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Chemistry : Seeing scents

OLIVER DE PEYER

A fast and colourful way to detect toxic chemicals by 'seeing' their smell has been developed by researchers in America. Kenneth Suslick and Neal Rakow of the University of Illinois at Urbana-Champaign have developed dye/metal combinations that undergo vivid colour changes when exposed to organic vapours.

The idea of 'artificial noses' to detect chemical smells is not new. For instance, coated optical fibres react and fluoresce when they find particular chemicals. But such fibres are timeconsuming to prepare and need electronic sensors to measure the fluorescence. And they are confused even by tiny amounts of water vapour.

These new 'porphyrin' dyes are waterproof and react rapidly. By combining them with metals such as iron, silver and zinc, the researchers make them sensitive to a range of chemicals.

Unusually for chemical sensors, each dye can detect a range of different molecules — giving each vapour mixture its own 'fingerprint', revealed as a pattern of coloured spots on a 'sensor' sheet. "This contrasts with the traditional 'one sensor, one chemical' method," says David Walt, a chemist at Tufts University in Medford, Massachusetts.

The dyes' sensitivity to low concentrations of chemical vapours (less than half a part per million) will make them particularly useful, Walt adds.

Ingemar Lundström of Linköpings Universitet, Sweden, agrees that the new sensors show promise. "Many [existing] odour sensors are not able to detect the most toxic vapours, such as ammonia," he says. Ammonia binds easily to the new dyes, causing a rapid colour change.

Other flammable — and potentially hazardous — vapours detected by the new technique include alcohols, benzene, and industrial solvents such as acetonitrile and acetone. The dyes can also identify and measure mixtures of these compounds.

One of the major advantages of the new dyes is how quickly and easily the spot charts can be read, Lundström says — they do not need complex, computerized sensors. "Human vision is probably the most efficient pattern recognition system available," he adds.

By tweaking the porphyrins and metals, suggests Lundström, a wide range of ‘real-world’ chemicals and pollutants could be detected, including pesticides, drugs, nerve toxins and even some bacteria.

And this particular artificial nose may be closer to the real thing than some people realise. Suslick and Rakow suggest that receptor proteins in the nose (responsible for our sense of smell) are likely to contain metals similar to those used in the new dyes.

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1. Rakow, N. A. & Suslick, K. S. A colorimetric sensor array for odour visualization. *Nature* **406**, 710–713 (2000).

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