give oakmoss its perfumery value. Ironically then, it cannot be classified as a 'natural product' according to the many bodies now attempting a definition of this term for the cosmetics trade, as recently reported on the *Aromaconnection* website.

Preparation of oakmoss concrete is via solvent hydrocarbon extraction (formerly benzene, but nowadays more often cyclohexane, or hexanes, although acetone and other solvents has been used). of the dried, or freshly wetted dried lichen. Resinoids have been obtained historically by hot solvent extraction, and fragrance synthetics have invariably been added in. Formerly, benzene extracted resinoids had found popular use in soap perfumery. Absolutes can be made directly from the concrete, or by refluxing benzene or hexane extracts with alcohol, and hot filtering out the insoluble material - removal of the alcohol give the absolute in 30-60% yield. Diluting the alcohol extract down to 80% and filtering may give a more soluble product with fewer residues, but further ethanol treatment may give a turbid extract, which when mixed with a saturated salt solution and solvent extracted (benzene was formerly used) further amounts of useful product can be obtained. The identity of the alcohol used will determine the odour - methanol gives sweeter smelling esters, and ethanol produces a sharper smelling product.

Oakmoss incolore and molecular distilled grades of oakmoss are also commercially available. Worryingly, Pybus & Sell (1999) state "with some particularly viscous concretes such as those from oakmoss or treemoss, it is more usual to dissolve the concrete in a high boiling solvent, such as bis-2-ethylhexyl phthalate, and then co-distil the product with the solvent." Hopefully, with current public disquiet over the potential toxicity of phthalates, this practice has been discontinued.

Oakmoss chemistry. As a preface to this section, it may be pertinent to recall Joulain's (2002) remarks to the effect that although the literature reveals qualitative information about oakmoss composition, there is little quantitative data. The fragrant compounds in oakmoss are generated by the degradative action of the solvents on the naturally occurring depsides in the moss (depsides are phenolics composed by two or three monocyclic units linked by an ester bond and derived from orsellinic acid), generating (volatile) odourous monoaryl substances. The character impact compounds of oakmoss are considered to include methyl β-orcinol carboxylate (methyl atrarate, Evernyl)) which imparts a powdery-mossy note, the monomethyl ether of β-orcellinic acid, methyl & ethyl everniate, and the phenolic compounds orcinol and β-orcinol. Boelens (1997) tabled the various yields from different solvent process (extraction and transesterification of the depsides) for both oakmoss and treemoss, reporting that the odour of oakmoss was preferred to treemoss by an odour panel of expert perfumers. Methyl β-orcinol carboxylate was the chief component of both oakmoss absolute and treemoss absolute products (47% and 57% respectively). The quantities of 3-chloro-2,6-dihydroxy-4-methylbenzoate (***Cropwatch comments***: this is possibly a misprint in the original article – surely it should have been 3-chloro-2,6-dihydroxy-4-methylbenzaldehyde, or chloroatranol - 10%), 2,6-dihydroxy-4-methlbenzaldehyde (- atranol - 5% and 6% respectively) and methyl 2,4-dihydroxybenzoate (0.5% and 0.7%) were similar. Oakmoss absolute was found to contain had twice as much cembrene (2%) as treemoss absolute. A full account of the work and composition of the benzene extract and benzene/methylanol transesterification products of oakmoss can be found in an earlier paper by Boelens (1993).

Treemoss (Mousse d'arbre) Treemoss derivatives (concretes, absolutes) are mainly prepared from the lichen species *Pseudevernia furfuracea* (L.) Zopf. with *Usnea barbata, Parmelia sulcata* and other species often co-gathered in. These tree lichens can both be found living on the barks of firs and pines in Southern and Central Europe including and France and Morocco, & Balkan countries, including former Yugoslavia. Preparation of fragrant treemoss products is carried out in a similar manner to the preparation of oakmoss products, although evidence that isopropanol may be included as a processing solvent is shown by the presence of isopropyl haematommate (which does not exist in lichens) in the analysis of the weakly acidic factions of treemoss absolute (Endo *et al.* 1999). It should be noted that Treemoss products are generally considered inferior to oakmoss products and command a lower purchasing price.

