

VOC's, Synthetic versus Natural

Do you believe a low or no VOC Synthetic product is healthier for you than a natural product with a relatively high VOC figure?

The issue is the type of VOC not how much VOC.

This information is aimed to provide food for thought when selecting products based on their VOC (Volatile Organic Compounds) information and why other important issues must also be considered when choosing paints and finishes.

VOC is a complex issue and often misunderstood, in short VOC does not mean harmful and no VOC does not mean harmless. One should interpret various aspects of the information to make a truly informed decision.

For the below information we will only be considering building materials however the information can relate back to other VOC sources as well.

How does one define a VOC? It all has to do with the boiling point of the solvent, not smell nor toxicity.

VOCs are found in a host of building materials and are partially responsible for that "new" smell.

VOCs are a subset of some 18 million known chemicals registered under the Chemical Abstracts Service (the so-called CAS number system). Depending on their boiling point, these are categorised as VOCs, Very VOC, Semi- VOC, and Microbial VOC.

The most commonly referred to VOC describes the several hundred organic chemicals which have a boiling point range falling below 250°C. These consist primarily of petrochemical solvent-type compounds.

Governments are now regulating against these unstable chemicals as they let off gasses that are very harmful to people and the environment. The highly regarded IQUH - Institut f. Qualitätsmanagement und Umfeldhygiene (Institute for Quality Management & Environment Hygiene),

Office for environmental and quality management, Elpersheim, Germany came to the conclusion that TVOC (indoor total volatile organic compound) measurements are useful as an indicative value, but the results should be critically scrutinized. The results in investigations show that these TVOC measurements are only of limited relevance.

Moreover, the climatic conditions such as temperature and air humidity in the real world are seldom so constant, as in a test chamber.

Just because there is no obvious smell does not mean there are no VOCs. Keep in mind, odourless mineral spirits is still mineral spirits! Just because it no longer has the usual solvent smell doesn't mean that it's no longer dangerous. Many products use various chemicals to mask the smell and these may not necessarily influence the VOC reading (see below). However for some reason, humans have this innate sense to equate the rule of smell to the danger level or lack thereof.

Finally the best way to avoid and evaluate possible harmful emissions is to know exactly what ingredients are contained in a product; this is where a full declaration is important. Only then are you fully informed regarding what could "come out/ off gases" after the manufacturing process.

Note. LIVOS natural products contain NO petrochemical based ingredients, with the exception of small quantities of Isoaliphates (explained further below)

Semi VOC (solvents with a higher boiling point) or SVOC, the persistent one.

It is common for many to assume that if an environment is free of odours from VOCs, then it's also chemical free, nevertheless many materials contain toxic SVOCs we can't smell.

There is a large amount of research and scientific evidence to support the idea that there is a significant distinction, in terms of health impacts, between naturally occurring VOC's such as orange oil, and synthetic VOC's. In addition to this, persistent VOC's which have a boiling point greater than 250°C are present in many paints and coatings which are not regulated and continue to off-gas for many years. These are sometimes referred to as SVOC's or semi-VOC's.

While indoor pollutants known as VOC's evaporate rather quickly, the semi-VOCs persist in the interior and are emitted only very slowly. They can be released from paintwork over a longer period of time. Occupants of these homes will inhale those pollutants for years instead of days as in the case of VOC's.

These semi VOCs may also be taken up via skin contact, contaminated food or house dust. As a result, they can cause a wide range of illnesses and complaints, such as eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system. A point made at the Healthy Buildings 2012 Conference (Brisbane) was that some SVOCs are human endocrine disruptors.

This inconsistency in VOC's testing and reporting is used detrimentally when labeling products, such as water-based paints and varnishes, as VOC-free or low-VOC (or solvent-free / low-solvent), even though they can contain SVOCs in high quantities which could immensely effect occupants quality of living.

This is further compounded with our lifestyles whereby there is reduced exchange between controlled indoor and the outdoor environment with windows and doors

remaining predominately closed. These exposures are correlated with common human diseases such as cancers, leukaemia and lymphoma.

