Tin, From Safe to Sinister Through the Power of Chemistry

Tin cans, tin foil, the Ford Model T (or Tin-Lizzie) all have something in common, other than tin. No one uses them anymore. You may still find the occasion tin can or piece of foil in a basement or kitchen pantry; you could even find a restored Model T, but these things are antiques, gone the way of the dinosaur. While this may seem to mean that this rather innocuous metal has departed from our daily lives and is a relic of another generation, the truth is quite the opposite.

While tin, historically, has rarely been in the metallic “spotlight” like certain other metals like gold, steel, iron, even aluminum gets more respect, tin has, however, been the go to option for alloys. Even thousands of years ago, when at the beginning of the Bronze Age when copper was combined with tin to give a stronger yet more malleable metal, a tin alloy became the metal of choice for generations. Pewter is roughly 90% tin. Iron and steel are often plated with tin to inhibit rust. Solder, indispensable for the electronics industry, is made predominantly from tin and accounts for over 50% of the global tin consumption annually.

When most people think of tin, or most metals for that matter, we tend to think of their applications in terms of their elemental forms. Since mankind is rather inventive and industrious, chemistry has allowed us to access all the potential power of the elements in their limitless combinations. While this may reward mankind with cheaper and more cost-effective goods, sometimes the price paid in human health can be too great.

Elemental tin is very safe. It plays no biological role in the body; it is very *very* poorly absorbed by the body, and even though tin poisoning can induce vomiting and diarrhea, it takes food that contains over 200mg/kg of tin before these effects are felt. According to the broad scientific community, tin poisoning is nearly non-existent.

Though in a number of articles on tin, a small caveat is included that refers to certain tin-based compounds that do have high toxicity, but limited detail is given. Though this information may simply be an aside in a general tin article, in the interests of human health and life in general it is no trifling matter.

If you take tin and combine it with hydrocarbons, you create the foundation for a whole new family of chemicals known as *organotins*. Organotins’ largest industrial purposes are the heat stabilization of plastics and biocides. Untreated PVC for example, rapidly decays when exposed to sunlight or higher temperatures and will quickly discolor and crack. Since PVC is primarily used for simple plumbing and fluid transfer, this is problematic. When certain organotins compounds are used on the PVC, it is protected from this type of damage and retains its strength much longer.

While plastic treatment may afford strength and protection to the plastic, the organotins make their way into various sections of the environment, whether it leaches into the water that is passed through the plastic (organotins are often used in plastic bottles by the way), or into the soil if the pipes are buried, etc. While the accumulation of these toxins is slow because of the nature of hardened plastic, other organotins have much easier access to our bodies.

Among the most commonly used substances to protect produce crops from mites, ticks, and fungi are organotins. This is because they are cheap to make, effective at killing, and the insects are slow to develop resistance to them.

Among the more notorious of these organotins is tributyltin, or TBT. TBT has been used in a variety of industries as a biocide. It's most notable application was as a coating for boat hulls. This coating prevented the growth of algae and other marine life that could damage the hull. It was so effective that for many years it was the coating of choice for nearly every form of naval vessel on the planet. It increased the longevity of hulls and reduced the number of times that it needed to be dry-docked for cleaning.

Unfortunately, such widespread use was releasing enormous amounts of TBT in the ocean and was causing major damage to marine life. Research conducted on TBT showed that it was an endocrine disrupter and created a number of illnesses in various organisms. In mice it caused predisposition to obesity. In marine snails it disrupted hormone function so severely that it changed their sex from female to male. In oysters it made their shells soft and mushy, affording little to no protection. Unhealthy concentrations of TBT have also been found in whales, fish, and sea birds. The long-term effects of TBT on the marine ecosystem have yet to be seen.

From the existing research, and the devastating impact TBT had on the oyster fishing industries in France and England, the International Maritime Organization, of which over thirty nations are a member, put a global ban into full force in 2008.

TBT, though banned in one industry now, is only one of the many organotins that have a high toxicity, not just in the animal kingdom, but in humans as well. TBT's ugly sister is dibutyltin, or DBT, which is primarily used in the heat-treating of PVC for water pipes. While DBT has not been as well researched as TBT, some recent research has shown that DBT may have the ability to actually cause and/or exacerbate autoimmune conditions in humans.

An in vitro study conducted on DBT was tasked with discovering what effects, if any, DBT had on a particular cellular receptor site. The way the immune system works is through a complicated signaling system that uses hormones and other chemicals that are made in the brain or kidneys and when these chemicals are released into the body they find the cells they are looking for and latch onto them at an opening in the cell called a "receptor site". Like a key in a lock, once turned delivers a signal to the cell that activates a certain cellular program within the DNA and off the cell goes.

Sometimes certain chemicals with different messages use the same receptor site to deliver its command. Depending on which chemical gets there first determines how the cell responds. There are also circumstances when the receptor sites become blocked by other substances which prevents the proper chemical from activating the cell.

One such chemical, cortisol (which is actually a steroid hormone) is made by the adrenal glands and is primarily responsible for controlling the rate of metabolism, as well as balancing the immune system by preventing over activity. DBT blocks the receptor site for cortisol, which effectively gives the immune system no bounds and in the

event that there is an allergic or auto-immune system event, there is much less capability for the body to bring it back under control.

This effect was seen with trace amounts of DBT, not unlike the levels of concentrations that have been found in human blood. While a caveat to this information is that this was discovered using a “Petri dish” experiment and actual animal or human exposure studies need to be conducted in order to conclusively prove the true toxicity of DBT, the fact is that the entire family of organotins are known toxins. The majority of them are biocides. In fact, if DBT were discovered to have truly no toxicological effects on the humans or animals, it would be the exception to the rule.

To illustrate the point, the majority of the organotins mentioned in the Wikipedia article on organotins chemistry are all biocides. In fact, some of them are in the same category of toxin as cyanide. These biocides are being commonly used in conventional agriculture, which is a strong reason to consider organic food purchases.

In order to protect yourself from this toxicity, reducing exposure is paramount. If you live in agricultural areas, learn about the types crops being grown and gain an understanding of the types of biocides being used and strongly consider adequate water filtration and consuming organic food.

Organotins can cause real stress for the liver and kidneys and it is important to take nutrients that support detoxification of these systems.

Some nutrients that may provide assistance are cilantro and chlorella, taken simultaneously. They are renowned for their ability to both prevent absorption of toxic substances and remove those that have already entered the body.

DMPS, a chelating agent, it has a degree of affinity for tin, meaning that it binds to tin and allows for urinary excretion and may be an option for people who have had a significant amount of organotins exposure.

Certain combinations of nutrients have been known to increase urinary excretion of tin, namely turmeric, hops, zinc, and andrographis.

While most of these substances are perfectly safe for most people, it is important that before beginning any new health plan or making significant changes to your diet, or vitamin regimen, to consult with a qualified medical professional who is familiar with your medical history and is knowledgeable in toxicity and can design a program best suited to your body’s needs.

A fascinating thing to think about and appreciate is how chemistry, with all of its power to help and heal, can take something as relatively benign as tin, and transform it into a deadly poison that can destroy ocean life, as well as human health. Fortunately, there are those using these same powers to design healing formulas to restore health to the body and eliminate these toxins for those who have been exposed. That should give us hope.

4789 Vineland Ave.
Toluca Lake, CA 91602
(818) 761-1661
www.nutrikon.com