Tabacchi (1983) acknowledged that pine products are co-gathered with treemoss, and this has caused the sensitising properties of treemoss extracts to be mis-interpreted by toxicologists at that time. More specifically, Joulain (2002) describes work confirming previous observations by Tabacchi that biosynthesized diterpenoid acids from *Pinus sylvestris* hosts migrate into the oakmoss lichen and assist in their oxidation. The author cites a patented process for producing a treemoss absolute with a low resin acids content but still containing high levels of atranol (0.31%) and chloroatranol (0.15%), which

produced no adverse effects at 3% in a suitable solvent in a HRIPT test carried out according to the Marzulli-Maibach protocol with 158 volunteers. Joulain suggested this supported the hypopthesis that 7-oxo-dehydroabietic acid is one of the main sensitizers in treemoss extracts, and that whereas 4-10% of atranorin & chloroatranorin may be present in many treemoss concretes, during the production of absolutes, alcoholysis of the depsides in hot ethanol reduces their content to a level such that they are undetectable by HPLC.

Cedarmoss qualities are derived from *Pseudevernia furfuracea* Ach. growing on the Atlas cedarwood tree *Cedrus atlantica,* found mainly in the Atlas Mountains of Morocco. Solvent extraction produces the resinoid (cyclohexane is used as solvent by some manufacturers), followed by distillation to produce an 'absolute' although other methods for obtaining the absolute are used. Often sweeter than corresponding oakmoss products, it is used in similar perfumery applications.

IFRA Standards for cedarmoss extracts apply exactly as for treemoss extracts, the logic being that they both originate from *Pseudevernia furfuracea* (Fr.). Because it may not be collected exclusively on cedar trees, cedarmoss invariably contains pine twigs and wood fragments which affect the properties & odour of the ingredient.

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EFFA's Citral, Farnesol & Phenylacetaldehyde submission is thrown out by the SCCP.

(First released on *Aromaconnection* Aug 2008).

Curiously ignored by the cosmetics trade press, whose hacks probably failed to understand its significance, the SCCP Opinion SCCP/1153/08 on *Dermal Sensitisation: Quantitative Risk Assessment (QRA) for Citral, Farnesol and Phenylacetaldehyde* (adopted 24th June 2008) **threw out** the 'industry-proposed' QRA approach for setting safe levels of exposure to citral, farnesol and phenylacetaldehyde in cosmetic products. The Opinion is extensively argued & fairly damning - the SCCP noted that the QRA approach is based on data from experimental sensitisation tests on humans e.g. the Human Repeated Insult Patch Tests (HRIPT) and that model suffers a lack of detailed method description, application experience, is not (yet) validated, and has no strategy to make it so. Epidemiological & experimental data are not integrated into the QRA model; & whereas the model allows for various product categories of exposure, the risks from aggregated exposure (including occupational exposures) are not considered. The SCCP further remark that there is no scientific consensus on the safety factors used. Perhaps most tellingly, the committee consider that safe levels of exposure to existing substances known to cause allergic contact

dermatitis in the consumer should be based on clinical data and/or elicitation low-effect levels (***Cropwatch comments***: as has proven successful for nickel & chromium allergic contact dermatitis). In this light, the required data for citral, farnesol & phenylacetaldehyde was not forthcoming, in spite of a specific request made by Brussels for EFFA to provide it.(**all that was provided were a series of model-generated numbers, the relevance of which, in terms of consumer safety, being unknown**).

Cropwatch had previously put forward an objection to SCCP 'expert' committee over the EFFA submission (of IFRA QRA-based data) on citral, farnesol & phenylacetaldehyde, a copy of which can be seen at http://www.cropwatch.org/objectcitral.pdf. Cropwatch had maintained that this particular submission passed on by EFFA was uniquely important, because it represented first use of the QRA methodology in submissions to the SCCP 'expert' committee, to further restrict newly alleged allergens (a process we described as 'sneaking allergens in by the back-door'). Since the existing classification of allergens under 2003/15/EC has proven so scientifically controversial, it seemed both inappropriate and extremely unwise to legislate to include further allergens in the Cosmetics Directive until the underlying science is better sorted out.