Note. LIVOS products contain no SVOC's and will not continue to off gas into the future. Independent testing by the AgBB (German Committee for Health-Related Evaluation of Building Products) tested for a range of SVOC's at the same time as the persistent VOC's with higher boiling points. (The current IEQ-8 credit does not take this into consideration). The SVOC result for Livos KUNOS at both 3 days and 28 days is 0. LIVOS products off-gas their natural VOC's in a relatively short time frame, with 95% dissipating within the first hour of application. Simply, there is no off gassing once the coating is dry. Their conclusion, "Livos KUNOS, and in fact all Livos products (as they use essentially the same raw materials as basis) are superior performers across and wide range of ecological and building & occupant health criteria."

What is the importance in the actual VOC limit as a number? It is meaningless and often misinterpreted.

In many countries, coating manufacturers must now indicate the VOC content of their paints and finishes. Relying solely on these numerical values should allow for easy comparison however in practise it is not so simple. The existence of "exempt" compounds and variable amounts of water (a solvent) in coatings may result in a significant difference between "actual VOC" and "regulatory VOC".

The GBCA (Green Building Council of Australia) have issued guidelines for VOC emissions within Buildings and their fit outs. The requirements are basically that of solvent content.

Their aim is to reduce the amount of VOC 's however to consider the total TVOC content while it is contained a can is incorrect. There is no relevance or logic in knowing just the contents of a paint or sealer; it has to be applied in order for it to be useful. Also a large fallacy is to test a product on one surface then use it on another. Instead, products need to be tested on surfaces that they will be used on to establish a correct reading. Various surfaces behave and off gasses completely differently. The environmental atmosphere also is not the same as a testing chamber. These green star rating tools do not consider any environmental impacts or the ongoing indoor air quality.

Essentially the assessment is desktop based and does not involve any on site measurements or assessments. It also does not include toxicity of additional products used within the building eg: what is used to clean. There are also no differentiations made between the origins of VOCs, how or if it affects the indoor air and health of the individual, nor are the coverage rates of products used considered. (See below under coverage).

Overall this is a complex, time consuming voluntary assessment tool which is provided by a private company with a board of directors.

Note: Livos does cater for Professionals who require products with a specific VOC limits for future accreditation, such as zero VOC paints and tints and Koimos, a zero VOC high solid oil.

Free of VOC does not mean free of toxins.

“Free of VOCs” does not mean that products are harmless for humans, animals and the environment, as even small quantities of solvents can be highly toxic. The VOC Directive assesses the amount of the solvents, however only certain criteria are considered.

While all products must legally provide MSDS information this is only required to list hazardous chemicals that individually make up more than 1% of the volume of the entire formula. Therefore, a paint company can put in several formaldehyde (precursors), chemical masking agents and biocides, and not have to list any of them because individually they are less than 1% of the volume, combined though can make up a large volume of the actual product. If an ingredient is part of a “proprietary blend”, it doesn’t have to be listed either. This is where the harmful semi VOCs may materialize but not appear in the tested VOC results.

This is not correct for European guidelines. In Europe, there are certain consideration limits depending on the dangerousness. For some toxic chemicals it starts at 0.1 % of content. But it is possible to add certain chemicals with different classifications with no resulting labelling and no knowledge of their interaction between each other and the health risk for humans.

In an effort to sell product, paint companies endeavour to make customers believe that their zero VOC formulas are the safest without actually demonstrating or proving it. They promote terms like "green", "environmental" and "eco" etc, and unfortunately with ambiguous labelling regulations these terms are not required to be verified. If you really want to use a paint that is truly healthier for the occupants, then look into products that have been used successfully by the chemically sensitive.

The importance of knowing the components of the products.

More and more consumers are looking closely at the actual ingredients contained in products and will not accept the manufactures green claims without proof. It is not sufficient for manufacturers to simply state their ingredient list is a trade secret.

Without accurate information, especially a full declaration, it is nearly impossible to know how each component within a product will react with each other, let alone how it reacts to humans and the environment. Only a small number of manufactures choose to disclose their list of ingredients willingly.

