USES AND ABUSES:

Good paint, bad paint

Insight into NZ's paint use and option to make your own natural paints.

By Désirée Haecki

About 5lts of paint per person are sold in NZ every year [1,2]. Most of this is paint based on petrochemicals and a magnitude of their ingredients are toxic during fabrication, application and disposal. Luckily it is very easy to make natural, beautiful and sturdy paint from readily available materials.

Commercial paints contain hundreds of chemicals. There's a range of substances that help the paint perform, but are not great for humans nor for the living environment. Paint needs a binder, a solvent or liquid and a pigment. The binder is the glue, holding the pigments together and making the paint adhesive. The pigment tints the paint and the solvent gives it the right consistency to apply. In many paints there are also fillers to bulk it up and additives to make the paint last and perform better.

Solvents

Solvents constitute for a third to almost half of the paint.[3] They are added for viscosity and curing properties. A solvent does not stay in the paint, it evaporates into the air. Solvents have a boiling point of less than 200°C. The simplest solvent is water. However nowadays almost all paints contain chemical solvents that make the paint dry quickly and leave a uniform coating. These chemical solvents contain volatile organic compounds (VOC). "Organic" in chemistry means carbon is present.

There are plenty of VOC in the air naturally, the scent in a pine forest, the smell when you give a lemon a rub. But the VOC in paint are petrochemical products with many related health and environmental issues. Headaches, nausea and irritated airways are the most common immediate symptoms, some VOC are carcinogenic. VOC are very harmful for embryos. It has been found that a reduction of VOC in In vitro fertilisation labs resulted in almost a third more live births [4]. Even back in the 1970's several studies published a link between VOC and neurological damage termed painter's syndrome. Painter's syndrome includes cognitive and intellectual impairment all the way to dementia.[5]

Paint gases its VOC into the air mainly in the first few days up to 6 months,[6] but some keep on emitting for years. The more airtight a building, the more VOC will collect in the indoor air. Because of more rigorous air pollution analysis straight after painting, there has been a trend to include more semivolatile organic compounds (SVOC). These are slower to gas off and perform better in air pollution analysis shortly after application. Yet they will release VOC over a much longer period and are not a good substitute in the long run. If commercial paints are used indoors, constant airing during the first few weeks is the most important and effective way to get rid of VOC.

Labels often advertise as "low VOC". All this means is that they contain less VOC than the average paint. Different Eco labels have specific criteria regarding the VOC content. The Environmental Choice NZ label does not allow more than 1% in weight of highly toxic VOC and not more than 5% in total of ecotoxic substances.[7] These attempts at regulating the VOC levels are a good start, better yet it is to avoid them completely.

Additives

Additives are designed to make the paint flow easily and uniformly, to stop it from freezing, to slow down corrosion as well as making it possible to leave that half empty bucket of paint under the house for years. Additives include biocides, surfactants or defoamers. You might have guessed that these are nasty, too. Biocides are by their nature toxic and there are a number of health concerns. Often it is hard to know exactly what

additives are in paint. A full ingredient disclosure should be standard, but is very rare. If you find one, it usually means low or no toxicity.

Titanium dioxide

The list of harmful paint ingredients could go on and on. One component worth mentioning is titanium dioxide (TiO2), the white powder with a high refractive index covers better than any other white pigment. It is heat resistant and doesn't yellow. These properties have allowed TiO2 to become the most used pigment worldwide.

TiO2 is not only found in paint, but is also a food additive, in cosmetics, sunscreens, plastics, toothpaste, ceramics, soaps etc. The production of TiO2 requires a lot of energy and a complicated chemical process. If the sulphate production is used, per tonne of TiO2 six to eight tonnes of sulphuric acid is produced. Up to the 1990s this was dumped in rivers or the sea. Nowadays the sulphuric acid has to be further processed.[8]

There is more and more evidence that TiO2 is also harmful for the environment. Many studies show a negative effect of the nanoparticles and international concerns are growing.[9] Titanium dioxide is thought to have harmed the life in the Mermaid Pools in Matapouri considerably. The International Agency for Research in Cancer has recently classified titanium dioxide as a group 2 carcinogenic.[10] As of October 2021, the EU requires products containing more than 1% of TiO2 to have a declaration on the label, in some cases a cancer warning has to be added.[11] This made paint manufacturers fear for their ecolabelling.

Yet even so-called natural paint often contains titanium dioxide. It is hard to avoid in oil-based paints for wooden joinery, it is prone to yellowing and will not cover well if it has no TiO2. From an aesthetic point of view TiO2 is used for its opaqueness. This comes with a visual superficiality. Surfaces painted with TiO2 have little optical depth and look blunt. Natural white pigments such as china clay, talc or lime have less hiding power and therefore sometimes need a coat or two more than paints with TiO2. With the layering and the different way

the natural pigments split the light, these surfaces have a lot more depth and hold a special beauty that is ever changing with the light, the time of day and the colour of the sky.

