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Science & Technology - *Posted by Steve McGaughey-Illinois on Monday, March 29, 2010 13:21 - 0 Comments* **Email This Post** **Print This Post**

Electronic coffee snob sniffs out brands

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Tags: aroma, chemistry, coffee, colorimetric sensor, optoelectronics, University of Illinois

Researchers have created a colorimetric sensor array, known as an optoelectronic nose, to analyze coffee aromas to a high degree of specificity and accuracy. In tests, the device could flawlessly discriminate between brands and could determine roasting conditions such as the length of time and the temperatures at which the coffee beans were roasted. (Courtesy: iStockphoto)

U. ILLINOIS (US)—Coffee connoisseurs may think they can tell the difference between a Starbucks gourmet blend and a generic grab-and-go brew, but now researchers have created a nose that really does know the difference.

University of Illinois researcher Kenneth Suslick has developed a colorimetric sensor that is so discriminating it can distinguish between a variety of coffee brands based on aroma and also report on roasting conditions.

Suslick, a researcher in the Department of Chemistry and at Illinois's Beckman Institute, had previously developed a colorimetric sensor—known as an "optoelectronic" nose—that consists of a printed array of different nanoporous pigments that strongly interact with chemicals for the general detection of industrial toxins.

The device is unaffected by humidity and allows for the visualization (through color change) of the pattern of the complex mixture of chemicals present in any odor or vapor.

Suslick and his collaborators then gave the nose sensor a task that has challenged the coffee industry for years: analyze coffee aromas to a high degree of specificity and accuracy, a difficult problem since roasted coffee beans contain more than 1,000 chemical compounds.

The resulting experiments showed their colorimetric sensor array produced unique molecular "fingerprints" of the coffee aromas tested, demonstrating an ability to accurately discriminate between the closely related mixtures of compounds found in coffee to a degree that is not possible with other electronic analyzers.

Their results were published in *Analytical Chemistry*.

The need for this technology is apparent because, as the authors write, coffee is “one of the most consumed beverages in the world, and remarkably, the primary industrial method of quality control for coffee remains the use of human smell and taste, in spite of the inherent nonquantitative and often subjective limitations that such ‘organoleptic’ analysis implies.”

As to other analysis methods, including other electronic nose technologies, they say that even for high -performance separation techniques, “the number of compounds that can be differentiated is disappointingly small relative to the extremely large number of components in truly complex mixtures.”

The colorimetric sensor array method they developed analyzed the aromas of 10 commercially available roasted coffees, both in whole bean and ground form. Vapors from each brand were forced over the sensor arrays, causing color changes in the nanoporous pigments that make up the sensor array; these color changes come from the strong interactions between the compound’s molecules and the sensor’s pigments.

This electronic nose method treats the complex mixtures in coffee as a single analyte, one which reacts strongly to interactions with the pigments in the dye, producing a unique fingerprint based on color. The strong chemical interactions produced by the method give much more specificity and reliability when chemically characterizing substances in the coffee aroma than previous electronic nose technologies or other types of analyzers.

The researchers report that the electronic nose “demonstrated flawless discrimination” among the 10 brands and could determine roasting conditions such as the length of time and the temperatures at which the coffee beans were roasted.

The researchers say that the method does not give information about individual components and so, “this approach is complementary to, rather than competitive with, more traditional chemical analysis” but because of the high specificity and low cost, “colorimetric sensor arrays are suitable for both laboratory and industrial applications in the analyses of complex mixtures.”

Toward that end, the researchers developed a prototype of a hand-held sensor device that provides a rapid and highly sensitive method for portable monitoring.

University of Illinois news: www.beckman.illinois.edu/index.aspx

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