Background

To recap, a considerable head of pressure is building up over the apparent misclassification of a number of fragrance chemicals as allergens under Council Directive 2003/15/EC (the '26 allergens' debacle) which is becoming impossible to ignore. Amongst the highlights of relevance here, you will remember that Storrs (2007) pointed out that the basis for inclusion of fragrance ingredients as allergens has never been defined by the SCCP committee, that Schnuch *et al.* (2004) have presented evidence showing that an number of fragrance chemicals listed in the '26 allergens' debacle (including citral & farnesol), are rarely found as allergens, and that Sanchez-Politta *et al.* (2007) had indicated that there was little independent peer-reviewed evidence to support the case showing phenylacetaldehyde as a sensitiser. It is not immediately apparent therefore why EFFA chose to make this QRA-based submission in such an incomplete form, as they must have expected rejection. .

Perhaps at this point we should pause briefly, to explain some procedural theory. The QRA is basically an exposure-based methodology for dermal sensitisation risk assessment, a key component of which is consideration of the dose (of sensitiser) per unit area to determine sensitiser potency. IFRA has expressed its intention to employ this particular methodology "*as the core strategy for primary prevention of dermal sensitisation to these materials in consumer products."* Allergic contact dermatitis itself is a skin disease which is classically considered to arise from a series of immunological events, the first being an induction process from a low-molecular weight chemical (for example, a component of an essential oil). Continued exposure to this chemical at a sufficient concentration gives rise to an elicitation process which results in the physical manifestation of

the disease. Risk assessment models to predict the potential skin sensitisation potential of fragrance ingredients incorporate three factors: predicted no-effect levels of sensitisation under experimental conditions, an appropriately deemed safety factor, and an exposure assessment. No-effect levels can be derived from predictive tests to determine the sensitisation potency of fragrance ingredients using animal based methodology (as in the Murine Local Lymph Node Assay or LLNA), or by using humans volunteers via the Human Repeated Insult Patch Test (HRIPT). In the HRIPT, fragrance ingredients are tested at ten times the use level on healthy human volunteers – if sensitization occurs, the maximum permitted level is taken as a tenth of the no effect level - but the HRIPT test is now considered an unethical procedure. Results obtained in the LLNA test can be mathematically treated to give an EC3 value (the concentration causing a threefold increase in the lymph node stimulation index) which is obtained by linear interpolation of the LLNA response data; these values being used to give an estimate of sensitiser potency, or to rank contact allergens.

Overall Cropwatch has major concerns over the interpretation of data obtained from these procedures - amongst them are worries that these predictive tests do not sufficiently distinguish between (weak) sensitisers and irritants; that outcomes for single ingredients are highly dependent on test substance purity (which is causing on-going controversy e.g. in the cases of linalool & coumarin), and that, anyway, different animal-based tests (such as rat popliteal lymph node assay or PLNA) yield conflicting results to the LLNA. For example, the LLNA results categorise citral as a low to medium potency sensitiser, whereas Friedrich *et al*. (2007) found that citral was an irritant & not an immuno- sensitising substance at all, in primary positive PLNA responses.

Regarding the occurrence of the individual fragrance ingredients in question, we explained in our submitted objection detailed above, ***citral*** is a mixture of two acyclic monoterpenoids, neral & geranial, which can be regarded as branched chain aliphatic unsaturated aldehydes (*cis*- and *trans*-3,7-dimethyl-2,6-octadien-1-al). Citral occurs widely in varying component isomer ratios in many natural products including citrus oils, & concentrated and terpeneless citrus oils such as lemon oil & orange oils, in lemongrass oils, Litsea cubeba oil, black pepper oil, verbena oil, melissa oil, ginger oil, etc. etc. In layman's terms, most people are regularly exposed to citral in their daily lives e.g. hand exposure occurs when peeling & cutting citrus fruits, and citral is regularly imbibed in the diet as a natural or synthetic flavouring component of some spices and in fruit-based or fruit-flavoured soft drinks.

