

What does the science say: Water Bottle Safety

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Introduction

Impetus

I thought it would be interested to look into the oft-quoted idea that water bottles are not reusable and that if you do anything other than drink from them and toss them, that you would get cancer. I personally had not heard many of the claims and in even looking them up, the first few results were usually previous debunkings. This almost made be stop by I figured for my few readers I may as well summarize some of the results. Plus I thought it would be nice to look into something where there was nobody I could offend, which is nice. This is part of an ongoing series that has included [energy drinks](#) and [water intake requirements](#).

A comment-enabled version can be found on my blog at:
<http://whatdoesthesciencesay.wordpress.com/2009/12/06/water-bottles-and-cancer/>

Note: BPA will be covered in another essay, as the FDA and CDC are currently awaiting for new studies to be completed. They were supposed to report back Nov 30, but this has come and gone. Currently the official position is that BPA as it is currently used is safe.

Summary

Your water bottle is not going to kill you. The best thing to do any time you hear that some every day item is going to kill you is to head on over to Snopes. Most stories like this are quickly found to be based on complete fabrications. This particular one happens to have very minute amounts of "real" science (e.g. dioxins and DEHA do exist and DEHA is in microwave-safe plastics) but that actual effects are in no way realistic. Additionally, DEHA is not actually carcinogenic as far as anyone can tell. Whether or not you personally believe in any claim of this sort, please refrain from passing it on before you have validated that it is credible.

Disclaimer

I am not a doctor or scientist, no words of mine should be construed as medical advice. My intent is only to find the best available scientific or medical evidence for or against claims that comes for authoritative sources. If you have credible studies that would contradict them, please let me know.

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Claims

Claim 1: Leaving a bottle of water in the car can make it cancerous

Personally I had never really heard about this one, but I did some searching and it looks to be a popular one, having originated with an email hoax purporting to come from "Johns Hopkins" and claiming that leaving a water bottle in the car can cause it to leak "dioxins". Occasionally the email will include the claim that Sheryl Crow was on Ellen to warn others about this happening to her.

Sample

From one [blog that has pasted the email](#) (and claims it came from a breast cancer doctor):
[¹]

Cancer Update from Johns-Hopkins

Bottled water in your car is very dangerous!

On the Ellen show, Sheryl Crow said this is what caused her breast cancer. It has been identified as the most common cause of the high levels of dioxin in breast cancer tissue.

Sheryl Crow's oncologist told her:

women should not drink bottled water that has been left in a car. The heat reacts with the

1. Smith-Batchen, Lisa. "Cancer Update from Johns Hopkins". April 11, 2009.
<http://lisasmithbatchen.blogspot.com/2009/04/cancer-update-from-johns-hopkins.html>

chemicals in the plastic of the bottle which releases dioxin into the water. Dioxin is a toxin increasingly found in breast cancer tissue. So please be careful and do not drink bottled water that has been left in a car. Pass this on to all the women in your life.

What the science says

Let's get the Sheryl Crow part of it out of the way right away. On her official site she posted real information about dioxins that specifically goes against the claim (i.e. she acknowledges that it is a hoax). It can currently be found on [page 23 of her "news items"](#) (the items are chronological, and this item is from October of 2006). It is a news item called "What You Need to Know About Dioxins (Updated with Notes from Gregg Dempsey)". In case that link doesn't get you there, an [Internet Archive version](#) exists of her older site which had the same news item. She actually ends up quoting from some of the same stuff that will come below.

Regardless, I think it should be stressed as always that celebrities should not be where you get your science or medical information from. This also goes for the ones I agree with.

Johns Hopkins has [specifically called out that this is a hoax](#) ^[2]:

The Internet is flooded with messages warning against freezing water in plastic bottles or cooking with plastics in the microwave oven. These messages, frequently titled "Johns Hopkins Cancer News" or "Johns Hopkins Cancer Update," are falsely attributed to Johns Hopkins and we do not endorse their content.

Freezing water does not cause the release of chemicals from plastic bottles.

Additionally, they have [another response](#) that goes into some more detail^[3]:

Question: What do you make of this recent email warning that claims dioxins can be released by freezing water in plastic bottles?

Answer: No. This is an urban legend. There are no dioxins in plastics. In addition, freezing actually works against the release of chemicals. Chemicals do not diffuse as readily in cold temperatures, which would limit chemical release if there were dioxins in plastic, and we don't think there are.

