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WORKING WITH NATURAL AROMATIC MATERIALS

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The Trouble with Theories About the Oxidation of Essential Oils.

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Judging by the response from Cropwatch supporters, many of you may have already read about a doctoral thesis and remarks made by Lina Hagvall of the University of Gothenburg, Sweden, distributed via the cosmetics trade press. Many trade professionals have found the reported remarks condescending, as we are well aware, and may even have a wider understanding, of the context of oxidized aroma materials than the source of the remarks. But I digress.

The thesis in question is entitled “Formation of skin sensitizers from fragrance terpenes via oxidative activation routes: Chemical analysis, structure elucidation”, and Katie Bird (Bird 2009) recently covered the story for *Cosmetics Design Europe*, although, as with any news knocking natural products, the article is being very widely circulated on websites dealing with health interest, chemophobia and related matters. Many of us have found the Bird-penned article makes for confusing reading: for example what is ‘geraniol oil’? A better recourse is maybe to download the thesis itself from the University of Gothenburg website at <http://gupea.ub.gu.se/dspace/handle/2077/18951>. You will then be able to gather that the thesis is primarily concerned with the consideration of substances without contact allergenic properties, but which can be activated either via autoxidation in contact with air, or via cutaneous metabolism involving skin enzymes, to reactive products which can cause contact allergy. Primarily the study looks a five published articles with which the author has had a major involvement, studying the oxidation of geraniol, geranial (a conformational isomer of citral), linalool, linalyl acetate & lavender oil. For convenience these articles are referenced below (Hagvall *et al.* 2007; Hagvall *et al.* undated; Hagvall *et al.* 2008; Skold *et al.* 2008; Hagvall *et al.* 2008a). Much of the linalool & geraniol used as fragrance ingredients is, of course, synthetic, stored and distributed in a way that prevents oxidative deterioration, and the peroxide content is subject to prescribed limits at the point of sale. Aaberg, the Information Officer at the University of Gothenburg chooses to emphasise however, that even natural perfumes may cause allergies, pointing to the natural geraniol content in rose oil as a potential problem (Aaberg 2009). To be frank, considering the high cost of rose oil, and the downward pressure on fragrance ingredient costs, I doubt if many perfume manufacturing companies are going to add rose oil in amounts

that risk consumer safety in the manner described by Aaberg. Studies involving lavender oil may be more realistic, but again, lavender oil is stored and transported in a way that prevents oxidative deterioration, and the peroxide limit at point of sale or use is subject to restriction by the internal standards of many cosmetic companies. It is of particular note that the autoxidation of synthetic derivatives of linalool used as fragrance ingredients (such as ethyl linalool) were not investigated by Hagvall *et al.*, adding to the perceived anti-naturals inclination of the studies.

If I were one of Hagvall's invigilators, I would have insisted on a re-write of a number of parts of the thesis, where the science as presented is dubious, incomplete, or, most importantly, does not present an accurate context & overview of the topic. Some knowledge of industrial practices would have aided its general acceptability as well, and a collection of these points will constitute a future article from this author.

Overall this author is not saying that the elucidation of underlying mechanisms whereby oxidized essential oils, which may be the cause of type IV allergy and acute contact dermatitis, is not important. But an overview which puts this work in perspective is importantly missing. Further, the mention of Axel Schnuch's work in this area (Schnuch *et al.* 2007) is selective, and not to include mention of Hostynek & Maibach's toxicological reviews of geraniol & linalool (Hostynek & Maibach 2004; Hostynek & Maibach 2008) is almost unforgivable, however inconvenient the conclusions in these articles may be to the thrust of Hagvall's work. The reader is thus left to form his/her own independent opinion on the relevance of the study, especially against a background of an increasing number of published studies on the anti-oxidative properties of essential oils, the declining concentrations & use of essential oils in fragrances generally, the use of cold-storage & nitrogen-blanketing (amongst other measures) to prevent the oxidative deterioration of stored essential oils, natural isolates & synthetic ingredients, and the addition of anti-oxidants, UV-filters and stabilizers to finished fragrances & cosmetics to extend their integrity & shelf-life. One is also tempted to mention that a major contributor to the cost of the studies was RIFM, a primary instigator to the culture of toxicological imperialism which has overtaken the regulation of cosmetics/fragrances in the West, to the general detriment of the perfumery art.

How does the publication of this thesis change anything? The lack of evidence of a clear cause-effect relationship between geraniol and linalool and cases of allergic contact dermatitis has been previously emphasised by Hostynek & Maibach (2004 & 2008), and Cropwatch would guess from its' own experience that adverse end-user effects would tend to support the same conclusion for lavender oil. Hostynek & Maibach (2008) also comment on the relative stability of linalool, its low oxidation rate kinetics and speculate negatively about how readily linalool would oxidize in fragrances & cosmetics, as well as low consumer exposure levels to the ingredients. We are the, really left with the concept of the creation of 'powerful' sensitisers from linalool, geraniol etc. by skin enzymes

(Cropwatch disputes that a number of these metabolites are actually the powerful sensitizers they are made out to be) in a dynamic situation of decreasing bio-availability of substrates to these dermally-located enzymes (from mass evaporation of the perfume from the skin over time). Elucidating a pathway for potential dermal sensitization by bio-metabolites of these terpene alcohols, either added as synthetics or as contained in natural products, would seem a long way from proving the effect poses a risk to consumers. Great store seems to have been put on the Hagvall investigations by the IFRA/RIFM toxicology juggernaut, but considering the importance of the sensitizer issue to the perfumery trade, and its impact on the use of natural ingredients in perfumery, the sponsoring of just one researcher to look (mainly) at the oxidation of geraniol & linalool / lavender oil seems an exceptionally disproportionate response to the problem. Unless of course you believe that IFRA & RIFM sees the future of perfumery as entirely synthetic.

Cropwatch is trying to work towards the sponsorship of toxicological research that emphasizes a risk/benefit approach towards the elucidation of the safety of natural products. Otherwise we will all drown in a sea of over-cautious toxicological negativity and chemophobia, which, it is becoming clear, has little relevance in terms of safety risks presented to the general public from natural-product containing products.

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