Rubber plumbing seals can leak additives into drinking water, study says

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As drinking water flows through pipes and into a glass, it runs against the rubber seals inside some plumbing devices. These parts contain additives that contribute to their flexibility and durability, but these potentially

harmful compounds can leak into drinking water, according to a small-scale study in *Environmental Science & Technology Letters*. The authors report that the released compounds, which are typically linked to tire pollution, also transformed into other unwanted byproducts.

To enhance rubber's strength and durability, manufacturers typically mix in additives. Scientists have shown that tire dust can transport these substances, such as 1,3 diphenylguanidine (DPG) and N-(1,3-dimethylbutyl)-N'-phenyl-1,4-benzenediamine (6PPD), into waterways. DPG and 6PPD have also been detected in drinking water samples, though it's unclear how the compounds got there.

In previous research, Shane Snyder and Mauricius Marques dos Santos found that these rubber additives can react with disinfectants in simulated drinking water. Their lab tests generated a variety of chlorinated compounds, some of which could damage DNA. Now, the team wanted to assess whether real-world rubber plumbing fixtures can release DPG and 6PPD and form chlorinated byproducts in drinking water samples.

In this pilot study, the team collected tap water from 20 buildings and detected polymer additives at parts per trillion levels in every sample. The researchers explain that these compounds are not currently regulated, but the measured levels are potentially concerning, based on their previous study's results from human cell bioassays.

The samples from faucets with aerators contained the highest total amounts. All of the samples contained DPG and one of its chlorinated byproducts, whereas 6PPD and two other chlorine-containing compounds were each found in fewer than five samples. This is the first report of chlorinated DPG byproducts in drinking water, according to the researchers.

To see if these compounds could have come from plumbing fixtures, the team tested rubber O-rings and gaskets from seven commercial devices, including faucet aerators and connection seals. In the experiment, the rings sat in water with or without chlorinated disinfectants for up to two weeks. Most of the seals, except for the silicone-based ones, released DPG and 6PPD additives.

Additionally, plumbing pieces sitting in disinfectant-treated water generated chlorinated forms of DPG in amounts that were consistent with those observed in the drinking water samples. Because some of the rubber plumbing seals released DPG and 6PPD, the researchers say that drinking water, as well as tire pollution, could be a route of human exposure to these compounds.

More information: Occurrence of Polymer Additives 1,3-Diphenylguanidine (DPG), N-(1,3-Dimethylbutyl)-N'-phenyl-1,4-benzenediamine (6PPD), and Chlorinated Byproducts in Drinking Water: Contribution from Plumbing Polymer Materials, *Environmental Science & Technology Letters* (2023). DOI: 10.1021/acs.estlett.3c00446. pubs.acs.org/doi/abs/10.1021/acs.estlett.3c00446

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