The [FDA has a page about dioxins](#). You are exposed to it quite often. Their page makes absolutely no mention of plastic bottles.

Technically some studies have shown that high levels of exposure could potentially cause cancer^[4]:

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2. Johns Hopkins School of Public Health. <http://www.jhsph.edu/dioxins>
 3. http://www.jhsph.edu/publichealthnews/articles/halden_dioxins2.html

G2. Why are people concerned about dioxins?

...

One of the main concerns over health effects from dioxins is the risk of cancer in adults. Several studies suggest that workers exposed to high levels of dioxins at their workplace over many years have an increased risk of cancer. Animal studies have also shown an increased risk of cancer from long-term exposure to dioxins.

G4. How might I be exposed to dioxins?

Most of the population has low-level exposure to dioxins. Although dioxins are environmental contaminants, most dioxin exposure occurs through the diet, with over 95% coming through dietary intake of animal fats (see also [E3](#) and [E4](#)). Small amounts of exposure occur from breathing air containing trace amounts of dioxins on particles and in vapor form, from inadvertent ingestion of soil containing dioxins, and from absorption through the skin contacting air, soil, or water containing minute levels of dioxins.

But again it has absolutely nothing to do with plastic bottles (or even, as far as I know, any plastics you would use regularly).

Summary

It is true that dioxins could be potentially hazardous, but it does not seem that the average person would be getting anywhere near the exposure that could be harmful. And it certainly has nothing whatsoever to do with water bottles.

Claim 2: Heating of Freezing Water Bottles Causes them to Leach Chemicals such as DEHA

Sample

<http://www.rifeenergymedicine.com/plasticwrap.html>

As a seventh grade student, Claire Nelson learned that DEHA, di(ethylhexyl)adepate, considered a carcinogen, is found in plastic wrap. She also learned that the FDA had never studied the effect of microwave cooking on plastic-wrapped food. Claire began to wonder: "Can cancer-causing particles seep into food covered with household plastic wrap while it is

4. Food and Drug Administration. "Questions and Answers about Dioxins".
<http://www.fda.gov/Food/FoodSafety/FoodContaminantsAdulteration/ChemicalContaminants/DioxinsPCBs/ucm077524.htm#g4> Visited 2009/12/06

being microwaved?"

Three years later, with encouragement from her high school science teacher, Claire set out to test what the FDA had not. Although she had an idea for studying the effect of microwave radiation on plastic-wrapped food, she did not have the equipment. Eventually, Jon Wilkes at the National Center for Toxicological Research in Jefferson, Arkansas, agreed to help her. The research center, which is affiliated with the FDA, let her use its facilities to perform her experiments, which involved microwaving plastic wrap in virgin olive oil. Claire tested four different plastic wraps and "found not just the carcinogens but also xenoestrogen was migrating [into the oil]...." Xenoestrogens are linked to low sperm counts in men and to breast cancer in women.

And,

On Channel 2 (Huntsville, AL) this morning they had a Dr. Edward Fujimoto from Castle Hospital on the program. He is the manager of the Wellness Program at the hospital. He was talking about dioxins and how bad they are for us. He said that we should not be heating our food in the microwave using plastic containers. This applies to foods that contain fat. He said that the combination of fat, high heat and plastics releases dioxins into the food and ultimately into the cells of the body. Dioxins are carcinogens and highly toxic to the cells of our bodies.

<http://www.bottledwater.org/public/downloads/antimonyposition2006a.pdf>
Dioxins

<http://www.jhsph.edu/dioxins>

What the Science Says

Others have done better research on this hoax (actually for both parts), a good one being at http://www.spysoftball.com/microwave_hoax.htm. As usual, Snopes is a good source on this one (<http://www.snopes.com/medical/toxins/cookplastic.asp>). Another one to take a look at <http://www.hoax-slayer.com/plastic-cancer-link-hoax.html>

I actually couldn't put it better than Snopes:

It's a pretty good assumption that if using plastic containers in microwaves posed a significant risk of cancer, you'd be hearing it somewhere other than an e-mail forward of an anonymous summary of a morning news spot on a Hawaii television station

Replace the item and the danger, and you have a large percentage of all the supposed health hazards out there from normal household items.. which are also not backed by any actual science.

