

An evaluation of chemistry when related to essential oils.

Two articles written for 'Aromatherapy Times' -the I.F.A. journal-UK.
Spring 2005. V.1. No.64. pp7-8.
Summer 2005. V.1. No.65. pp 8-9.

Part 1 of 2.

For years I have been saying that aromatherapists do not need a detailed knowledge of organic chemistry because it has little relevance to the external uses of essential oils. Most of you have in fact been educated by people with no specialist training in phytochemistry (meaning the chemistry of plants). This weak non-specialist education has become the accepted standard, and not just in aromatherapy.

Most aromatherapy courses have for years been teaching that the therapeutic actions and safety of essential oils can be based on the largest percentages of chemicals in the oil, and on ludicrously broad chemical groupings, i.e. alcohols, monoterpenes, aldehydes, etc. The whole concept is wrong, as is teaching that a given essential oil will have a relaxant effect simply because it contains an alcohol -of which there are hundreds with hugely different properties.

Why is this science unsound?

I have written articles on this that have been on my website for years, but for those not on the internet below are a few explanations to these complicated issues. As an example; as a trainee herbalist I was taught phytochemistry which included how certain chemicals caused specific clinical reactions when the herb was taken internally. With internal use some of that chemistry is valid, however, we were never taught about how just the fragrance of the same plant (which does contain potent chemicals in trace amounts) could also possibly have therapeutic effects. The reason for that was our teachers were not specialist in that area of science and so we were not taught about it. Several researchers have studied so called 'headspace analysis' of plants which is vital to aromatherapy, but I doubt most of you will never have heard of them [\(3\)](#).

Toxicity, carcinogenicity and embryotoxicity testing methodology errors:

1. When scientists want to test the safety of a chemical, they rarely use the chemical extracted from the plants it occurs in. Instead, most of them use **lab grade synthetic chemicals** -always labelled "hazardous do not consume", does that not tell you something about their quality? These chemicals usually contain small but significant amounts of contaminants from the production processes. Those contaminants may or may not affect the ultimate results, but one thing is for certain, they throw an enormous element of doubt on the accuracy of any results produced, especially where toxicity is concerned. One can purchase 'pharmaceutical-grade' chemicals and the chemicals extracted from plants, but they can be very costly so most researchers don't bother!

2. Scientists have a habit of extrapolating results from chemicals when tested on rats, into human toxicity. This is despite it having been proven that methyl chavicol for example promoted cancer in rats, but that humans did not retain the carcinogenic metabolites for long. That research on humans proved the consumption of Basil herb was perfectly safe. [\(1\)](#) We now see the same crazy extrapolations being used over the metabolism and toxicity of methyl eugenol and other chemicals that occur in a natural diet. These scientists are so ill educated in their subjects, that it just does not register, **that they are implicating common foods as "toxic" or "carcinogenic"**. All their tunnel brains can take in is that this lab grade chemical (when used in isolation) is causing undesirable effects in tests on isolated tissues or in animals. These tests rarely take account of the human digestive tract and our elimination processes evolved over millions of years to cope with hugely varied food intakes. Those foods almost always contain chemicals which in isolation are toxic. However, the earth would not be overrun by humans if these natural chemicals were really so dangerous in small amounts.

3. Research scientists will often use the cheapest methods and materials they can because of budget limitations. Rarely are these dubious methods challenged by the peer reviewing systems used by scientific journals, this is because the "peers" have blindly accepted such methods as being the norm. For example, it is common to find that chick embryos are used for testing carcinogenicity or other toxicological effects. Even good old olive oil has been shown to be embryotoxic when injected straight into the egg (2). Recently, another group of scientists have suggested that olive oil is the main thing responsible for reducing cancer and heart disease in the Mediterranean diet!! **Yet, we are still expected to place our confidence in these people repeating the same unreliable tests with other common food and fragrance chemicals.**

4. A fundamentally unsound concept is that you can ascertain the toxicological or therapeutic effects of an essential oil based on one or two of out of the hundreds of chemicals that the average oil can contain -you cannot. If you could then Millions of Pounds and countless animals lives could have been saved. Specialist phytochemical researchers acknowledge that you can't judge safety in the complex chemical synergies occurring in plants just because it contains a given chemical. One has to take into account many other factors such as how the product will be used, what fraction of the plant is being used and how, etc.

Ordinary organic chemists have a habit of living in a fairy tale world of man-created classification systems. These people so quickly accept scientific theories as being fact and those theories are taught as facts within Universities. These same unsound theories are now incorporated into our laws with no one in authority challenging their lousy science. **Many questions are now being posed by so called "expert" scientists over the safety of essential oils based on the above unsound concepts.** Anyone that challenges long held theories in science is ignored or frozen out of the system.

The world now revolves around chemists who are not trained or experienced in the wider range of industries that their advice can affect. Their opinions are blindly accepted by Governments who quickly push unsound science into legislation. Specialist chemists and phytochemists are overlooked because some Professor at a University says different and their opinion ranks higher among Civil Servants than those who have worked in a trade all of their lives.