Natural paint: easy to make at home

How about making your paint at home instead?

Humans have made paint for millennia without ever needing any petrochemicals. It would be wonderful to see a movement away from the dependency on commercially manufactured paint towards home cooked or mixed paint. It's a lot of fun to experiment!

Below are a couple of very simple but effective recipes. There's plenty on the internet, but we use these often for their simplicity and attractive finish.

There's a multitude of natural binders, solvents and pigments to choose from. Binders could be lime, chalk, casein (quark), animal or plant-based glues or oil.

Solvents make sure the paint has the right consistency. Water can be used for most paints for walls or ceilings. Oil based paint is often used for joinery with natural turpentine from pine resin and citrus peel as solvent. Even natural turpentine can be irritating, of possible use outdoors.

PHOTOS, THIS PAGE:
Limewash, Blue on limewash.

PHOTO, OPPOSITE PAGE:
Finding the right tone

Natural pigments can be found everywhere: coloured clays, charcoal or plant materials. We often bring back a bag full of some especially brilliant clay we found on the side of the road from our outings. For more consistent looks, natural pigments such as ochres are available at hardware stores or pottery suppliers.

Limewash

Think of a Greek island, buildings with glowing white walls and roofs sitting high above the glistening blue Mediterranean. Limewash, also known as lime paint, whiting or whitewash, must be the easiest, cheapest paint. It is nothing more than hydrated lime or lime putty watered down to a milky consistency. The lime is the binder and pigment in one. It is sloppy and applied with a big brush in large sweeping strokes. You might need a few layers to get the desired opacity, but it is very quick and satisfying work.

The lime is said to have crystals that allow the light to be reflected twice. This creates a beautiful surface glow. Limewash works well on porous surfaces such as earth, lime plaster, cement board or bricks.

Even wood can be limewashed. Because it is penetrating into the substrate, limewash does not peel away. It will still be vapour permeable after hardening and won't trap moisture in the wall.

For earthen substrates the first layer of limewash needs to be very watery so it permeates deeply. Every subsequent layer can have a bit more lime. It is important to make the limewash pretty wet. Spray down the substrate beforehand. Fresh earthen or lime plasters can be limewashed when they are still slightly moist. If lime wash dries out too quickly, it will chalk up and leave a powdery surface. If this happens, brush off the powder and water down the limewash and/or reduce air circulation and sun exposure. A cloudy, wet day is a good day to limewash.

On the other hand sometimes the powdery quality is favourable. I used to work next to the department for heritage buildings in Zurich when they tested a whole range of coatings to prevent graffiti damage. Limewash came out on top, the graffiti could be brushed off easily.

Limewash can be tinted with lime fast pigments, eg. oxides. It always helps to dissolve the pigments first, but adding them dry can have an interesting effect, too. Little bits of pigment won't dissolve, but burst with the brushstroke, leaving various coloured lines.

Untinted lime wash keeps indefinitely, as long as there is a layer of water on top. Some pigments are pozzolanic and make the lime go hard under water.

In many cultures limewashing was a yearly ritual. In the northern Alps limewashing of stables was done ritually between Christmas and New Year along with a smudging. Limewash is antiseptic, antifungal and a fire retardant. Along with the grand fluid movements of the applications, this is an excellent way to spring clean.

Swedish Flour Paint

Flour paint is very easy to make and reminds us of the days when making paint was much like cooking. Early painters used yolk and egg white as binders or even beer.

For the flour paint normal wheat flour works fine, but the traditional swedish red paint uses rye.

Add 100g of flour to one litre of water and boil it slowly until it thickens. Add pigments (for a very thick, intense paint about 200g of pigment) and 100ml of linseed oil. Voilà.

This paint is dense, works beautifully on wood and is surprisingly hardy.

For interior flour paints you can add fillers/ pigments such as mica, ground limestone, chalk or ground marble to create a white or offwhite paint and it doesn't necessarily need any oil. It is easy to apply with a big brush. Coarser screened materials create a more textured surface.

A clay paint can be made from one part flour paste, one part fine sand and one part screened clay. This makes a dense, well covering paint that has a plaster look. For a finer finish, smooth the paint at the end with a moist sponge.

Flour paint works on all common substrates. If the substrate is coated in a shiny acrylic or latex paint, the surface needs to be sanded first.

Casein (Milk) Paint

Casein is a milk protein that makes an excellent glue or binder when mixed with an alkaline substance such as lime.

Casein is available in powderform or can be made at home.

PHOTO, THIS PAGE:
Swedish flour paint application.

PHOTO, OPPOSITE PAGE:
Swedish flour paint ingredients.

Skim your milk and let it sit outside for a while. The milk will curdle. You can speed this up by adding lemon juice or vinegar.

