Research team identifies culprit behind canned wine's rotten egg smell

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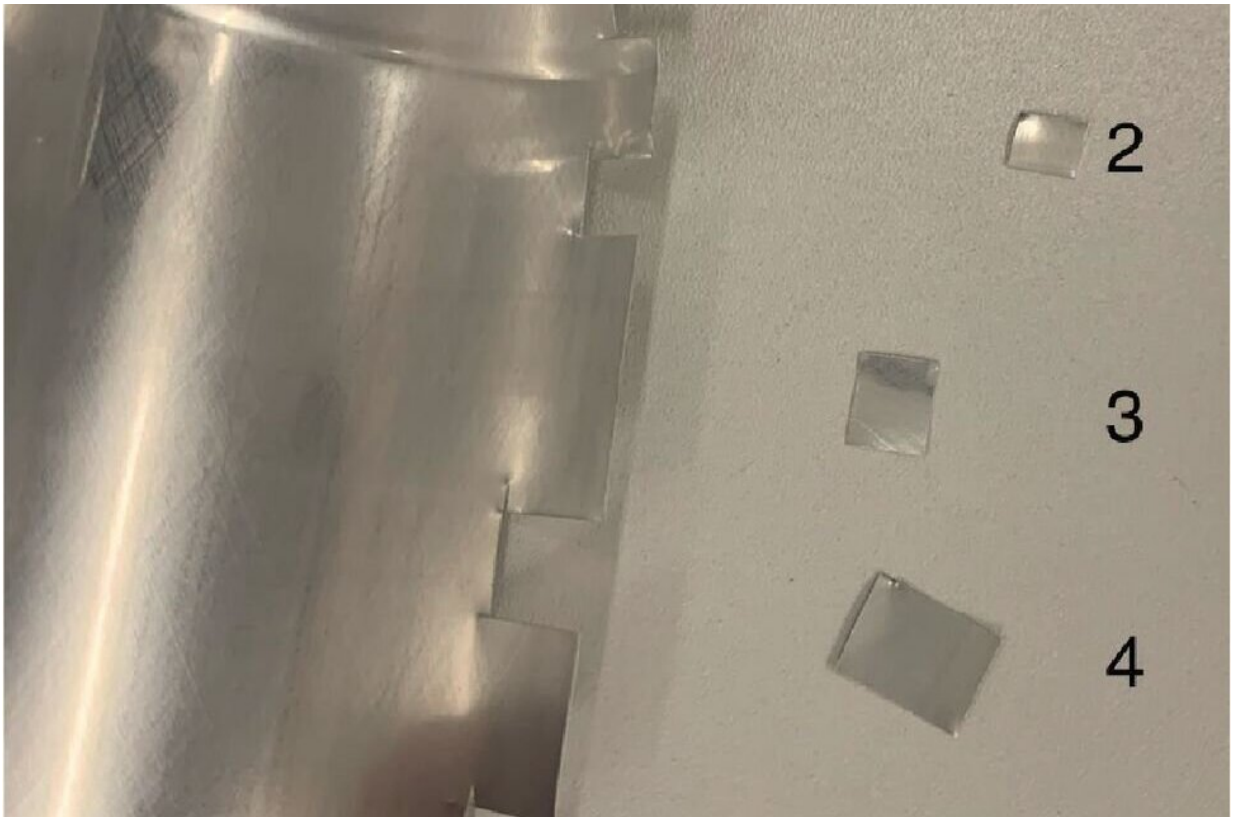

Locations within can body sampled for liner and aluminum surface analysis: 1, top of neck, adjacent to seam; 2, tapered portion of can neck; 3, upper can body below the neck; 4, middle can body; and 5, lower can body. Credit: *American Journal of Enology and Viticulture* (2024). DOI: 10.5344/ajev.2023.23069

While it is the fastest growing sector of the wine-packaging market,

canned wine faces a few hurdles. It's not considered as elegant as wine in a bottle, and it's not as popular as the formerly maligned "wine bag in a box." There is also the unfortunate fact—and there is no gentle way to put this—that canned wine occasionally smells like rotten eggs.

A team led by Gavin Sacks, Ph.D. and Julie Goddard, Ph.D., both professors of food science in the College of Agriculture and Life Sciences, is working with wineries, manufacturers and New York state to eliminate that "off" aroma by ever-so-slightly altering the product's formulation and packaging, which is also prone to corrosion.

In recent research published in the *American Journal of Enology and Viticulture* (*AJEV*), the team found that the choice of the ultrathin plastic coating inside aluminum cans can go a long way towards improving the aroma of the beverage and the lifespan of its container.

'Why doesn't Coca-Cola have a problem?'