Farnesol a common sesquiterpene alcohol component of many essential oils, the isomers of which may be typically be found to 4.5% in neroli oil, and to 1% in rose oil. *E*,*E*-farnesol also occurs in *Santalum spicatum* (Australian sandalwood) oils and extracts to 5% (subject to confirmation, IFRA quote to 8%), which distinguishes it from the lower concentrations found in the oil of *Santalum album* (E.I. Sandalwood). Farnesol is also an impurity in many commercial grades of bisabolol; Cropwatch has recently described

[http://www.cropwatch.org/newslet8.pdf] the demise of the Candeia Plant (*Eremanthus erythropappus)* which was harvested to the point of extinction in the Atlantic Brazilian rainforest to furnish demand from the German pharmaceutical trade for its natural (-)-α-bisabolol content.

Phenylacetaldehyde has a piercing green odor, which on dilution is reminiscent of hyacinths, and is a minor component of many essential oils and fruits – for example it occurs at up to 5% in the headspace of the sweet-pea blossom, *Lathyrus odoratus*.

Concluding Remarks.

To sum up, it remains to be seen whether the SCCP committee will be able to stick to the principles enshrined in their Opinion SCCP/1153/08, in the face of inevitable pressure from industry, and are able to insist that clinical evidence be provided which shows that allergic contact dermatitis is unequivocally linked to exposure effects from specific fragrance chemicals. If they are able to maintain this, and the required forensic examinations of the available clinical & experimental evidence are independently carried out, the list of allergens fulfilling the required allergenic listing criteria could be very short, and the committee will need to reverse their own previous Opinion on allergens & make changes to Directive 2003/15/EC. Meanwhile IFRA plunges even deeper into its predictive QRA-based sensitiser policy, with the announcement of the 43rd IFRA Amendment. In spite of the pretence of a state of voluntary regulation within the industry, iFRA & EFFA members are required to fulfill the requirements of the IFRA CoP to the letter, right or wrong. Overall therefore, the casual observer could be forgiven for thinking that the gulf between toxicological theory/conjecture about sensitisation issues, and the link to robust clinical evidence, is becoming an ever-wider chasm, and we are merely observers in a power-struggle between toxicologists & regulators. Cropwatch pessimistically believes the outcome is inevitable - the regulators salaries depend on the continual passing of new legislation (whether it is appropriate or not) and the data-providing toxicology machine is now the most powerful force in the aroma/cosmetics world. One way or another therefore, aroma ingredients will continue to be restricted & prohibited unnecessarily. The status quo is maintained by the attitude of the fragrance customers, who seem to worry little about whether legislation is either scientifically sound or fair - they just want to know that their fragrance providers are following the current legislatory rule-book.

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Linalol: comprehensive review suggests allergen status is disqualified.

There has been even more bad news for the reputations of the cosmetic industry's regulators this year, with the (political?) decision by one of the aroma industry's flagship magazines, *Perfumer & Flavorist,* to reproduce Hostyneck & Mailbach's excellent investigative review article on "Allergic Contact Dermatitis to Linalool" (Hostyneck & Mailbach 2008). You will remember that linalol (it can be spelled with either one or two 'o's) has previously been controversially identified as an important fragrance allergen by the SCC(NF)P in their Opinion SCC(NF)P/0760/03, and who's presence in cosmetics must be labeled if present at a concentration of 0.001% in leave-on and 0.01% in wash-off products under 2003/15/EC. However, we must again return to Storrs comments (Storrs 2007), who pointed out that the basis for the inclusion of fragrance ingredients as allergens has never been clearly defined by the SCC(NF)P.

