

Low Tox Method - Assignment 2

Response ID:56 Data

1. Ingredient research skill-building

1. What's your name?

Andria Ronne

2. What chemical have you been given to research?

Organochlorines, a group of synthetic pesticides.

3. How would one describe this chemical or group of chemicals from a structural point of view?

Organochlorines are chlorinated hydrocarbons - in other words, they are chemical compounds made up of chlorine, hydrogen, and carbon atoms only. Chlorine is one of the most reactive elements and forms very strong chemical bonds with other atoms.

One infamous example of an organochlorine is Dichlorodiphenyltrichloroethane, commonly known as the pesticide DDT, with the chemical formula: C₁₄ H₉ Cl₅. DDT is produced by combining chlorobenzene and chloral hydrate, a precursor to chloroform.

4. Is there anything in the research (provide study links or articles written by authorities on the subject either journalists or scientists) that suggests this chemical can cause harm?

Organochlorines are the largest group of synthetic pesticides and were developed in the 1940's, starting with the chemical DDT. During World War II, DDT was used to protect soldiers from mosquito-borne illnesses, such as malaria and typhus. After the war, DDT became a widely used pesticide in industrial agriculture. Organochlorines can either be sprayed on plants or injected into soil to be taken up by their roots. These chemicals kill insects by inhibiting the enzyme cholinesterase, which is essential in the functioning of the nervous system. (<https://www.britannica.com/technology/insecticide#ref71059>, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240724/pdf/ehp0110-000125.pdf>)

The chlorinated nature of these compounds produces strong chemical bonds which are slow to degrade in the environment. For example, DDT has a half-life of 2-15 years, meaning it takes up to 15 years for the concentration of a particular sample to fall to half of its initial value. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5464684/>) Organochlorines are most heavily concentrated in adipose, or fat, tissues in animals and can accumulate up the food chain affecting predators like eagles and hawks dramatically. Research in the 1960's demonstrated that high levels of DDE (a metabolite of DDT) in certain birds of prey caused such thin eggshells that they could not produce live offspring. Additionally, sprayed organochlorines can travel great distances over air and water, crossing oceans and dispersing through waterways. For all of these reasons, they are classified as Persistent Organic Pollutants (POPs) by the EPA and many were included on the "Dirty Dozen" list that was banned by the Stockholm Convention in 2001. (<https://www.epa.gov/international-cooperation/persistent-organic-pollutants-global-issue-global-response>)

There is strong evidence that organochlorines build up in the body over time and have been linked to endocrine disruption in humans, hormonal cancers, such as breast and prostate cancer, and neurotoxicity. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5464684/>) They have also been linked to obesity, diabetes, thyroid effects, and reproductive problems such as decreased sperm quality. (<https://www.nature.com/articles/srep19982>) Underscoring the persistence of these chemicals, one study conducted in the US found the DDT metabolite, DDE, in 99.7% of participants aged 12 years and older, even though it was conducted over thirty years after DDT was banned from use (samples taken between 2003-2004). (<https://pubmed.ncbi.nlm.nih.gov/19320182/>)

5. Based on the research you gathered, to what level would you feel comfortable using a product with this ingredient in it?

Considering the deleterious consequences on human health and wildlife and the persistent nature of these chemicals in the environment, any level of use in agriculture is unacceptable. I would personally aim to limit my intake of conventional produce,

unfiltered water, and food products imported from China, India and the Korean Peninsula. Even though there is an argument for continued use as a global health tool to control the spread of malaria, I believe it is unacceptable without a commitment to phase out and invest urgently in more sustainable alternatives.

6. Where might we find this chemical appearing in our day to day lives?

A study in the journal of Environmental Research conducted between 2010-2012 found organochlorine pesticides in over 60% of a cohort of black women in the Detroit area born between 1975-1980. Higher levels were found to correlate with more water intake, heavier alcohol use, cigarette smoking, age and having been breastfed.

(<https://www.bu.edu/sph/news/articles/2020/ddt-was-banned-decades-ago-why-is-it-still-detectable-in-these-women/>) This is one example of the mounting evidence that pesticides can remain in drinking water and soil even many years after being banned.

Due to their low cost and effectiveness in controlling mosquito-borne illnesses and pests, organochlorine insecticides such as DDT, hexachlorocyclohexane (HCH), aldrin and dieldrin are still among the most widely used pesticides in developing countries such as China, India and North Korea. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5464684/>) As a result, organochlorines might travel trans-continentially through air and water into nations that have banned their use.

(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2801202/>) They might also be found in imported food products, in particular fatty meats and fish.

7. If we were to stop using products with this chemical, what could we use instead? A couple of brand ideas that omit that ingredient or DIY recipe links to support the transition for people. (If you've found it to be safe and supported that with evidence, just pop N/A here")

In the mid-1960's the Dow Chemical Company invented an alternative to DDT, called Chlorpyrifos, an organophosphate pesticide which is currently the most widely-used pesticide on crops, including corn, soybeans, broccoli, and apples. It is also widely used in non-agricultural settings like golf courses. In 2000, two independent studies, one from Columbia University and one from Berkley, found that when children were exposed to chlorpyrifos in the womb, they tended to be smaller, have poorer reflexes, and show higher risks of having ADHD and other developmental disorders years after being exposed. Since then, numerous peer-reviewed publications have corroborated the evidence for neurodevelopmental toxicity.

(<https://sitn.hms.harvard.edu/flash/2018/widely-used-pesticide-one-year-later/>)

Petitions to ban the use of chlorpyrifos in all food uses were tied up in the courts in the US between 2007-2017. In 2017, Trump's head of the EPA, Scott Pruitt, decided to postpone a decision until the next registration review of the chemical in October 2022 on the grounds that a unilateral ban in the U.S. would disrupt international trading and hurt American farmers and consumers financially. (<https://sitn.hms.harvard.edu/flash/2018/widely-used-pesticide-one-year-later/>)

Where mosquito-borne illness is a matter of global health, non-chemical pesticide control is a promising alternative. Some examples of non-chemical pesticide control would be reducing mosquito breeding habitats, improved housing and mosquito netting, strategic use of aquatic predators such as fish, and employing bacterial microbial larvacites which produce toxins that are specific to mosquitoes and have a low risk of resistance development.

(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2801202/>) As of 2020, microbial larvicides are currently considered the safest biological insecticides for the health of humans and other non-target organisms, however they need more development to be a feasible replacement for DDT. (<https://idpjournal.biomedcentral.com/articles/10.1186/s40249-020-00767-3>)

Until all toxic pesticides, including organochlorines, are banned, I would recommend getting a great water filter and trying to buy organic produce whenever possible. I would also limit imported foods from countries like China, India and the Korean Peninsula. If you have access to small, local farms, you can ask about their use of pesticides and soil management practices in order to avoid toxic chemicals without having to spend organic prices.