U-M researcher's idea jells into potential new disease-detection method

March 23 2009

Relying on principles similar to those that cause Jell-O to congeal into that familiar, wiggly treat, University of Michigan researchers are devising a new method of detecting nitric oxide in exhaled breath.

Because elevated concentrations of nitric oxide in breath are a telltale sign of many diseases, including lung cancer and tuberculosis, this development could prove useful in diagnosing illness and monitoring the effects of treatment.

Assistant professor of chemistry Anne McNeil and graduate student Jing Chen will discuss the work at the spring meeting of the American Chemical Society in Salt Lake City, Utah.

McNeil and Chen work with molecular gels, which differ from Jell-O in being made up of small molecules, rather than proteins. But there are also key similarities, McNeil said.

"In both Jell-O and molecular gels, you can use heat to dissolve the material, which then precipitates out into a gel structure. This gel structure is basically a fibrous network that entraps solvent in little pockets," she said.

The researchers wanted to design a material made up of molecules that would organize themselves into a gel when prompted by particular cue ---in this case, the presence of nitric oxide and oxygen. Other research groups have achieved similar feats with materials whose solubility changes when exposed to triggers (for example, a change in pH). But McNeil had the idea of promoting the process, known as stimuli-induced gelation, by changing the stackability of the molecules that make up the material.

"We took the approach of designing a molecule that has a shape that won't pack together with other, identical molecules very well, but will change into a more stackable shape on exposure to nitric oxide," McNeil said. When the molecules stack together, gelation occurs.

Because it's easy to see when the material stops flowing and turns into a gel, this method of nitric oxide detection is simpler and less subject to interpretation than other detection methods such as colorimetry and spectroscopy.

"I like the simplicity of not needing an instrument and just being able to flip the sample vial over and see if a gel has formed," McNeil said. At this point, the new technique isn't sensitive enough for clinical use, but McNeil and Chen are working to improve its sensitivity. They're also extending the approach to design materials that would use stimuli-induced gelation to detect hazardous materials, such as explosives.

More information: McNeil and Chen reported earlier stages of their work in a paper published in the *Journal of the American Chemical Society* in November 2008 at: pubs.acs.org/doi/full/10.1021/ja807651a

Source: University of Michigan (news : web)