LIVOS have taken the unique ethical stand of openly disclosing the full ingredient list for every product. This allows all components to be independently researched and tested for any health implications. Other similar products that are labelled VOC free can legally contain undeclared and unregulated chemicals and compounds which can have a negative impact on human health but are not considered under various systems of testing and regulations.

Large amounts of research and scientific evidence supports the concept that there is a significant distinction, in terms of health impacts, between naturally occurring VOC's such as orange oil, and synthetic VOC's. Oranges are not regulated, yet orange oil is a VOC and therefore is regulated. One would expect to have less health issues with substances found in nature than synthetic chemicals that are manmade. Also many new synthetic compounds have no long term studies of their effects on man or our

environment, let alone how they react when combined. However again through full disclosure one may assess their individual needs and make a fully informed choice.

It is also worth noting, that disposal of products manufactured from natural raw materials create or have less impact on the environment when reused or disposed of.

Note: LIVOS products contain less than 1% orange oil (this is food grade quality and not industrial grade). The question here is why a substance that is widely found in nature is considered "hazardous", particularly as this ingredient has evolved in nature and can be broken down and biodegraded without harm or negative impact. Can the same be said for all synthetic chemicals?

Water as a solvent requires additional substances to stabilise a product.

Many oils and paints produced with water (water based) as the solvent require a multitude of auxiliary substances and preservatives in order to be stable. As you may remember from science class, oils and water don't mix so to blend these substances, one needs strong emulsifiers. These cannot be obtained from natural sources. Many of these chemically-produced substances are a health hazard and are not easily biodegradable, and therefore are also harmful to the environment. By not breaking down completely, impacts negatively on our sensitive environment. These with synthetic resins block the water vapour permeability (breathability) of the surfaces affecting vegetation and animal life.

These modified products also require more energy and water in their production methods.

Natural solvents are not always the best alternative.

Unfortunately natural solvents such as turpentine oil, pinene as well other terpenes are known to be highly aggressive to the skin and known to be the reason behind some very serious diseases.

Organic substances such as Isoaliphates are recognized as one of the most harmless solvents known to man. Accordingly, Isoaliphates are therefore a better alternative to their natural solvents. While they are made from petroleum they are highly purified so that they are almost odourless making them also suitable for allergy sufferers. In addition, after the coating has dried, all the solvent has evaporated and the indoor air climate is not affected. They are approved for medicine, food and cosmetics and cannot be absorbed by the human body and have no sensitizing effects. On water, they form a layer that evaporates quickly and does not harm aquatic organisms. Also in the air Isoaliphates react very slowly with sunlight with the lowest potential to form smog

NOTE: Since natural solvents, e.g. Gum or other terpenes can trigger allergies, LIVOS decided to use as a solvent Isoaliphates, the most harmless organic solvent. The fact that the health of the individual is of paramount importance Livos use only a very pure form of Orange Peel Oil in food grade quality and only in amounts of less than 1%.

Coverage rates can also influence the Indoor Air Quality.

One must also consider the actual coverage rates of particular products. If one has a Low VOC product with a small coverage rate and a comparison is made with a higher VOC product but this covers a larger area, in total the actual VOC per square metre of the higher VOC product can work out to emit significantly less.

The coverage rates of natural products, especially the penetrating oils, are extremely economical. This means that there is actually less product being applied over larger areas which then results in a greatly reduced amount of VOC/mt.

An example is, a 1Litre can of natural floor coating contains 435g (high) of VOC, which is considered high, when used as a 3rd coat though it uses 4ml/m². The 1Lt can then covers 250 m².

Whereas a 1Lt can of typical epoxy floor sealer, can according to the TVOC method contain up to 140g (low) of VOC per Lt. The coverage as a final coat is 9 m²/Lt.

So to cover the same area as the natural coating then, one would need 27.77 Lt of the Epoxy product.

Hence 27.77 lts x 140g of VOC = TOTAL VOC over the 250m² is 3,888.9g

Therefore the high VOC and in some cases non compliant product has only 435g TOTAL VOC over 250m² while the non-compliant product is consequently 8.9 times BETTER in environmental outcome than the low VOC compliant one.