Do not think the scientists on Government advisory committees are there because they are the best around, no that is NOT the way those systems work. These committees, and the Civil Servants who create and administer them, still live in the Victorian era of paternalistic appointments based on who you know rather than what you know. Keep your nose clean by being 'yes' men or women and you will get free flights; accommodation; consultancy fees as well as a nice fat pension or pay off. Those advisors on these committees who see the faults or disagree with the systems usually end up resigning in frustration.

(1) Caldwell A. et al. 1987. Food & Cosmetics Toxicology Vol.25, No.11, pp. 799-806.

(2) A. Abramovici et al. Toxicology 1983, 29, 143-156.

(3) 'Organic chemicals in the air'. Helmig D. Arey J. 1992. Sci. Total. Environ. Mar;112 (2-3):23350.

See next page:

An evaluation of chemistry, and methods used, when establishing the skin safety of essential oils.

Part 2 of 2.

In the last article I evaluated misleading chemistry when related to toxicology. In this article I will evaluate chemistry relating to adverse effects of essential oils on the skin. However, to do this, I have to cover the question of misinformation about individual chemicals a bit more.

Adverse effects on the skin are far more complex than toxicology because there are many variables to take into account. Many facts are known about the chemistry of essential oils in this respect. However, as with toxicology, there is an awful amount of irrelevant and misleading information around. This is the case with European Directives coming from their so called "expert" committees.

By now, most readers should be aware of the regulations introduced a couple of years ago over chemicals that the EEC classified as "sensitisers". Directive 76/768/EEC and several others. Those regulations, when applied to essential oils, are based on highly flawed science, **yet they are now law.**

Under these regulations, if the chemical linalool occurs in any cosmetic product at over 0.001% in leave-on products, and 0.01% in rinse-off products, then it must bear a label warning that it might cause an allergic reaction.

Note: I have argued that pure essential oils are not cosmetic agents, but are **raw materials** used by many trades. In my opinion, the sale of undiluted essential oils should not fall under cosmetics regulations. However, few in this trade will challenge the regulators on such issues.

In addition to the sensitiser regulations, we are now faced with new proposals that may see the banning of the sale of undiluted tea tree oil. SCCP/08438/O4. In the conclusion it states, "The sparse data available suggest that the use of undiluted Tea Tree oil as a commercial product is not safe". Certain trade organisations tried to oppose these draconian and unfounded laws being imposed, but so far with no success. This is mainly because -unlike the food supplements trade -the essential oils and cosmetics trades just will not stand and fight the European bureaucracy.

Back to chemistry:

With the EEC directives, no attempt is made to distinguish between synthetic chemicals; extracted plant chemicals, or when the chemical is part of complex natural combinations as occur in essential oils. In the case of linalool we know that as it ages it creates chemicals that cause allergic sensitisation. (1) A sensible label saying something like: "please use this product by the date indicated or it may cause allergic reactions" would be fine, but instead we get a directive based simply on if a chemical occurs in a product or natural extract at all. Several of the chemicals they classify as sensitiser are common in many essential oils.

These regulations are even more inept because they fail to take account of common formulation practises aimed at reducing known safety issues. For example, if the product contains an anti oxidant, that should prevent or reduce the sensitising chemicals in the essential oil from forming. All commercial cosmetics should already contain antioxidants, and some essential oils have them added by the larger producers.

As I am sure most of you know, linalool occurs in lavender oil at around 30-50%. An oil which is ideal for healing minor wounds and burns. It can even help seriously infected wounds. Yet, the EEC tells us that just because lavender oil contains linalool, the whole oil must therefore be viewed as an allergen. Rose oil contains at least six of the chemicals on the 'sensitisers' list, and all far above the volumes requiring a product to be labelled as containing allergens. Yet, rose oil and rose water have an Ancient tradition as anti-inflammatory agents. If a substance has an inflammation

subduing effect on the skin, then the chances of acquiring sensitisation are dramatically reduced because it is much harder for the chemicals to penetrate and reach immune system cells.

Also in the list of sensitizers is d-limonene -the major chemical in citrus peel oils. Like linalool, it can be a skin sensitizer, although the numbers of cases reported over the years of skin sensitisation to d-limonene are minute compared to latex or nickel jewellery reactions. Do the EEC committee advise on labelling all products made of latex with a warning notice? Do they heck! If they stuck to their own guidelines, then all condoms should be labelled as allergens, and no operations should be performed without first informing the patient they might get an allergic reaction to the surgeons latex gloves!

In a pot of Marmalade you will get thousands of times more d-limonene into your body than you would ever get from the use of orange oil in aromatherapy massage, or from its use in a cosmetic product. Oh dear I better not say too much on that or the idiot scientists will insist we ban marmalade or Duck in orange sauce!