Hostyneck & Mailbach's article on linalol has appeared previously in slightly different forms in *Cosmetics & Toiletries* & *Exogenous Dermatology*, and it is concerned with forensic examination of the clinical & experimental data for allergic contact dermatitis allegedly caused by linalol. It appears that the existing evidence infrequently or rarely suggests an underlying clear cause-effect relationship, thus effectively disqualifying linalol's fragrance allergen status. The authors conclude that the combination of linalol's weak sensitizing potential and low exposure conditions would, anyway, not predispose the ingredient to be the cause a high number of clinical cases, and whilst linalol may be responsible for frequently inducing type IV allergy, the connection between such allergy and clinical allergic contact dermatitis is not established. Further, the evidence that the autoxidation of linalol might lead to allergenic by-products was also considered by the authors, who concluded that although this may be the case (as shown by predictive animal tests), the oxidation of linalol is probably well controlled in the lifetimes & foreseeable usage conditions in cosmetics.

The conclusions of this article can only further highlight the unsatisfactory situation regarding the EU's handling of alleged sensitiser issue as manifest in EU Directive 2003/15/EC. Cropwatch has been championing Hostyneck & Mailbach's body of work for several years, which further examines the evidence for the allergenic status of a number of aroma materials (including geraniol, anisyl alcohol, amyl cinnamal, citronellol, α-iso-methyl ionone & methyl heptine carbonate). It is also worth remembering that Schnuch *et al.* (2007) has identified the alleged allergens benzyl alcohol, benzyl benzoate, methyl heptine carbonate, hexyl cinnamal, anisyl alcohol, linalool, benzyl salicylate, amyl cinnamal,

limonene & γ-methyl ionone as extremely rare sensitizers, and in 3 cases, not sensitisers at all.

Clearly the Commission needs to carry out some damage limitation; as researchers queue up to offer further proof to discredit the existing SCCP allergen listings.

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IFRA's 43rd QRA-based Amendment extends restrictions on natural aromatic product usage.

***To briefly recap**, Cropwatch opposed IFRA's introduction of the Dermal Sensitisation Quantitative Risk Assessment System (QRA) system in early 2007, the latter being introduced via IFRA's 40th Amendment to its CoP, on the basis that the hugely increased level of bureaucracy involved would act against the interests of the aroma trade in general and SME's in particular. At the time Cropwatch saw nothing wrong with the existing leave on/wash off-based system of ingredient standards, and viewed the QRA-based development as further proof of the developing predominance of toxicological imperialism within the cosmetics trade, brought about by whipping up an unrealistic 'fear culture' about ingredient safety. Unexpectedly, we found that many senior technical staff within the big aroma corporations quietly agreed with us, making us wonder where the pressure to go forward with these developments was coming from. A Cropwatch petition against the 40th Amendment was signed by almost 1000 perfumers, craft-based industries and aroma ingredient users, and sent to IFRA in 2007, but an acknowledgement was never received.*

It may be that IFRA are worried about their future – it was recently announced that a telephone survey of IFRA members is to be carried out during September.2008 re: IFRA's services & reputation. A research organisation which actively defended the use of key perfumery ingredients, and operated a risk/benefit policy with respect to the use of aroma materials might be more useful to the industry, rather than present way of working (in Cropwatch's humble opinion, of course). By focusing solely on the adverse effects of individual fragrance ingredients, and failure to defend key perfumery materials (citrus oils, oakmoss extracts, coumarin etc) it is obvious to many that the big-business/synthetic ingredients agenda predominates IFRA's sympathies. IFRA have no policy on natural perfumery, the art of which IFRA (inadvertently perhaps) have made almost impossible to pursue. Overall we believe that many in the perfumery sector perceive IFRA as actually being '**anti-fragrance**' and to be '**killing the goose that laid the golden egg**'.

Returning to IFRA's QRA- based safety policy, to be realistic, many of the imposed restrictive concentrations for fragrance ingredients in cosmetic products under IFRA's intensely bureaucratic 40-42nd Amendment, are set relatively high. This has meant that the impact on fragrance quality / art of the possible in fragrance creation has not been that great in conventional perfumery (although, as we mention above it has more severely impacted the natural perfumery art). The real problem for artistic freedom in fragrance formulation with respect to the use of natural ingredients, is more centered perhaps on the impact of IFRA's crushing methyl eugenol restrictions, a subject which urgently needs forensic examination.