Once curdled, strain through a cheesecloth and keep the fresh low fat cheese aka quark. This contains casein and is wonderful to use (or eat). To activate its glue magic, add lime putty or hydrated lime.

The mixture turns a bit more liquid as lime is added. There will be fine translucent bubbles of casein floating around if made from fresh curds. The proportions are fairly flexible, play around to find the right opacity and look. A base to start from is 1 part quark to 5 parts lime putty.

A very thin coat with minimal lime can be used on earthen walls to retain the colour but reduce abrasion and increase washability. The wall will keep its natural tone, yet get a very subtle milky, almost sparkly sheen.

With some pigments added, the same mixture can be used for lazuring (lazure is layers of paint prepared nearly as thin and transparent as watercolor, consisting of water, binder, and pigment). Usually the surface is first painted in a light colour and several layers of lazur are added to achieve shimmering veils of soft colour.

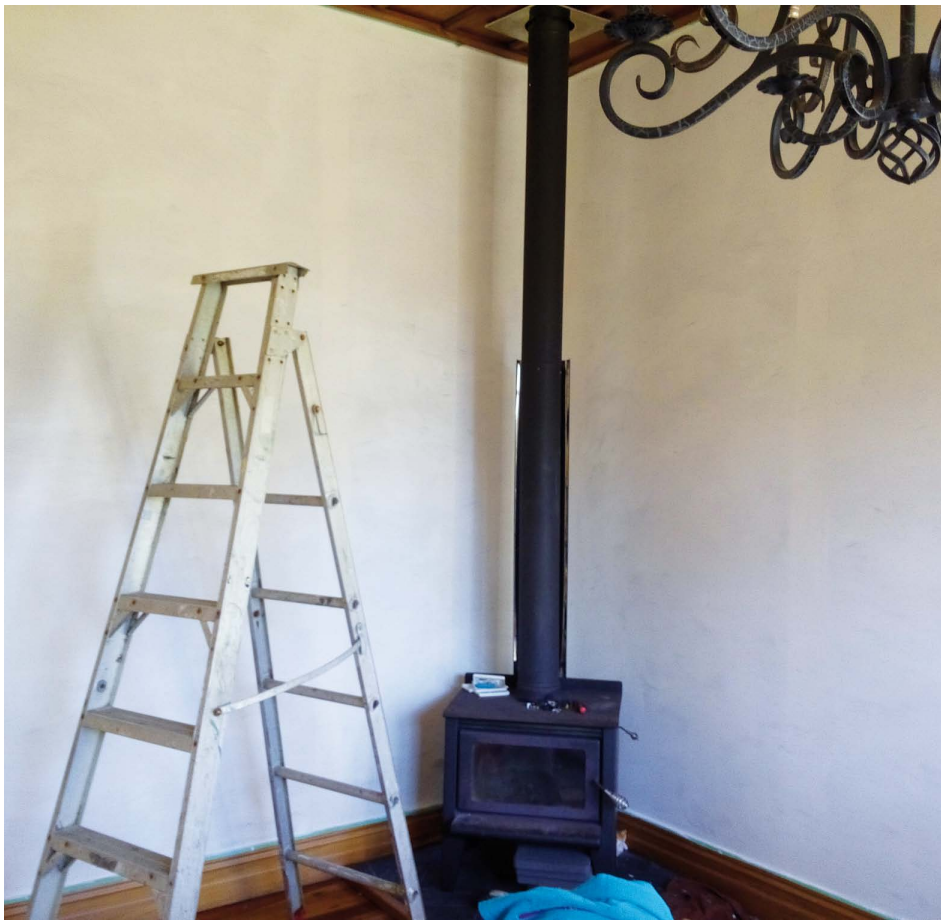
To make the casein paint cover better, add more lime, chalk, china clay or pigments.

If the paint cracks, it contains too much casein. Not enough casein reduces the wipeability.

Casein paint sticks to almost anything. It covers better than simple lime wash and it can be wiped or even washed. Due to the higher binding force, the paint can take up more pigments and is therefore more opaque. It dries quicker, too.

On the other hand it is less suitable for moist areas that are prone to mould and you can't keep the casein paint forever, it will go off just like milk. Keep it in the fridge until used up.

And if it does start to smell a bit sour or you have made too much, simply put the leftovers in the compost.



PHOTOS - OPPOSITE PAGE:
Casein Lime Paint ingredients

THIS PAGE - TOP:
Casein Paint over old acrylic paint

THIS PAGE - LEFT:
First Coat of Casein Paint

REFERNCES:

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10) *Carbon Black, Titanium Dioxide, and Talc, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 93*
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PHOTO, THIS PAGE:

Lazur

OPPOSITE PAGE:

Casein Paint drying, notice the brushstrokes

AUTHOR BIO

Désirée Haecki is an environmental scientist and building biologist living in Waitakere. Most of her time is spent the bush, keeping the hens out of the garden and running a lime plastering business with her husband.

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