

# The Magic Chemicals Tree and Other Myths

Tips on educating policymakers and thought leaders in chemical realities

Janet Greenwood, TT Environmental Ltd, 12<sup>th</sup> May 2022

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## “Chemicals” get a really bad rap these days - It’s cancel culture for chemicals

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## Policy seems to be driven by NGOs as much as anything else – like the EU Green Deal?

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And the Cosmetics industry doesn't help sometimes

Rid your beauty routine of chemical nasties with ethical, certified and natural products  
The Independent

The best chemical-free makeup, tried and tested by beauty editors  
Glamour Magazine

29 Clean Makeup Brands That Deserve to Be on Your Radar  
Allure.com

The 27 Best Natural Makeup Brands With Products That Deliver  
Because your skin deserves makeup that looks good while being good for you.  
Marie Claire

The Best Organic, Natural, and Non-Toxic Makeup Brands to Shop Now  
Harpers Bazaar

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People in the NGOs, and many politicians think there's a Magic Chemicals Tree

- where non-hazardous chemicals can be found to replace all the hazardous ones
- and which will work just as effectively
- with no downsides at all
- and substitutions are quick and easy to do



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But here in the chemical industry, we know that the Magic Chemicals Tree doesn't exist

- Any more than the Magic Money Tree
- So why do people who have power and influence over our industry believe in something so obviously untrue to those of us involved in chemical manufacture or formulation?
- Most of them don't seem to be chemists or chemical engineers
- And the Magic Chemicals Tree seems to be based on a series of myths, which we'll go through

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### Myths propping up the Magic Chemicals Tree

1. There is such a thing as a non-hazardous chemical
2. You can substitute any hazardous chemical with low or no hazard alternatives
3. The hazards of some chemicals are so severe, we should ignore their benefits
4. You can make low hazard chemicals from other low or no hazard chemicals
5. "Natural" is better or safer than artificial
6. It's easy to develop substitutes for existing hazardous chemicals

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### Myths propping up the Magic Chemicals Tree

6. Making chemicals at a commercial scale is easy
7. Controlling chemicals more strictly in the EU and UK makes the world a safer place
8. Fewer hazardous chemicals on sale is a good thing

And underlying these myths is a major assumption about chemicals and chemistry :

- That we understand everything there is to know about chemistry, chemicals and how they behave

So let's look at what happens when these myths meet the real world

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### Myth 1 - There is such a thing as a non-hazardous chemical

**Marathon victim died from drinking too MUCH water**



A 25-year-old man died after completing his first London Marathon because he drank too much water. David Rogers collapsed at the end of the race and died yesterday in Charing Cross Hospital.

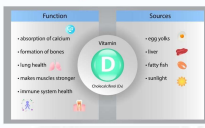
Would you eat something which is labelled like this?



**Danger**  
Fatal if swallowed. Fatal if inhaled. Causes damage to organs through prolonged or repeated exposure

Vitamin D3 is an essential vitamin that your skin produces in response to sunlight exposure. It can also be consumed through a variety of animal and plant-based foods. Vitamin D3 is known to support bone health, but it also supports the immune system to protect you from environmental germs and bacterial threats.

With increased exposure over our lifetimes, there has been an increase in vitamin D3 deficiency, which can affect immune function. Taking supplements of vitamin D3 helps you maintain healthy levels to support immune function, bone health, and overall health.



**Paracelsus (1493 – 1541): "the dose makes the poison"**

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### Myth 2 – you can substitute any hazardous chemical with low or no hazard alternatives

- Fact – a lot of chemicals are useful because we are exploiting their hazardous properties
- Toxicity
  - If you've ever taken an antibiotic for an infection, you've killed millions of pathogenic bacteria in your own body
  - Toxic chemicals are often used as chemotherapy agents, giving a low dose to try to destroy cancer and allow the patient to live
  - And even organic farmers use (old fashioned) pesticides to protect their crops, like pyrethrum extract (from chrysanthemum plants)

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### Myth 3 – the hazards of some chemicals are so severe, we should ignore their benefits