The detail. With the recent announcement of IFRA's 43rd Amendment to its CoP, IFRA are continuing to impose their extensive program of restrictive QRA-based ingredient sensitisation policies onto their members, and indirectly, onto their wider spheres of influence. This move seems completely at odds with the SCCP's views about the QRA data generated thus far, as presented by EFFA for IFRA (for citral, farnesol & phenylacetaldehyde at least) in Opinion SCCP/1153/08. Most damningly the QRA approach for the ingredients investigated was said to have provided a bunch of model-generated numbers for the alleged sensitizer potency of fragrance ingredients, with no clearly established clinical & experimental proof).

IFRA's 43rd Amendment now extends to 153 individual fragrance ingredients and introduces 8 New RQA-based Standards, including restrictions for coumarin, carvone, ylang ylang ('various extracts'), jasmine absolute (Grandiflorum) & jasmine absolute (Sambac). Many / most of the experimental findings on which these Standards are based are not available in the public domain, and since there is some level of controversy over the way in which QRA-based experimental data on individual fragrance ingredients has been derived and interpreted thus far, this seems to a very arrogant and high-handed way of proceeding. It can't have escaped your attention either, that key researchers and proponents of LLNA testing also seem to be elected to 'independent' expert committees investigating and validating that very same technique (e.g. Api of the trade-financed RIFM organisation, to ICCAM). Many of us in the industry simply cannot understand how key researchers can be allowed to populate 'independent' expert committees and thus function as witness, judge & jury [and this applies as much to the SCCP as it does to ICCAM]. But that's another story….the 8 New IFRA QRA-based Standards include:

Ylang ylang extracts ('extracts'? does this term include distillates? – everyone we know is confused) are given a botanical name easily confused with cananga oil. [Note to IFRA staff: ylang ylang qualities are derived from *Cananga odorata* (DC) Hook f et Thoms **subsp. *genuine*]*.*** Toxicologists have been gunning for ylang ylang ***oil*** for a long time; Frosch *et al*. (2002) in a study organised to find additional sensitizers to the fragrance mix in 6 dermatoligical centres in Europe, found 2.6% of subjects (drawn from 11.4% of subjects reacting most frequently to the fragrance mix) reacted to ylang ylang oil – the highest level of reaction after

the fragrance mix itself. No clear identification of the sensitisers present in ylang ylang oil has been satisfactorily made – although adverse reactions has been put at the door of isoeugenol & maybe dihydro-isoeugenol (White *et al*. 2007). Cropwatch's money however is on the content of the (GC-unstable) potent sensitiser coniferyl benzoate, and who's removal, we believe, has previously led to the production & marketing of hypo-allergic ylang ylang oil.

Carvone is restricted for the first time and so 'hazardous' contributions from in fragrances from spearmint oils, dill oils, caraway oil, gingergrass oil etc. etc. now have to be taken into account. Brings it home to you, doesn't it, the risks we all must take when gathering in these dangerous kitchen herbs growing in our own gardens!

Coumarin. This restriction is of course especially interesting to Cropwatch (see 'Coumarin – the real story' at http://www.cropwatch.org/Coumarin%20-%20the%20real%20story%20update.pdf), not the least since we have dialogued with researchers concerned with coumarin sensitisation studies. We are fairly sure in our own minds that pure coumarin is not an allergen, but that impurities in certain commercial grades may be responsible for its misdiagnosis as an allergen. We further believe that on-going research will eventually be published which completely clear pure coumarin as an allergen. Whether natural coumarin is an allergen, where it occurs in tonka bean absolute, deer tongue absolute, lavender & lavandin absolutes, hay absolute, cassia oil, flouve absolute, narcissus absolute, tobacco absolute, mimosa absolute etc. is, as far as we can establish, presently unclear. Without re-visiting the past too much, you will remember that Schnuch (2007) reporting on IVDK results of subject exposure, considered that coumarin was amongst a group of materials where the risk of being allergenic was too small to consider.

