Scientists in the UK have modified plant spore microcapsules to take up to three and a half times their own weight in oil by a simple mixing process, giving them potential as natural oil-spill clean-up materials.

**Microcapsulation**
Grahame Mackenzie at the University of Hull and colleagues at Sporomex, a company that deals in micro-encapsulation for the pharmaceutical, food, cosmetics and personal care industries in Hull, extracted the outer layer of *Lycopodium clavatum* (clubmoss) spores, removed the inner contents using a simple, non-toxic process and modified the surface functional groups to make them more soluble in oil. They then put the microcapsules into an oil in water emulsion, shook it by hand for 15 seconds, and filtered the microcapsules out to leave an oil-free sample. The microcapsules could be used two or three times without a change in oil recovery efficiency, which the team attributed to the high strength of the naturally occurring sporopollenin polymer in the spore walls.

**Rapid recovery**
‘The advantage over conventional methods, for example phase separation paper or simple solvent extraction, is that the emulsion is simply mixed with the shells and then filtered, which is more rapid,’ says Mackenzie. Compared to other oil recovery methods, he says, ‘the spores are a natural material, are very robust and have a consistent size, making them easy to filter’.

Sporopollenin is also known to be very elastic and so the group tested the release of oil from the microcapsules under prolonged friction. They found that the oil could be released slowly over short time periods, indicating that the microcapsules could be used as delivery vehicles in the pharmaceutical and cosmetic industries.

**No solvent required**
‘A major breakthrough is the ability to evacuate the spores without toxic solvents,’ says Miriam Rafailovich, an expert in nanoscale materials engineering at Stony Brook University, US. However, she says that ‘since these spores can be allergens in their native form, the interactions of these processed capsules with higher organisms will need to be tested’.

Mackenzie considers one drawback to be ‘the high cost and lack of large-scale availability’ of the spores, however he adds that ‘research is ongoing and applications are being explored by various companies’.

Thibaud Coradin of the materials and biology team at the College of France in Paris says that the approach ‘should be highly inspiring for the future identification and processing of biocapsules’.  

Lucy Gilbert

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Did you know?

Plants like ferns and mosses (as well as bacteria and fungi) produce spores to reproduce – this is a form of asexual reproduction. The spores are often adapted so that they can be dispersed some distance away and survive for very long periods of time.

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Find out more

Traditional oil dispersants are made from surfactants; molecules which are soluble in both oil and water. Find out more about surfactants at [www.rsc.org/CWsurf](http://www.rsc.org/CWsurf)

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A fish oil in water emulsion before (left) and after (right) introduction of the plant spore microcapsules. The microcapsules were able to recover 98% of the oil from the emulsion.
X-rays uncover hidden self portrait

A collaboration between scientists and art historians in Australia has uncovered a lost work of art by one of the country’s most famous artists. But rather than lying neglected in a dusty attic, this work was hidden under nothing more than a layer of paint.

Seeing is believing
The use of x-rays to see the unseen is well known. Our own bones absorb x-ray radiation, so medical x-rays can effectively strip away our flesh to reveal our skeletons. In the same way, x-ray radiography has been used to look at works of art, uncovering hidden works where artists have reused their canvasses, painting new over old. ‘However, these techniques have their limitations,’ says David Thurrowgood, senior conservator at the National Gallery of Victoria, Australia, ‘particularly when large amounts of lead or other heavy elements prevent visualisation of the layers underneath.’ Unfortunately, such elements are extremely common when artists have applied a white, often lead-based, layer to begin afresh. Conventional radiography is then unable to penetrate the lead-lined tombs of such lost works.

Hidden secrets
To solve this problem, Thurrowgood and collaborators employed x-ray fluorescence, using x-rays produced at the new Australian synchrotron facility in Melbourne. Exposed to this radiation, the paint fluoresces — each of its component elements emitting a unique signal that can be detected and used to recreate the underlying image. This also enriches the quality of the data says Deborah Lau, one of the collaborators and a programme leader at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Victoria. ‘X-ray fluorescence allows an appreciation of the different colours and paint composition,’ she explains. The technique was pioneered by Koen Janssens at the University of Antwerp, Belgium, who has used it to reveal hidden works by Vincent van Gogh.

A rare treat
The painting in question is a self-portrait by Arthur Streeton, who was, fittingly enough, a native of Victoria. ‘Streeton is one of Australia’s most loved artists,’ says Thurrowgood. ‘He painted very few portraits and this was an opportunity to uncover a very rare self portrait.’ The technique also reveals other secrets, he adds. ‘In this case, we can see changes in [Streeton’s] composition and his painting methodology... understanding drawn from this painting will impact how we look at other parts of the collection.’

These new insights demonstrate that this marriage of science and art is coming of age says Janssens. ‘At the moment, we are still in the scientific world, publishing papers on improving the technique,’ he says. ‘But the first art history papers are now coming out.’

Philip Robinson