- Very few things in life are without drawbacks, and we weigh benefits and costs to ourselves every day almost unconsciously
- Focussing on one specific type of chemical hazard, without looking at whether it's at a level to cause harm (Paracelsus again!) or what the context of its use is doesn't help anyone, and can cause greater harm in the future
- We've seen this recently with the Titanium Dioxide carcinogenicity classification for nano-scale powders. If the original proposals hadn't been altered, we would have seen it banned from cosmetic products, including sun-screens, with potentially 10s of 1000s of deaths from skin cancer every year in the EU (because you can only have very high SPF with a combination of chemical and physical sunscreens) – versus very little evidence of increase lung cancer in Titanium Dioxide workers

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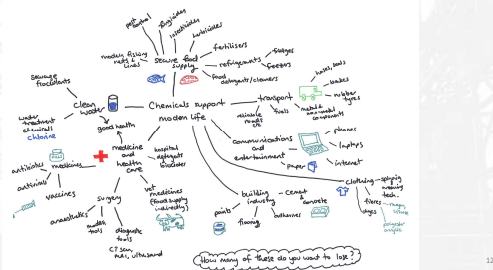
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### Chemicals support modern life as we know it



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### Myth 4 – you can make low hazard chemicals from other low or no hazard chemicals

- To make low hazard chemicals we often need to react them from other ones
- Reactive chemicals are, by definition, hazardous chemicals, because of their potential to react
- Around 60% of chemicals are used inside the chemical industry, and don't make it out into consumer use
- And we can't make desirable articles without using very hazardous chemicals
- Everything which has a chip inside it.....
  - Smartphones
  - Laptops/ other computers
  - Most modern cars

.... relies on Hydrofluoric acid to etch those chips

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### And a related myth is that using plant-based feedstock is somehow “sustainable”

- Like we should go back to using indigo plants to dye our denim jeans
- Slight problem – the volume of plants needed to meet current global demand would require so much indigo to be grown that it's actually more than the area of viable farmland in India (source: SP Wilkinson, retired from Milliken, previously Keystone Dyes)
- There are a lot of global pressures on farmland even before the supply chain crisis, e.g. “rewilding”, moves for blanket reforestation regardless of whether the natural environment is trees or not
- We need oil as a chemical feedstock to prevent famine, both in providing energy to create sufficient nitrogenous fertilisers, and to give an alternative feedstock for valuable chemicals

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### Myth 5 – “natural” is better or safer than artificial

- The most poisonous chemicals in the world are naturals
- Promoting “natural” over artificials feeds this myth
- Cosmetics and personal care marketing should be more honest



Botulinum toxin (Botox), LD50 1 ng/ kg



Batrachotoxin LD50 2,000 ng/ kg or 2 µg/kg



Pufferfish (fugu) and other animals - tetrodotoxin, LD50 300 µgram/ kg (about 50 fatalities per year)



Ricin, LD50 22 µg/ kg

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### Myth 6 – Making chemicals at a commercial scale is easy

- There are many more wrong answers than right answers when it comes to process plant design (summary of Sean Moran, chemical engineer, author of Process Plant Layout)
- In my working life, I have seen many small and several large processes fail to get off the ground commercially through lack of knowledge:
  - Lack of chemical knowledge (making biodiesel was seen as “easy money”)
  - Chemists not listening to chemical engineers and vice versa
  - Lack of proper scale up research
  - Poor planning - failing to understand the amount of money and effort it will take

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### Myth 6 – Making chemicals at a commercial scale is easy (continued)

- There is a 20 year investment life for process plants, and money is a key resource for the chemical industry, not to mention the accumulated knowledge or “culture” in individual sites of how to make their products safely. If it takes 2 generations of trawlermen to fully learn how to fish, why not making chemicals?
- And we haven’t even touched on the difficulties of setting up and running a chemical manufacturing plant here in the UK or the EU
  - Planning permission and local objections (we had a resident object to a chemical factory which was operational before their house was built, decades before they bought it)
  - REACH registration
  - Licences to operate – Environmental or IPPC Permits; COMAH compliance; Consent to Discharge; costs of hazardous waste disposal etc
- Regulations are like a tax, and taxes fall hardest on people at the bottom (Jordan Peterson), in this case, on SMEs
- But SMEs are the base of the chemicals manufacturing ecosystem

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### The chemical innovation process

- This is not a linear process, which is why communication between teams is so important (coffee break?)
- Individual steps can take weeks/months/years
- Rushing any one step can be dangerous

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### Myth 7 – Controlling chemicals more strictly in the EU and UK makes the world a safer place

