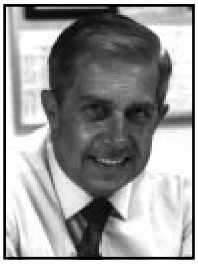


Fact or Fiction?

Jack W. Dini
1537 DeSoto Way
Livermore, CA 94550
E-mail: jdini@earthlink.net

Chemophobia—Part 2

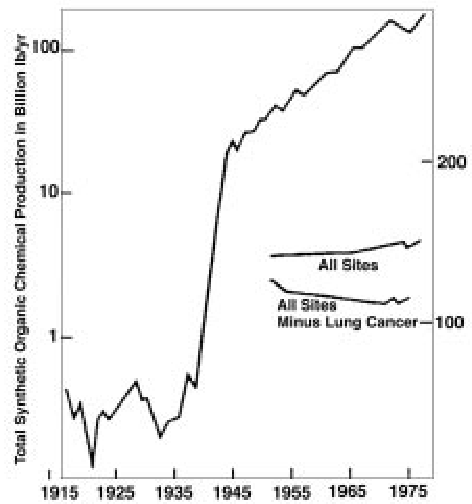
***Editor's Note:** This is continuation of a discussion about the fear of chemicals and public concerns about chemicals and cancer. Part 1 appeared in the December 1998 issue.*

What's the public to believe? Boric acid is a household product when used in laundry detergents, a drug when sold as an antiseptic eyewash, an insecticide when used to kill roaches and a herbicide when used to kill weeds. Some additional interesting information on boric acid relates to Harvey W. Wiley, who was the first director of the Food and Drug Administration and was largely responsible for moving Congress to enact the Pure Food and Drug Act of 1906.[1] In 1902, Wiley established what became popularly known as "Dr. Wiley's Poison Squad." This squad was set up "to enable the Secretary of Agriculture to investigate the character of food preservatives, coloring matters and other substances added to food, to determine their relation to digestion and health and to establish the principles which should guide their use."

Twelve healthy young men from the Department of Agriculture volunteered for the one-year experiment. They agreed to eat and drink only what was given to them at meal times from the Department of Agriculture's kitchen. Six of the volunteers were given a normal diet containing boric acid, which was the most common food preservative of the time, while the other six were given sodium borate (borax). Wiley concluded from this experiment that both boric acid and borax (sodium borate), when continuously administered in small doses for a long period of time or when given in large quantities for a short period, create disturbances of appetite, digestion and health. Showing how the media could twist findings even at this earlier time in our history, an enterprising reporter wrote a story on the activities of the poison squad, and stated that Dr. Wiley had discovered that borax gave the volunteers a most beautiful pink complexion. (The reporter neglected to mention that most of the men walked briskly to work, even on frosty mornings.) As a result of this story, Dr. Wiley received numerous letters from all over the country asking how borax should be taken in order to produce such a desirable cosmetic effect.[1] When writing about Wiley in 1971, Benarde stated: "On this score little seems to have changed. Reporters still often prefer to write their own more colorful version of laboratory experiments, and people are still ready to believe and use anything that is mentioned in print, no matter how flimsy the evidence."[1] This still seems to hold true today. (For more on this topic, see "Fact or Fiction?" in February 1998 *P&SF*.)

Similar to boric acid and many other chemicals, hydrochloric acid comes under many banners. It is regulated as a household product when it is present in cleaning compounds, as a drug when it is used to treat people with low gastric acidity, as a hazardous industrial chemical when it is used in electroplating and as a pesticide adjuvant when it is used to enhance the germicidal activity of chlorine in swimming pools. Hydrochloric acid is natural when produced by the stomach and synthetic when made in the laboratory.[2]

No debate—there are indeed a lot of chemicals, and many play a variety of roles. A 1983 report by the National Research Council noted that about five million different chemical substances are known to exist.[3] Fewer than 30 of these have been definitely linked to cancer in humans, 1,500 have been found to be carcinogenic in tests on animals and about 7,000 have been tested for carcinogenicity.