In aromatherapy it is common to be told that essential oils contain maybe around 10-20 chemicals -yes, the manufactured ones might! However, anyone that takes a look at food trade GLCs of for example orange oil, will find trace chemicals in that rather simple oil come out to around 5 pages long. So to assume that a given chemical will have a given effect simply because it is present in reasonable amounts is ludicrous. What about the far more powerful ones in trace amounts? How any chemical reacts with the body depends not just on the volume used, but on the ability of that chemical to initiate reactions with body tissues. For example, the unique fragrance of most oils is due to molecules occurring at only a few per parts per billion; those are the chemicals detected by our olfactory apparatus, which in turn can trigger physiological reactions. Other chemicals in an oil may be present in huge volumes, yet contribute absolutely nothing in terms of fragrance. Major chemicals may have more of an effect if the oil is taken as a medicine, but even that is not inevitable. My point is that regulations based on such childishly simplistic chemistry are wrong.

An example of extrapolating known effects of individual chemicals, to the effects of a whole substance containing them is as follows:

Water is made of hydrogen and oxygen. Put a match to either of these chemicals and they will ignite violently. Combine the two together in the appropriate blend (H₂O) and you get water, something used to put fire out. **So, if we are to believe the chemists, you should never use water because the chemicals it contains are known to be explosive!!!**

Testing methodologies:

With skin sensitisation we have better potential to identify substances causing problems in humans than with toxicity testing. Dermatology clinics have been reporting and recording results of testing for fragrance chemical allergies for 50 years plus. The International cosmetics trade associations such as RIFM and IFRA (2) have also produced extensive reports on the problems associated with synthetic and natural chemical allergens, as well as on essential oils and other natural extracts. These reports are the basis of an extensive database on the known adverse effects of essential oils. Yet, despite this extensive knowledge, the pseudo experts behind the European regulations dismissed it. Instead they chose to stick to their crazy chemical philosophies that if a substance contained a given chemical that the substance should be treated as a potential allergen. The result of this is we now have numerous essential oils, which if used in a product, must bear a warning label. **This is despite solid evidence that a particular oil containing the implicated chemical, when tested on humans at the appropriate level, displays no such sensitising capacity.**

Dermatological testing:

While I have the greatest respect for the work done in many dermatology clinics, there is some doubt about some of the test materials and methods that they use. In most cases we don't know if the chemicals they use for establishing sensitisation are pure, lab grade or extracted from the plants concerned (see article 1). There can be big differences between these chemicals and one cannot simply presume that if an individual reacts to a synthetic linalool used in a patch test, that they will react to any essential oil containing real linalool. In some cases dermatologists do test the

plant extracts to double check, but not always, and this factor alone puts an element of doubt over the statistics for population reaction rates. There is also reason for concern when tests are conducted on people with pre-existing skin damage such as eczema, and the results are extrapolated to the general population. Certain oils can cause eczema-like skin problems, but to test on damaged skin will always produce a much higher reaction rate than on normal skin. **Some of the cases on which the European advisory committee are basing their case for a ban on the sale of tea tree oil are based on such tests.**

The World Health organisation established a criteria for the classification of Skin Sensitising Substances. The item below has been ignored by the European regulators:

"The ingredient must have a sensitisation potential which has been proven in well-designed human or animal tests".

This means that much of the EEC legislation is wrong. Their list of sensitisers has ignored the published results of tests of whole oils on humans proving they are not allergens in normal use. Instead, they opted for a classification system based 100% on the occurrence in an oil of individual chemicals.

Other factors that can throw results:

The biggest factor as far as I am concerned is the complete failure of dermatology experts to take into account other factors that have led to the apparent increase in the population to fragrance allergies. In the last 30-40 years there has been a massive increase in the volume of natural allergens consumed as part of our diet. Just think of the vast increase in:

- Fast foods flavoured with spices,
- The consumption of citrus juices flavoured with extracts made from the peel oils.
- The use of mouthwashes and suchlike flavoured with menthol and mint flavours.
- People dining out where numerous natural allergens are added to their food.

When I was in my youth 50 years ago, we were not exposed to anything like these kinds of volumes of allergens in our daily food. Foods can cause sensitisation that manifests as skin reactions. Therefore, to implicate a given chemical used in a fragranced product applied to the skin as being the causative factor of a reaction is highly misleading. All that can be said is that "this individual is allergic to this chemical", but instead, the so-called experts are turning this around to "this chemical used in cosmetic products is responsible for the increase in allergies". Wrong interpretation; based on wrong chemistry; based on faulty statistical data; from people who are not experts on the subjects they are reporting on.

CONCLUSION:

Chemistry can be very useful, but should always be secondary to known effects of the whole extracts. I don't trust most organic chemists as far as I could throw them. They are the ones who developed environmentally polluting chemicals such as DDT and others which they claimed at the time were safe. They are the ones who developed pharmaceutical drugs which later had to be withdrawn due to their serious side effects. They are the ones who developed the synthetic chemicals used to adulterate many essential oils. Plants are far clever than humankind at chemistry and are a few million years ahead of us in this subject.

1. Basketter D. Et al. 2002. Contact Dermatitis, 46, 161-164 & Maria Skold et al. 2002. Contact Dermatitis, 46. 267-272.

2. I.F.R.A. is the International Fragrance Research Association.
R.I.F.M. is the Research Institute for Fragrance Materials.

Both organisations are involved with assessing and publishing the results of studies into the safety of fragrance materials for the International cosmetics and fragrances trades.

[Back to top.](#)

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