Where Did the Water Go?

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It may seem a bit strange to see a “Best Before” date on a bottle of water – but it’s there for a rather unexpected reason. The water itself really doesn’t have a critical time-frame beyond which it’s quality begins to deteriorate. It’s the plastic bottle that tends to cause the limitations.

Any of you who use bottled water know just how flimsy the bottles themselves are. They are so thin, that one of my colleagues says that if they were any thinner, they would be a plastic bag.

The water bottles are made from the same polymeric material as the large two-litre soft drink bottles. That’s polyethylene terephthalate, or PET, for short. PET can be made into strong, light-weight, shatter-resistant bottles in a variety of shapes and sizes. Bottle molding technology has advanced to the point where extremely thin containers can be formed. These can be used for products such as drinking water since there is no internal pressure like we see with carbonated beverages which require a sturdier container.

About three or so years ago, I placed couple of unopened bottles of water on top of a filing cabinet in my office. They ultimately got shoved to the back and languished there before being recently re-discovered. Surprisingly, the shape of the water bottles was quite distorted, and they appeared to be more slender than they were originally. When I compared the weight of one bottle to the weight of a fresh full bottle, there was a difference of over 75 grams. So where did the water go?

This is where we need to look at the packaging material.

Because the plastic containers are so thin, they lose some of the barrier properties that thicker containers of the same material possess. One of these barriers is to moisture, or water vapour loss. Even though the bottles are holding water inside, water vapour can very slowly diffuse through the plastic and leave the container. In the normal course of events, the product would be consumed in a relatively short time period after being purchased. However, that’s not what happened in my case.

My water bottle sat in my office for over three years. During this time, water molecules slowly diffused through the plastic. On average, twenty-five grams of water per year, or about two grams per month, managed to escape the confines of the water bottle. The fact that my office tends to be hot during most of the year also played a role in the water loss. This is because the rate of diffusion increases with higher temperatures.

In extreme cases, where enough water is lost, the concentration of dissolved minerals in the water can increase to the point where they no longer can remain dissolved. When this happens, it is possible to see small deposits of undissolved minerals on the bottom of the bottle. These are totally harmless, but its interesting to see them and think about how they got there.

So, it's not really the water that needs the "best before" date – it's that packaging material.

Just out of curiosity, I intend to put the water bottles back where they were, and see what happens to them during the months ahead.

Compare the fresh water bottle on the left to the one on the right that is well over two years beyond its "Best Before" date