In spite of doubts over coumarin's status as an allergen, as far as we can see IFRA have been no help whatsoever in defending this key perfumery ingredient and component of so many natural products. The 43rd IFRA Amendment Standard restricting coumarin refers to 4 unpublished pieces of work on which the Standard is based, so the general publics are none the wiser about the robustness of the studies, nor about the source and purity of coumarin, factors which have proven so crucial in previous experimental work. Amongst the crumbs from the table offered to the general public by IFRA on their website is REXPAN's conclusion that the No Expected Sensitisation Induction Level (NESIL) for whatever grade(s) of coumarin were used in the experiment(s) was 3,500µg/cm^2.

Jasmin absolutes. The new restriction on jasmine absolutes will come as no great surprise to anyone either, since this is another ingredient that toxicologists have had in their gun-sights for a number of years. However it can be argued that work like this is a complete waste of time – few companies (apart from, maybe, those at the market level of *Chanel*) - are going to be able to use jasmine absolute at the levels described in the new Standard, purely on cost grounds. In high-end Natural Perfumery, it may be different.

In addition IFRA/s 43rd Amendment includes 10 QRA-based Revised Standards, two of which are concerned with oakmoss & treemoss extracts more on this later! You might also remember that the QRA-based approach of ingredient restrictions was partly sold to us on the basis that it would allow higher concentrations of some fragrance ingredients to be used than were previously set by existing IFRA Standards. But the IFRA received communiqués, (presumably from members of the *Department of the Bleedin' Obvious*), who argued about the possibility of increased numbers of elicitation reactions in cases where the QRA level (based on induction) exceeds the restriction level of a material already having an IFRA Standard. So this concession is now taken away in a procedure called "capping", whilst a 5-year monitoring program is introduced, after which the situation will be reviewed…. err… except for category 11 (non-skin products) and oral care products, that is. *Readers outside the industry might begin to comprehend the impossible levels of bureaucracy surrounding fragrance construction, which is being piled upon us progressively higher & higher, month on month. Soon none of us will actually have time to actually make & sell perfumes, we'll still be trying to catch up with all these restrictive developments!*

The upshot of the above is that New Standards for 14 substances already mentioned in the 42nd Amendment, are announced, as "capped" back to previous IFRA Standards levels. These include a Standard for Peru balsam extracts & distillates, and for several components of natural products e.g. cinnamic alcohol, cinnamic aldehyde, eugenol, isoeugenol, trans-2-hexenal & 1-octen-3-yl acetate.

IFRA also presents, under the 43rd Amendment, a series of individual monographs of materials with non-supported use, which Cropwatch interprets as representing a group of ingredients which have not been investigated because of a lack of time or money. This set of monographs replaces IFRA's previous 'other materials' list IFRA contrived the original list from notification by structural alerts as defined in the RIFM Human Health Criteria Document (Ford *et al*. 2000) or from adverse data on the material itself, or because of adverse data for a structurally related material. Cropwatch is opposed to this armchair approach to toxicology and structural alerts methodology in general – which is already known to have failed over the toxicological status of certain fragrance ingredients. Cropwatch would be interested to receive (in confidence) any further information on this topic.

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FDA Globalization Act of 2008.

- a personal view by Judith Miller Aug 2008.

If you buy or make handmade perfumes, lotions, lip balm or other cosmetics in the US, you need to know about the Discussion Draft of the FDA Globalization Act of 2008 (http://energycommerce.house.gov/FDAGlobalAct-08/Dingel_60AXML.pdf), proposed legislation that would make these products unavailable by driving most micro-cosmetics makers (many, if not most, being home businesses) out of business. As the Draft now reads, it would require a $2000 yearly fee from each cosmetics maker (this fee to rise with pay raises of FDA personnel). Then there are the changes in manufacturing processes & paperwork, mostly requiring separate facilities, fees for their yearly inspections, additional employees just to check measurements (!), registering each recipe and notification of each change. If your local beauty company makes different scents of lotion, different creams, flavors of lip balm--and might want to tweak recipes to add a bit more essential oil or cocoa butter, say--each change would have to be re-registered.

