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Does Your Bottled Water Contain Nanoplastics?

Analysis by Dr. Joseph Mercola | January 24, 2024

STORY AT-A-GLANCE

- Using new technology, researchers were able to more accurately detect single nanoparticle plastics smaller than 100 nanometers (nm) and found concentrations that ranged from 110,000 to 370,000 particles per 1 liter of water
- This was far higher than the 2018 estimate that found an average of 325 microplastic particles per bottle; the technology found millions of nanoparticles that were not among the seven types of plastics the algorithm could identify, suggesting they did not originate from the bottle
- The size of the nanoparticles creates the most questions and concerns as they can get into individual cells and cause dysfunction in major organs when they deposit endocrine-disrupting chemicals
- Plastic has contributed greatly to the throwaway society in which we live. Municipal wastewater treatment plants are not equipped to filter out plastic particles and one study using older technology estimated we consume an average of one credit card's worth of plastic each week
- There's evidence that plastic chemicals are harming the health of future generations through intergenerational endocrine disruption. We can all have an impact on plastic pollution by not adding to it, such as avoiding plastic bags and water bottles, and washing synthetic clothes less frequently

Using a hyperspectral stimulated Raman scattering (SRS) imaging platform, researchers[1] were able to detect single nanoparticle plastics smaller than 100

nanometers (nm) more accurately than before. Researchers were able to identify seven types of plastic particles and count concentrations that ranged from 110,000 to 370,000 particles per 1 liter of water, far higher than the estimate in 2018 that found an average of 325 microplastic particles per bottle.[2]

While the featured study found plastic nanoparticles in bottled water at volumes far higher than anticipated, plastic water bottles are not the only source of plastic that we can consume. Microplastics from artificial clothing fibers, microbeads in personal care products, and plastics that break down from fishing nets, plastic bags, and biosolids spread on cropland have created a nightmare for the environment, particularly the oceans, waterways, and marine and bird life.

While some lobby groups are fighting to restrict plastic use, other groups and organizations that rely on plastics for their financial health, are fighting those restrictions. The Plastics Industry Association's lobbying arm, the American Recyclable Plastic Bag Alliance, formerly the American Progressive Bag Alliance,[3] backs legislation that would prevent local communities from addressing plastic pollution.

For example, in Tennessee, legislation was passed that prohibited local cities from enacting bans on plastic grocery bags, which was supported by the American Progressive Bag Alliance.[4] The group argues that people use these bags multiple times, and they are recyclable at the stores they came from.

"If you love the outdoors, you love nature, and you think that Tennessee is a beautiful place, I really cannot see any justification for saying that it's OK to have these single-use plastics that we see piled up against fences … in our rivers," said Richard Briggs, Senate Republican. "It won't get any better by doing nothing, it will only get worse."[5]

1 Liter of Water Has 240,000 Plastic Particles

Reducing single-use plastic bags can help to lower the volume of microplastics that enter the waterways and are difficult to extract. However, the featured study measured the volume of nanoplastics released into bottled water "with unprecedented sensitivity

and specificity."[6] The results demonstrated a far higher volume of nanoparticles than expected.

And, as CNN Health notes,[7] the size of nanoparticles is such that they can move through the tissues of the digestive tract or lungs and enter the bloodstream where they are distributed throughout the body. For comparison, the researchers were measuring particles of plastic that measure 1,000th the average width of a human hair and they found an average of 240,000 particles from seven types of plastic in the equivalent of two standard-sized water bottles.

Of the plastics identified, 90% were nanoplastics and the remainder were microplastics, that range from less than 0.2 inches (5 millimeters) to 1/25,000 of 1 inch (1 micrometer). Sherri Mason, director of sustainability at Penn State Behrend, who was not involved in the study, called the work "profound" and "groundbreaking."[8]

Mason said these findings reinforce the advice that you should steer clear of plastic contact in your food and drink. "People don't think of plastics as shedding, but they do," she said. "In almost the same way we're constantly shedding skin cells, plastics are constantly shedding little bits that break off, such as when you open that plastic container for your store-bought salad or a cheese that's wrapped in plastic."[9]

The data from this study offers new information. But, even more disturbing, the researchers were studying seven major types of plastic when they concluded there were from 110,000 to 370,000 bits of plastic in the three popular brands of water sold. However, using the new technology, the researchers could see millions of nanoparticles that were not among the seven types they studied.[10]

In other words, 370,000 nanoparticles of plastic in 1 liter of bottled water are just the tip of the iceberg. At the time of the study, the researchers were limited to seven types of plastics based on new technology. The modified version of spectroscopy used to boost the image could not identify the particles, so the researchers developed a machine-based learning technology that allowed them to identify seven types.

Lead author Naixin Qian commented on the types of plastic found in bottled water, saying, "Based on other studies we expected most of the microplastics in bottled water would come from leakage of the plastic bottle itself, which is typically made of PET (polyethylene terephthalate) plastic. However, we found there are actually many diverse types of plastics in a bottle of water, and that different plastic types have different size distributions."[11]

Lack of Effective Analysis Results in Fundamental Knowledge Gap

The researchers identified plastics that were not all from the bottle. The team from Columbia is now investigating a hypothesis that particles may have come from the source water or tainted at the manufacturing plant. This begs the question, which has less plastic, tap water or bottled water?