Plus, the epoxy equivalent can remain toxic throughout the majority of its life through semi VOCs, and is particularly dangerous to remove at the end of the buildings life, making recycling of the building materials difficult and dangerous. In comparison, the natural product has no semi VOCs and is easy and safe to both humans and the environment to recycle or reuse.

Note. The standard of the Kunos DIN EN 71 part 3 is qualified "suitable for toys" as well as being certified food safe according to the rigorous nature of the DIN (Deutsche Industry Norm) German Industry Standards.

Often it is said the best way of getting an explanation clear is to explain it to children, here is VOC EXPLAINED (in a children's story)

A Volatile Organic Compound, is like an orange, in fact Orange Oil which is in the peel of an orange is a VOC, a natural one.

A little girl named Mary has one can of paint, with 435 oranges in it. A fairy gave her a special elixir which allowed her to dissolve 435 oranges into a thin liquid oil that smells really nice. Mary can paint 240 squares with her thin oil using 435 oranges.

Now Andrew is also a little boy with a can of paint, although his only has 140 oranges. An evil goblin called the Epoxyman, chopped up Andrew's oranges quite roughly, and mixed them with a sticky, thick stinky honey called Epoxy which makes children very sick. Now because Andrew's can is so thick he can only paint 6 and a half squares with his one can.

How many cans and oranges does Andrew need to cover the same 240 squares that Mary's paint covered?

ANSWER: 37 cans and an amazing 5,180 oranges. So the Fairy was very clever and made the oranges go much further, and the stinky epoxyman goblin honey used much more oranges wasting them and also making kids sick.

In relation to Human Health, knowing the VOC as a figure is meaningless.

For us mere mortals and where our health is of concern, the level of VOC in a container is not of much bearing. It is the toxicity of the ingredients that is important as these are the ones that affect the IAQ (indoor air quality). We spend 90% of our time indoors (CSIRO), combined with the fact that we do not ventilate ideally, the concentration of these chemicals can cause some major health issues such as asthma or chronic bronchitis. Therefore, knowing the VOC data is not sufficient to make an informed decision.

As mentioned “Free of VOCs” does not mean that products are completely safe for humans, animals or the environment. Even small quantities of solvents can be highly toxic, today many of these are masked to pass requirements only to reappear as hazardous ongoing semi VOCs, (resulting in persistent off gassing) which are not assessed. Whereas natural products with a preliminary high VOC classification usually contain no masking agents and no semi VOCs and once dry, do not off gas. Toxicity and VOC are not automatically related. Oranges are not regulated, yet orange oil is a VOC. Low VOC does not inevitably mean a lower toxicity than a high VOC product or vice versa. Toxicity depends on the type of solvent, the percentage of the solvent in the wet product and how it influences the indoor air that we breathe...and not simply a number on a tin.

Consider the following:

That knowing the VOC content in a can is not sufficient to make an informed decision. What happens to the air quality once the product is actually used on the floor or wall? How do the emissions influence the indoor air quality and the health of the occupants, especially those that are sensitive?

What are all the ingredients/solvents in a particular product? If you do not know, how can you decide if you want to use it or not?

What are the long term emissions from the product?

Is the product biodegradable and does not adversely impact the environment on disposal or reuse? Or does it contain problematic chemical preservatives that discourage the future reuse and recycling of materials?

Points of interest.

Alkyd coatings can contain as many as 100 different VOCs.

The majority of emissions from latex paints occur after the coating has dried.

It may take as long as 3.5 years for some VOCs to be released from gypsum board.

Some paints marketed as “low-VOC” may still emit significant quantities of HAPs (Hazardous Air Pollutants).

Synthetic, petro-chemical based are ethically irresponsible for a number of reasons.

These include however are not limited to

- Contain unknown ingredients.
- Contain secondary (auxiliary) chemicals that do not influence the initial VOCs reading however influence the semi VOC levels which can affect the health of home occupants’ long term.
- Its long term recyclability and disposal of the product and materials it has been used on is questionable. Cradle to grave.
- The energy and chemicals used in its production.

So now when you are asked, do you believe a low or no VOC Synthetic product is healthier for you than e.g. a natural product with relatively high VOC?

The answer is a simple **No**.