Scientists learn startling new truth about sugar

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Flying in the face of years of scientific belief, University of Illinois researchers have demonstrated that sugar doesn't melt, it decomposes.

"This discovery is important to food scientists and candy lovers because it will give them yummier caramel flavors and more tantalizing textures. It even gives the pharmaceutical industry a way to improve excipients, the proverbial spoonful of sugar that helps your medicine go down," said Shelly J. Schmidt, a University of Illinois professor of food chemistry.

In a presentation to the Institute of Food Technologists about the importance of the new discovery, Schmidt told the food scientists they could use the new findings to manipulate sugars and improve their products' flavor and consistency.

"Certain flavor compounds give you a nice caramel flavor, whereas others give you a burnt or bitter taste. Food scientists will now be able to make more of the desirable flavors because they won't have to heat to a 'melting' temperature but can instead hold sugar over a low temperature for a longer period of time," she said.

Candy makers will be able to use a predictable time-temperature relationship, as the dairy industry does in milk pasteurization, to achieve better results, she said.

Schmidt and graduate student Joo Won Lee didn't intend to turn an established rule of food science on its head. But they began to suspect

that something was amiss when they couldn't get a constant melting point for sucrose in the work that they were doing.

"In the literature, the melting point for sucrose varies widely, but scientists have always blamed these differences on impurities and instrumentation differences. However, there are certain things you'd expect to see if those factors were causing the variations, and we weren't seeing them," Schmidt said.

The scientists determined that the melting point of sugar was heating-rate dependent.

"We saw different results depending on how quickly we heated the sucrose. That led us to believe that molecules were beginning to break down as part of a kinetic process," she said.

Schmidt said a true or thermodynamic melting material, which melts at a consistent, repeatable temperature, retains its chemical identity when transitioning from the solid to the liquid state. She and Lee used high-performance liquid chromatography to see if sucrose was sucrose both before and after "melting." It wasn't.

"As soon as we detected melting, decomposition components of sucrose started showing up," she said.

To distinguish "melting" caused by decomposition from thermodynamic melting, the researchers have coined a new name—"apparent melting." Schmidt and her colleagues have shown that glucose and fructose are also apparent melting materials.

Another of Schmidt's doctoral students is investigating which other food and pharmaceutical materials are apparent melters. She says the list is growing every day.

Having disposed of one food science mystery, Schmidt plans to devote time to others. For instance, staling intrigues her. "We could ship a lot more food around the world if we could stabilize it, keep it from getting stale," she said.

Or there's hydrate formation, which can make drink mixes clumpy if they're open for a while. "We've observed the results—clumping under conditions of low relative humidity—but we really don't know why it happens," she noted.

Schmidt said that new instruments are making it possible to probe some of the processes scientists have taken for granted in a way they couldn't do before.

More information: Four studies describing Schmidt's research have been published in recent issues of the *Journal of Agricultural and Food Chemistry*.

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