The size of the nanoparticles creates the most questions and concerns as they can get into individual cells and cause dysfunction in major organs when they deposit endocrine-disrupting chemicals. Phoebe Stapleton is an associate professor of pharmacology and toxicology at Rutgers University's Ernest Mario School of Pharmacy and one of the scientists on the study.[12]

"Micro and nanoplastics have been found in the human placenta at this point," Stapleton said. "They've been found in human lung tissues. They've been found in human feces; they've been found in human blood."

"We know these microparticles are getting into the body, and we know even greater percentages of the smaller nanoparticles are getting into cells, but we don't know exactly where they're going in the cell or what they are doing, and we don't know if or how they're getting back out again," she told CNN Health.[13]

The researchers point out that there "remains a fundamental knowledge gap in nanoplastics because of the lack of effective analytical techniques,"[14] which the new technological advancement appears to begin to bridge. Mason points out that this is a

new frontier in plastic research, understanding the potential impact it has on human health.

Scientists are only just beginning to understand the vast influence plastics have on the environment and the human body. CNN reached out to the International Bottled Water Association for comment. A spokesperson told CNN via email:[15]

> *"More research needs to be done to develop standardized methods for measuring and quantifying nanoplastics in our environment. There currently is both a lack of standardized methods and no scientific consensus on the potential health impacts of nano- and microplastic particles. Therefore, media reports about these particles in drinking water do nothing more than unnecessarily scare consumers."*

Senior writer on the study, Wei Min, is a professor of chemistry at Columbia University in New York City who co-invented SRS in 2008. Min told CNN[16] that the technology is well suited to evaluating human tissue samples and that the study's raw data is a series of images. "In fact, we have plenty of data to show if a particle has entered a particular location in a certain type of cell, then we will be able to locate it precisely in space," he said.

We Ingest and Inhale a Surprising Amount of Plastic

It's no secret that we live in a throwaway society and many products are manufactured for short-term consumption. Estimates suggest that by 2050 the ocean will contain more plastic by weight than fish and marine life will be irreparably destroyed.[17] One problem with plastic is that it doesn't biodegrade, it photodegrades.[18] This process can take hundreds of years, and even as it breaks down it doesn't completely vanish.

Additionally, municipal wastewater treatment systems fail to filter out microplastics, since the process was invented long before the plastic explosion. As I wrote in late 2023, thanks to a throwaway mentality, **plastic has invaded** some of the most pristine areas of the world, threatening wildlife and the water supply.

According to Australian research,[19] the average person consumes approximately 5 grams of plastic each week. To put that into context, that's about the size of one credit card. These data were published in 2019, long before the current advances in technology demonstrating an even greater amount of plastic is ingested in bottled water than was estimated in the past.

There is clearly a potential for catastrophic biological consequences as many of the plasticizing chemicals are similar in structure to natural human hormones and as such, interfere with many physiological processes. And we don't just ingest plastic particles in our water supply. According to a study[20] from Amsterdam, roughly 80% of beef and pork meat, blood and milk contain plastic particles.

One study writer commented that "producing plastic-free feed for animals may be one way to improve exposure to plastic particles for livestock." As if we are not eating enough plastic,[21] the U.S. Defense Advanced Research Projects Agency (DARPA) is partnering with universities to create a process that makes food from plastic and paper waste, which began as a project to provide short-term nourishment for U.S. military personnel on extended missions.

Microplastics Linked to Altered Physiological Functions

In this video, Pete Myers, Ph.D., adjunct professor of chemistry at Carnegie Mellon University and founder, CEO and chief scientist of Environmental Health Sciences, talks about plastic chemicals and the impact it has on the human endocrine system. According to Myers, there's evidence that plastic chemicals are harming the health of future generations through intergenerational endocrine disruption.

As I have written in the past, we have a **dangerous addiction to plastic** with a long list of known health disturbances and problems. Added to this, **recycling is nearly impossible** and costly. While the Australian research showed that plastic particles end up in livestock meat, researchers at the University of Vienna discovered it also ends up in the brain.[22]

Just two hours after mice ingested drinking water with plastic, particles were found in the mice's brains, which increases the risk of neurological disorders and inflammation.

According to The Guardian,[23] "In addition to potentially severe degenerative consequences, the researchers also believe that microplastic contamination in our brains can cause short-term health effects such as cognitive impairment, neurotoxicity and altered neurotransmitter levels, which can contribute to behavioral changes."

A 2019 study,[24] found that polystyrene microplastics affected the gut barrier, microbiota and metabolism of mice. The authors reported "In this study, we exposed male mice to 5 μm pristine and fluorescent polystyrene MP for six weeks. The results showed that the polystyrene MP was observed in the guts of mice and could reduce the intestinal mucus secretion and cause damage to the intestinal barrier function."

Eliminating unnecessary plastic packaging could go a long way toward reducing plastic waste. Beverage manufacturers can also make a dent in pollution and adverse health effects by reverting to inert and easily recyclable glass bottles.

While many have promised to tackle plastic pollution, no apparent dent has been made in the rising tide of plastics entering the oceans, water supply, food supply, and our bodies. We can all have an impact on plastic pollution individually, by not adding to it. Consider:

- Avoiding plastic bags (including for snacks and food storage)
- Avoiding disposable straws (reusable straws made from stainless steel, bamboo and even glass are widely available)
- Washing synthetic clothes less frequently, and when you do, use a gentle cycle to reduce the number of fibers released; consider using products that catch laundry fibers in your washing machine
- Choosing non-plastic toothbrushes made from bamboo or flax
- Avoiding disposable plastic bottles; bring your own reusable bottle instead

Sources and References

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