Corporations like Revlon or Aveda would pay the same $2000 as home-based businesses, and already have departments for paperwork and GMP compliance; microbusinesses will have to absorb the fees, costs of building or renting separate facilities, hire a measurement checker and take on the mass of paperwork themselves.

Considering that cosmetics in the US have a safety record of **less than 150 adverse reactions per 11 billion personal care products sold yearly** (according to the Personal Care Council), this seems to many small cosmetics makers to be especially heavy-handed, fixing a problem that doesn't exist and damaging or destroying family incomes in the process. For more information or to join in efforts to change this proposed legislation, go to

http://soap-queen.blogspot.com/2008/08/law-with-unintended-consequences-fda.html , http://essentialu.typepad.com/my_weblog/2008/07/the-wrong-polic.html

or

http://www.indiebusinessblog.com/indie_business/2008/06/stop-the-fda-gl.html

Cropwatch comments: the highlighted orange text above was added by the editor! Really at this level of adverse reactions per cosmetic product sale, it is obvious that the US cosmetics trade is adequately self-policing. The danger, as has happened in Europe, is allowing a costly bunch of non-technical administrators in on the act, to pursue their own visions & interpretations of 'safety'. This eventuality has proved the death-knell for SME's in Europe, but in the US things may be different. Not only do they have strength in much greater numbers, but their SME's and micro-companies are peopled by individuals who

have a healthy disregard for the ability of the authorities to do anything appropriate, and carry it out correctly. It will be interesting to see what happens!

Opinion: Sandalwood Hype Continues (2008 style).

by Cropwatch's would-be gonzo journalist!

Reportage of this year's Tropical Forestry Services (TFS) Sandalwood 'Conference' in Kimberly Grande Hotel, Kununurra West Australia seems to have been largely written up in the trade press by people who weren't there. Much of the reportage seems to have been aided by helpful press information and coloured photographs from TFS themselves, but perhaps the 'distance reporting' is not too surprising since ***only 75 attendees*** were present. You may forgiven for thinking then, not so much a conference, but more of an investors 'pep' talk, maybe? Cropwatch wasn't there either… but as you may have noticed, we never seem to be short of an opinion……

TFS were hoping to impress, not least because they have 1200 ha of *Santalum album* in the ground and 500 ha just planted. It must be true because you can make it out on Google Earth, apparently! The 'conference' emphasised the problems with Sandalwood oil East India (poaching, deforestation and adulteration)…..err….you might think as has been similarly reported in Cropwatch's back issues. The anonymous report of the conference in *Perfumer & Flavorist* (Anon 2008) also describes how demand for *Santalum album* (err….oil, logs?) is booming in Asia, Europe & Middle East. With respect, Cropwatch doubts this – most perfumers cannot afford (any more) to employ highly expensive sandalwood oils in fragrances, when they can use cheap sandalwood synthetics at a fraction of the price. Neither have the sandalwood growers satisfactorily proven, as far as we are aware, that the grade of sandalwood oil potentially to be produced from these Australian sandalwood plantantions is that of a high-grade perfumery oil quality. Although they have indicated the α- & β-santalol content, a satisfactory odour profile hinges around a lot more than that – doubtless we can all remember Sandalwood oil Indonesian (now virtually unobtainable through over-exploitation) – which had all the required analytical features but had an inferior odour and under-performed quite markedly in product against East Indian sandalwood oil,

Perhaps we will yet end up eating our words, but as we suggested in our extensive Sandalwood Biblio, maybe the real future lies in exporting sandalwood logs to China for incense-making.

Reference:

Anon (2008) "Sandalwood sustainability." *Perf & Flav* **33** (Aug 2008) p26.

[See also Cropwatch bibliography http://www.cropwatch.org/santalum.pdf for further information}.