The collaboration began several years ago, when Sacks was approached by winemakers who had encountered occasional quality issues with canned wines: corrosion, leakage and—mingled among the fruity and floral notes—a certain rotten egg smell.

"They said 'We're following all the recommendations from the can suppliers and we still have these problems, can you help us out?'" Sacks said. "The initial focus was defining what the problem compounds were, what was causing corrosion and off aromas, and why was this happening in wines, but not in sodas? Why doesn't Coca-Cola have a problem?"

Sacks teamed up with Goddard, and they blended his work in flavor chemistry with her expertise in packaging and material science. They began a series of experiments that characterized the chemical makeup of commercial wines, then evaluated the corrosion and off aromas.

"At first it was like an epidemiological-type study. The can producers have a long list of potentially problematic compounds, so you've got to measure as many things as possible," Sacks said.

The researchers stored the initial samples in a variety of cans with different internal coatings for up to eight months. Another batch of samples underwent accelerated aging by being incubated in ovens at higher temperatures for one to two weeks. The researchers also created a wine of their own with known amounts of suspected problem compounds.

All the approaches came to the same conclusion: The most important compound for predicting can failure, corrosion and off aromas was the neutral or "molecular" form of sulfur dioxide (SO_2), which winemakers routinely use as an antioxidant and antimicrobial. The plastic lining on the can interior did not fully stop the interaction between molecular SO_2 and the aluminum, resulting in production of hydrogen sulfide (H_2S), the source of the rotten egg smell. The smoking—or in this case stinking—gun had been found.

"Of all the things we measured, most had no correlation," Sacks said. "The one that stood out was molecular SO_2. With that, wineries typically aim for about 0.5 to 1 parts per million (ppm). We were noticing that in wines with more than 0.5 ppm molecular SO_2, we had sizable increases in hydrogen sulfide, the rotten egg smell, within four to eight months."

The team determined that maintaining 0.4 ppm of SO_2 in wine and using epoxy liners could ensure low formation of hydrogen sulfide during long-term can storage up to eight months.

"We're suggesting that wineries aim on the lower end of what they're usually comfortable with," he said. "Yes, there's going to be the chance of having more issues of oxidation. But the good news is that cans

provide a hermetic seal. They're not likely to let in any air if the canning is done properly, which is why brewers love them. It's great for preventing oxidation."

There is an irony to molecular SO_2 being the smelly culprit for canned wine. Molecular SO_2 levels are typically lower in red wines than in white wines. However, because consumers generally associate cans with less expensive and less serious wines, many companies don't put their red wines in cans.

"If you go to a store, you're far more likely to see sparkling wines, white wines, rosés in cans, but unfortunately those are the products that are more likely to have issues," Sacks said.

That paper's co-lead authors, doctoral student Austin Montgomery and Rachel Allison, Ph.D., won the 2024 Best Enology Paper from *AJEV*.

In the follow-up paper, written by doctoral student Matthew Sheehan, the team focused on how the variation of can liners affects the formation of hydrogen sulfide.

"It's not as important as wine composition. But we see considerable variation from manufacturer to manufacturer, even if they claim to be using the same type of polymers—plastic—on the inside," Sacks said. "We tried to understand why we were getting differences from manufacturer to manufacturer."

The team found that the thicker the liner coating, the less corrosion occurred, but the reactions between wine and liner still tended to vary during storage.

But there isn't such an easy fix here. There are several notable downsides to using thicker liners, according to Sacks. They are more expensive to

produce, and they are less environmentally friendly because the thicker plastic gets burned off during the aluminum recycling process.

Versatile, recyclable, convenient—and interesting

Rather than simply diagnosing the problem, Sacks and Goddard are now working with Héctor Abruña, the Emile M. Chamot Professor of Chemistry in the College of Arts and Sciences, to design more robust liners using food-grade materials that can prevent corrosion. The group is also tackling another popular beverage peccadillo: sour beer.

While cans may not have the luster of glass or the storage capacity of wine in a box, and they sometimes seem like an antiquated technology, they are versatile, recyclable and convenient, Sacks says. And interesting, too.

"I thought aluminum cans were boring until I started working on them," he said.

Perhaps canned wine's time has finally come.

"The current generation of wine consumers coming of age now, they want a beverage that's portable and they can bring with them to drink at a concert or take to the pool," Sacks said. "That doesn't really describe a cork-finished, glass-packaged wine. However, it describes a can very nicely."

More information: Matthew J. Sheehan et al, Hydrogen Sulfide Formation in Canned Wines: Variation Among Can Sources, *American Journal of Enology and Viticulture* (2024). DOI: 10.5344/ajev.2023.23069

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