In spite of the dramatic increase in the manufacture and presumed increased exposure to synthesized organic chemicals, there has been no apparent increased risk in the cancer rate, even after correction for smoking and other lifestyle factors.[4]

Adams[3] used a black rectangle to represent the darkness of ignorance, *(i.e.*, what we do not know about the carcinogenic effects of most substances), a much smaller white rectangle to represent the 7,000 substances that have been tested, and a tiny pinprick of light relative to the size of the black rectangle to represent 30 as a proportion of five million.

Another way of looking at chemicals and cancer concerns is shown in the figure reproduced here, where, in spite of the dramatic increase in the manufacture and presumed increased exposure to synthesized organic chemicals, there has been no apparent

Hydrogen Cyanide (HCN) Levels Liberated from Common Food Crops Containing Cyanogenic Glycosides[5]

Food	HCN Yield (mg/100g)
Bitter almond	
Seed	290
Young leaves	20
Wild cherry, leaves	90-360
Apricot, seed	60
Peach	
Seed	160
Leaves	125
Sorghum	
Mature seed	0
Etiolated shoot tips	240
Young green leaves	60
Bitter cassava	
Leaves	104
Bark of tuber	84
Inner part of tuber	33
Lima bean, mature seed	
Puerto Rico, small black	400
Puerto Rico, Black	300
Java, colored	312
Burma, white	210
Jamaica, speckled white	17
Arizona, colored	17
American, white	10

increased risk in the cancer rate, even after correction for smoking and other lifestyle factors.[4]

Results of a study sponsored by the University of California Agricultural Issues Center[5] led to the following conclusions:

1. Inorganic chemicals in general, and heavy or toxic metals in particular, do not constitute health hazard situations of "crisis" proportions. While inorganic chemicals certainly enter the human food chain, they still do this at acceptable rates.
2. There are no (or only a few) so-called point sources of heavy-metal pollution in the State of California. They do not appear to be responsible for the observed heavy metal content of foods.
3. The so-called nonpoint sources of heavy-metal pollution (natural trace element distribution in soils and rocks) could pose problems and need to be monitored frequently.

Cyanide

Let's talk about cyanide, a chemical those of us in the electroplating industry are quite familiar with. We are all well aware that hydrogen cyanide is an extremely toxic material (average fatal dose in humans is estimated to be 50–60 mg). Many plants produce hydrogen cyanide as a degradation product of cyanogenic glycosides that have been detected in 110 different plant families and in more than 2,000 plant species, including several commonly consumed in the human food chain. Human poisoning from cyanogenic glycosides has been observed most frequently in populations consuming lima beans and cassava. The accompanying table lists hydrogen cyanide levels liberated from a variety of common food crops.[5]

Conclusion

One reason the public is not better informed about these matters is that scientists do not communicate well with the public—and when they do, they are not very effective. Scientists and engineers must speak out to correct misinformation and state the facts in a consumer friendly and understanding manner. Several writers of environmental books have asked "where are the scientists?" Scientists have simply attended their meetings, read their papers and gone home, satisfied that they have done a good day's work. As Benarde[1] has pointed out, this is totally unsatisfactory. As scientists, we should be speaking and writing for the public rather than just for our own professional forums. This leaves the field open for muckrakers with their purple prose and clever amateurs who cry "poison."

If nothing else, the above information speaks to the importance of our Government Relations Board. It's extremely important that we all be involved with this activity, either by volunteering our time and/or monetary contributions.

A pastor at our church in Livermore suggested that parishioners needed to offer their church the three "T"s: time, talent and treasure. Clearly, the same applies in terms of educating the public and the Government Relations activities are one way to help accomplish this. P&SF

References

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5. *Chemicals in the Human Food Chain*, C.K. Winter, J. N. Seiber and C. F. Nuckton, Eds., Van Nostrand Reinhold (1990).