- Impacts of REACH
  - Pre-REACH, approximately 130,000 known chemicals on the EU marketplace
  - Estimated 50,000 at registration levels (1 tonne per annum and above)
  - Actually registered to date – 26,433
- Where did they all go?
  - No longer available
  - Offshore, no longer made in the EU – often in countries where life is cheap, and a river is just a convenient method of waste disposal – “moving the problem” from safer, well-regulated emissions environment
  - Stayed in EU/UK at sub-REACH levels through entity-splitting, mainly by smaller companies (less well-resourced, potentially less safe)

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### Myth 8 – Fewer hazardous chemicals on sale is a good thing

- If we knew everything and could predict the future, perhaps
- But we don't know what we don't know
- Most chemicals are used by the chemical industry ourselves, before they get to the consumer
- After Covid, can you predict what we might need in the next pandemic?
- There is an ecosystem of chemicals used to make other chemicals, just as there is an ecosystem of chemical companies who make them
- To work properly, these ecosystems need to have a wide variety of chemicals available, and innovation will naturally emerge, rather than the current “avoidance” innovation we have
- Incidentally – how many good R&D people are now in regulatory affairs, and how many businesses are focussed on compliance rather than making chemicals?

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### And the underlying assumption that we know everything there is to know about chemicals is clearly wrong

- Otherwise these new products wouldn't exist:
  - Viagra
  - YInMn Blue, the new inorganic blue pigment
- And we wouldn't be seeing unintended consequences from regulatory changes
  - Remove formaldehyde releasing biocides– increasing dependence on isothiazolones as preservatives – increase in allergic responses
  - Or the concerns about an increase in bacterial resistance, “superbugs” which is likely to be exacerbated by a reduction in the number of biocidal actives available as disinfectants, as well as a reduction in the number of functioning antibiotics

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Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know.



And if one looks throughout the history of our country and other free countries, it is the latter category that tends to be the difficult ones.

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In my view the amount of investment in time and effort, as well as capital into chemical manufacture

- Should mean that we should stick with the status quo as a first step, and only look at changing where there is clear evidence of unexpected/unanticipated harm; or where genuine improvements can be made
- We also need to keep manufacture and formulation within the EU and UK, where health, safety and environment standards are very high
- (This may be controversial, but I personally think we should exclude carbon from any calculations where we're comparing relative risks of chemical pollutants – it's a theoretical unproven risk, versus current actual risks)
- And we don't need extra rules like REACH on emissions – perfectly well captured by current rules and standards, e.g. IED/Env Permit/IPPC
- By the way – water standards are usually breached by sewage, not industry

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Questions to ask thought leaders and policymakers

- What chemical(s) would you use instead of the current one you're trying to ban?
- Do they do the job as effectively?
- Do we need more or less of them? (usually more is needed if less effective)
- What are the hazards of the chemicals needed to make the less hazardous one(s) you are proposing?
- Is there manufacturing capacity in the EU and/or UK for these substitutes?
- Are the supply chains in place to support the predicted extra demand for the substitute?

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### Questions policymakers should ask themselves

- Are there signs of a concerted PR campaign against a specific chemical?
- Do these focus on the perceived drawbacks and ignore the societal benefits of that chemical?
- Is there clear and unambiguous data about the drawbacks which is accepted by industry, as well as by the NGOs?
- Are other chemicals with the same hazards included in any lobbying campaign, or is one chemical being focussed on, e.g from a particular manufacturer?

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### And finally – are the NGOs acting as if there is a magic chemicals tree?

- Because there isn't one
- And it's far easier to destroy a viable chemical industry than to create one
- We need to have open discussions about the costs and benefits of chemicals, not just "all chemicals are nasty"
- And keep the chemical industry onshore here in the UK and EU, where we can make them as safely and cleanly as possible, and enjoy the benefits which a thriving chemical industry brings to society



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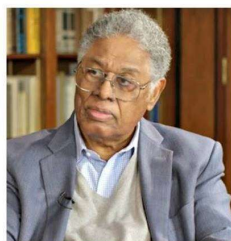
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“It is hard to imagine a more stupid or more dangerous way of making decisions than by putting those decisions in the hands of people who pay no price for being wrong.”



Thomas Sowell

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Thank you! Questions/ discussion

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