Sep 14, 2009 10:18 AM in Health | 0 comments | Post a comment

Sniffing out toxic chemicals--With colors

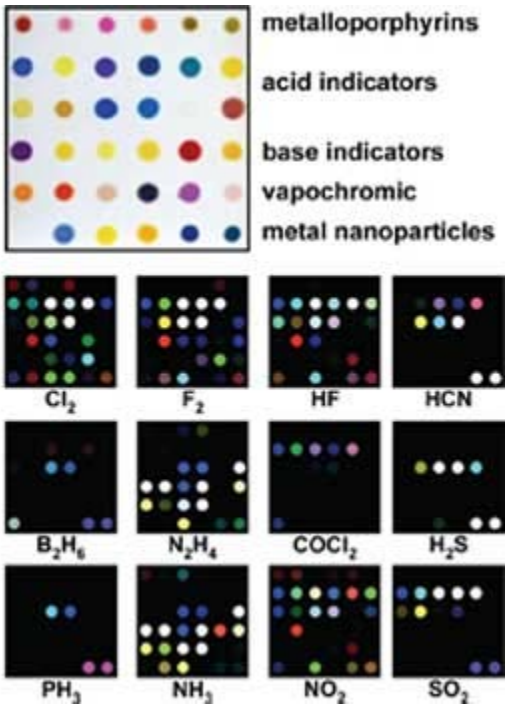
By Katherine Harmon in 60-Second Science Blog

Miners had canaries; physicists and medical technicians get radiation badges. But for those in other labs or factories with toxic chemicals, there has long been a need for practical sensors to warn workers when chemical concentrations get dangerous.

Many groups have tried to develop such devices, but some have been too expensive or unreliable in extreme conditions. A new prototype promises to deliver a practical, humidity-proof answer just by changing color, almost like a mood ring. The current version is portable, but the developers hope that it will soon be something workers could wear.

"Our device is simply a digital multidimensional extension of litmus paper," Ken Suslick, a professor of chemistry at the University of Illinois at Urbana–Champaign, said in a prepared statement.

The device relies on a square of 36 colored dots—made from nanoporous pigments—printed on paper, glass or plastic. A small scanner or camera captures changes in the colored dots for analysis. "The pattern of the color change is a unique molecular fingerprint for any toxic gas and also tells us its concentration," Suslick said. "By comparing the pattern to a library of color fingerprints, we can identify and quantify the TICs [toxic industrial chemicals] in a matter of seconds." The researchers reported no misclassifications in more than 140 trials.



The device boasts more refined detection capabilities than previous efforts, which have relied on more low-strength chemical interactions. The dyes used, the researchers report, are able to respond to a wide catalogue of common, harmful chemicals and register even before toxins exceed permissible exposure limits (PELs).

"Given the broad range of chemicals that can be detected and the high sensitivity of the array to those compounds, it appears that this device will be particularly useful in occupational settings," David Balshaw, a program administrator at National Institute of Environmental Health Sciences (NEIHS), which funded the study, said in a prepared statement.

Other research groups are also working with nanotechnology to create portable sensors. A research team at Ohio State University has been working with metal-oxide nanoparticles, which can detect toxic chemicals, they reported in a paper in *Materials Chemistry and Physics* earlier this year. "These are sensors that a soldier could wear on the battlefield, or a first responder could wear to an accident at a chemical plant," Patricia Morris, an associate professor of materials science and engineering at Ohio State and research leader, said in a prepared statement. Their work relies on the change of electrical conductance rather than change in color to detect the presence of chemicals.

The Illinois-based group's results were published online yesterday in *Nature Chemistry* (*Scientific American* is a member of the Nature

Publishing Group).

"This paper brings us one step closer to having a small wearable sensor that can detect multiple airborne toxins," Linda Birnbaum, director of the NIEHS, said in a prepared statement.

The Illinois group's prototype is now being developed into a commercial product by Palo Alto, Calif.- and Champaign-based iSense.

Image of the device and the postage stamp-sized dot array courtesy of Kenneth Suslick/University of Illinois