

Algal bioreactors

Old clean coal

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Using photosynthesis to capture power-station exhaust gases

FOR its supporters, the idea of growing single-celled algae on exhaust gas piped from power stations is the ultimate in recycling. For its detractors, it is a mere pipe dream. Whoever turns out to be right, though, it is an intriguing idea: instead of releasing the carbon dioxide produced by burning fossil fuels into the atmosphere, recapture it by photosynthesis. The result could then be turned into biodiesel (since many species of algae store their food reserves as oil), or even simply dried and fed back into the power station. Of course, if it were really that easy, someone would have done it already. But although no one has yet commercialised the technology, several groups are trying.

One of them is GS CleanTech, which has developed a bioreactor based on a patent held by a group of scientists at the Ohio Coal Research Centre, at University of Ohio. The GS CleanTech bioreactor uses a parabolic mirror to funnel sunlight into fibre-optic cables that carry it to acrylic "glow plates" inside the reactor. These diffuse the light over vertical sheets of polyester that form the platform on which the algae grow. Eventually, the polyester is unable to support the weight of the algae, and they fall off into a collection duct.

GreenFuel Technologies, based in Cambridge, Massachusetts, has a different approach. Its reactor is composed of a series of clear tubes, each with another opaque tube nested inside. This arrangement allows the exhaust gas to be bubbled down in the outer compartment and then bubbled back up through the opaque middle. The bubbling gas causes turbulence and circulates the algae around the reactor. The constant shift between light and darkness as the algal cells circulate increases the amount of carbon that they fix, probably by promoting chemical reactions that occur naturally only at night.

A preliminary test of GreenFuel's reactor design, at the Massachusetts Institute of Technology's campus

power plant, suggested that it can remove 75% of the carbon dioxide from a power station's exhaust. A more serious test is now being carried out by Arizona Public Service, that state's power utility, at its Redhawk plant, and another is planned in Louisiana.

GreenFuel claims that over the course of a year, a hectare of its reactors should be able to produce 30,000 litres of oil, which could be used as biodiesel, along with enough carbohydrates to be fermented into 9,000 litres of ethanol, which can be used as a substitute for petrol.

There is, of course, no free lunch. As Rob Carlson of the University of Washington points out, if money is to be made selling products made from exhaust gas, then that gas goes from being waste matter to being a valuable resource. Far from giving it away, power companies might even start charging for it. That would, indeed, be a reversal of fortune.