From (arguably potentially biased) site plasticsinfo.org^[5]:

The student's thesis incorrectly identifies di(2-ethylhexyl) adipate (DEHA), a plastics additive, as a human carcinogen. DEHA is neither regulated nor classified as a human carcinogen by the U.S. Occupational Safety & Health Administration, the National Toxicology Program or the International Agency for Research on Cancer, the leading authorities on carcinogenic substances.

In 1991, on the basis of very limited data, the U.S. Environmental Protection Agency classified DEHA as a "possible human carcinogen." However, in 1995, EPA again evaluated the science and concluded that "...overall, the evidence is too limited to establish that DEHA is likely to cause cancer."

Further, DEHA is not inherent in PET as a raw material, byproduct or decomposition product. DEHA is a common plasticizer that is used in innumerable plastic items, many of which are found in the laboratory. For this reason, the student's detection of DEHA is likely to have been the result of inadvertent lab contamination. This is supported by the fact that DEHA was detected infrequently (approximately 6% of the samples) and randomly, meaning that the frequency of detection bore no relationship to the test conditions.

Moreover, DEHA has been cleared by FDA for food-contact applications and would not pose a health risk even if it were present.

Finally, in June 2003, the Swiss Federal Laboratories for Materials Testing and Research conducted a scientific study of migration in new and reused plastic water bottles from three countries. The Swiss study did not find DEHA at concentrations significantly above the background levels detected in distilled water, indicating DEHA was unlikely to have migrated from the bottles. The study concluded that the levels of DEHA were distinctly below the World Health Organization guidelines for safe drinking water.

Or if you don't trust "plasticsinfo.org", how about the [American Cancer Society](http://www.cancer.org)^[6].

These emails are apparently based on a student's college thesis. In fact, DEHA is not inherent in the plastic used to make these bottles, and even if it was the U.S. Environmental Protection Agency (EPA) says DEHA "cannot reasonably be anticipated to cause cancer, teratogenic effects, immunotoxicity, neurotoxicity, gene mutations, liver, kidney, reproductive, or developmental toxicity or other serious or irreversible chronic health effects." Meanwhile, the International Agency for Research on Cancer (IARC), says diethylhexyl adipate "is not classifiable as to its carcinogenicity to humans."

5. American Chemistry Council. "FAQs: The Safety of Plastic Beverage Bottles".
http://www.plasticsinfo.org/s_plasticsinfo/sec_level2_faq.asp?CID=705&DID=2839#6 Visited 12/6/2009

6. American Cancer Society. http://www.cancer.org/docroot/med/content/med_6_1x_reusing_plastic_water_bottles.asp?sitearea=med

The IARC study that both reference can be [found online here](#). The above have already quoted it, so the link is just for reference.

Or how about the [EPA](#) (you will note that they make no mention of water bottles)^[7]:

What is di(2-ethylhexyl) adipate?

Di(2-ethylhexyl) adipate is a light-colored, oily liquid with an aromatic odor.

What are di(2-ethylhexyl) adipate's health effects?

Some people who drink water containing di(2-ethylhexyl) adipate well in excess of the maximum contaminant level (MCL) for many years could experience toxic effects such as weight loss, liver enlargement, or possible reproductive difficulties.

How does di(2-ethylhexyl) adipate get into my drinking water?

The major source of di(2-ethylhexyl) adipate in drinking water is discharge from chemical factories.

Summary

The FDA, EPA, and American Cancer Society are well aware of DEHA, water bottles and plastics. They make absolutely no claims about them being carcinogenic when frozen or heated. In fact they make sure to point that these claims are specifically untrue.

Claim 3: Water bottles are unsafe for re-use because of bacteria

Summary

Well, yeah. You should re-use any container without rinsing it with soap and water. Why would water bottles be any different. Claiming that water bottles are any different means that as soon as you open a bottle of water you must throw it away after the first drink if you don't finish it. Does that make any sense?

Further References

Not surprisingly, Brian Dunning of Skeptoid covered this already (in 2007 no less) at: <http://skeptoid.com/episodes/4060>

It has also been covered on pretty much every email-hoax debunking site.

7. Environmental Protection Agency. "Basic Information about Di(2-ethylhexyl) adipate in Drinking Water". <http://www.epa.gov/ogwdw000/contaminants/basicinformation/di-2-ethylhexyl-adipate.html>

