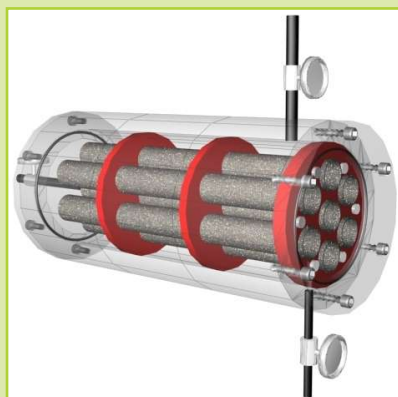


A new UK recycling technology could aid international efforts to cut VOC emissions

World-leading process recovers and recycles volatile organic compounds in printing, fine chemicals and pharmaceutical industries



Worldwide efforts to reduce emissions of VOCs (volatile organic compounds) could receive a boost from the success of new recycling technology pioneered in the UK, it was announced today, 29th May 2003. The patented adsorption process is based on the use of a special monolithic form of activated carbon produced by UK manufacturer MAST Carbon Ltd. The company took part in a collaborative research project with scientists at the University of Bath through the Waste Minimisation through Recycling, Re-use and Recovery in Industry (WMR3) LINK programme, a wide ranging initiative backed jointly by government and industry. The DTI and EPSRC (Engineering and Physical Sciences Research Council) made a grant of just over £136,000 towards the cost of the project.

The award-winning green technology will enable small printshops to meet tough new legislation restricting emissions of VOCs used as solvents. Now there is growing interest from the pharmaceutical and fine chemicals industries, which need to reduce a wide range of solvent vapour emissions. Plans for field trials are being discussed with a number of major companies. The potential market could be worth £400m in Europe alone, and as much again in both the United States and the rest of the world. The same technology could also help oil companies and power generators to cut emissions of greenhouse gases.

Professor Barry Crittenden and Dr Semali Perera of the University of Bath Department of Chemical Engineering led the work of evaluating carbon materials supplied by MAST Carbon Ltd and obtaining data to design an electrical regeneration system. The materials have the special property of conducting electricity, allowing regeneration be carried out quickly and economically by electrical heating instead of steam.

'We have demonstrated how this process could

provide a cost effective way of reducing environmental vapour emissions by small to medium sized printshops,' explains Steve Tennison, Managing Director of MAST Carbon Ltd. 'We now envisage a much wider range of applications, across a much wider range of solvents, so there could be enormous potential.'

For users, a major attraction is reduced operating costs, estimated at less than a third of conventional adsorption processes. In addition, the value of solvent recovered could pay for installation and operating costs in less than two years, says the manufacturer.

'The process not only eliminates release of solvent vapours into the air, which has a greenhouse gas effect in its own right, but also eliminates substantial CO2 emissions produced by existing methods. In certain circumstances you can re-use the solvent, giving you a substantial payback,' Steve Tennison adds.

Small and intermediate-scale production processes are major sources of VOCs, which have prompted health concerns throughout the world. Recent legislation in Europe and North America has tightened restrictions on the amount of solvent vapours that can be discharged. Existing removal processes are costly to operate on a small scale and generate additional greenhouse gases.

WMR3
(Waste Minimisation through Recycling, Re-use and Recovery in Industry) was a collaborative industrial research programme supported by £12m of funding from EPSRC and DTI during 1995 – 2003.

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'The new process could be applied to a far bigger problem; tackling greenhouse gas emissions. Power companies are investigating how it could be adapted to remove CO₂ from combustion effluent.'

done the work without taking part in the WMR3 LINK project,' comments Steve Tennison. 'In addition to funding it gave us the basis for our very strong, ongoing relationship with the University of Bath. It has had an enormous effect on our company and is enabling us to expand the use of these monolithic carbons into many new areas.'

Additional project details and background

Why is there concern about solvent vapour emissions?

Solvent vapours are volatile organic compounds (VOCs), a large class of carbon-containing compounds, which vary in their effects on human health and the environment. They are under considerable scrutiny internationally, and work is being co-ordinated between countries to reduce emission levels. Concern about VOC pollution relates to its contribution to the formation of ozone at ground level. Ozone is an aggressive ground level pollutant that is formed by a reaction between VOCs and nitrogen oxides in the presence of sunlight. It can induce respiratory distress in about 10% of the population and also damages crops and building materials. [Source: Envirowise – www.envirowise.gov.uk]

Why bother about small-scale producers?

Much solvent vapour emission takes place on numerous small sites, so net effluent levels may actually be higher than those from large-scale producers. New legislation introduced to meet UK targets on reducing emissions began by setting concentration limits on producers of large VOC emissions. Smaller producers have been brought progressively within the scope of the legislation.

Where do VOCs come from?

The printing, painting and pharmaceuticals industries are all major sources of solvent vapour emissions. VOCs are also produced in very large quantities in petrol and diesel exhausts, oil production and distribution and the metal finishing, chemical and brewing industries.

What are the limitations of existing control methods?

Conventional processes based on thermal and catalytic oxidation destroy VOCs rather than recovering them. They are expensive to install and use a lot of fuel, increasing running costs and emitting carbon dioxide. Adsorption using conventional beds of activated carbon is designed for large-scale plants. Steam has to be used for regeneration in a slow, energy intensive process.

How does the monolithic carbon technology work?

The process is based on the use of activated carbon in a special monolithic form that conducts electricity. This makes it possible to carry out regeneration by electrical resistance heating. This makes regeneration much quicker, taking around 30 minutes instead of six to ten hours using steam. Compared with conventional adsorbent beds, much less material is needed – typically around 500 kg instead of several tonnes. This would be enough to deal with 10,000m³/hour, containing 1,000 ppm vapour. Equipment is much smaller and less complex.

How easily can the technology be built into existing processes?

Tubes of monolithic carbon are assembled into a device resembling a heat exchanger. The material's honeycomb structure achieves a low pressure drop, allowing units to be built directly into effluent air ducts and reducing capital outlay. Systems are simple to operate and ideally suited to smaller facilities. The material has very good mechanical properties, keeping it clean and preventing it breaking up.

Could the process pay for itself?

The process recovers solvent in essentially water-free form (unlike conventional adsorption using steam for regeneration). In industries such as printing and painting this improves the economics considerably, as costly solvents can be re-used. The value of recovered solvents could pay for installation and operating costs in less than two years, say the developers.

'Small printshops cannot afford to install the same pollution control devices as large printers, so they will be very hard hit by the new legislation,' Steve Tennison explains. 'Our process is much cheaper to operate and we can claim that it is a truly green technology as it has a minimum energy demand and very low effluent levels.'

In the longer term, the new process could be applied to a far bigger problem, tackling greenhouse gas emissions. Power companies are investigating how it could be adapted to remove CO₂ from combustion effluent.

Potential applications are already being studied in the defence industry. These include regenerative protection for tank crews against chemical weapons attack.

The WMR3 LINK programme played a key role in the research, which won the IChemE 2002 Severn Trent Water Award. 'We couldn't have

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The Engineering and Physical Sciences Research Council is the UK Government's leading funding agency for research and training in engineering and the physical sciences. The Department of Trade and Industry co-sponsors industrial R&D projects through LINK.

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