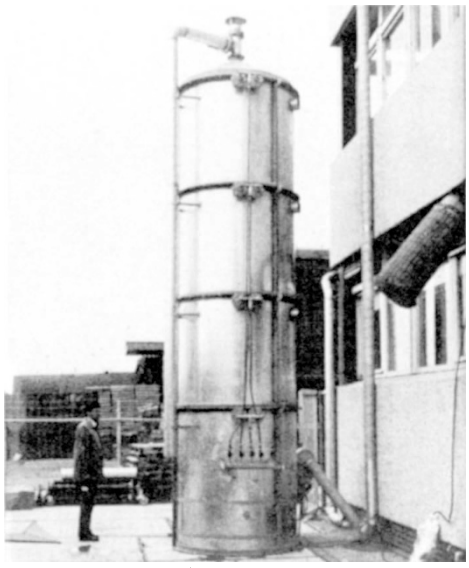
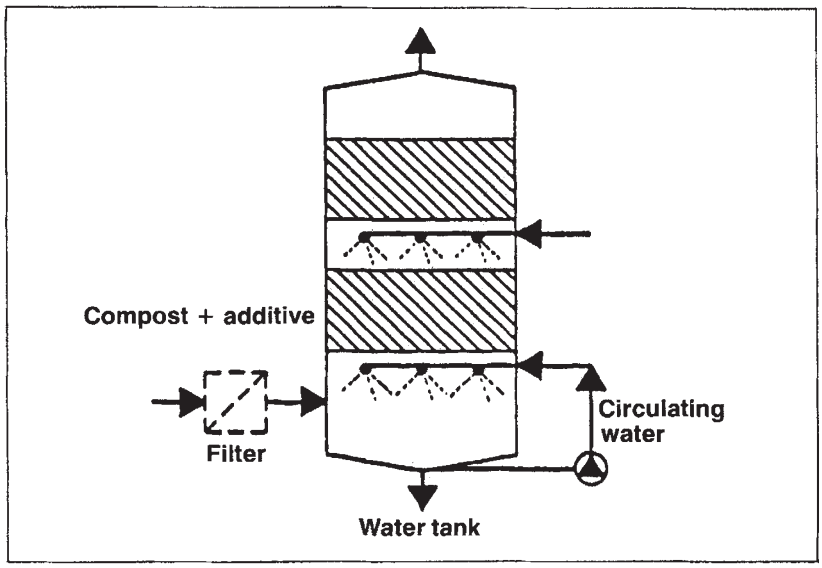
POLLUTION CONTROL

DUTCH BIOFILTRATION REDUCES BAD SMELLS





The new biofilter designed at the Technical University of Eindhoven is built vertically with the exhaust gases passing different stages. The system is closed, and water is added at each step by showers.

EINDHOVEN, The Netherlands—The Technical University of Eindhoven soon will start full-scale experiments to reduce the ammonia smell emitted by pig farms. The researchers use a technology called biofiltration: bacteria, either spontaneously growing in or inoculated into a peat bed, metabolize the foul smelling components of emitted gases.

The University's system has a higher flow rate than existing systems, requires less space, and deteriorates slower. According to Simon Ottengraf from the Technical University, these advances make biofiltration feasible for small-scale establishments like small industry and pig and poultry farms.

A working system was installed recently at Verhoef Plastics, a printing shop, to reduce the exhaust gas coming from the company's solvent, a mixture of xylene, toluene, and different alkanes. Biofiltration reportedly decreased odor by more than 90 percent. The system, baptized "Bioton," was commercially developed by Clair Tech, a new firm jointly developed by DHV and Van Tongeren, both engineering consultancies. The Dutch government is supporting further commercialization through its Department of Environmental Affairs.

Exhaust gases containing organic compounds can be cleaned in different ways, among them washing with water and adsorption on activated charcoal. Both of these physical methods are expensive because either water or charcoal has to be regenerated. Also, the noxious compounds do not disappear.

Chemical oxidation by ozone, chlorine, or by burning is also expensive because of reagent and fuel costs. As of a decade ago, burning cost about $3 per 1000 cubic meters of exhaust gas, making it about twice as expensive as ozone or chlorine treatment and some six times as costly as activated charcoal.

The biological alternative, used since the early 1960s, is to allow bacteria to metabolize the organic compounds into carbon dioxide and water. Authorities responsible for cleaning wastewater typically can reduce smell by directing the exhaust gases through large, horizontal compost beds. The compost feeds inorganic nutrients to microflora specifically adapted to the exhaust gases. The cost of this cleaning method is less than $0.25 per cubic meter.

A disadvantage of this kind of biofiltration is that it takes up a lot of space due to the low flow rate of the gases. The filters age over time and channels form that prevent homogeneous gas flow. Another problem is humidity, which is difficult to regulate in a large filter. Anaerobic regions can develop in which even smellier compounds form.

Ottengraf has developed a novel, vertical, multi-stage biofiltration reactor. He prevents aging by adding proprietary stabilizers to the compost. On top of that, a 10-fold increase in flow rate (from 2 to 20 cm per second) is feasible. He regulates humidity with separate showers at each stage, thereby increasing control.

In the new system, toluene is metabolized at about 40 grams per cubic meter per hour, while a rate of 50–100 grams per cubic meter per hour is achieved for a mixture of butanol, ethylacetate, and butylacetate.

Interestingly, sometimes the compost has to be inoculated to get a working system. Such has been the case with an experimental system built for a small paint factory. The toluene of the solvent had to be metabolized, but no bacteria grew spontaneously. Ottengraf ended up isolating a toluene-metabolizing strain from the soil beneath a gas station.

In Ottengraf's system, no nutrients are added to the compost—inorganic compounds do not limit the growth of the bacteria, he says. Researchers at TNO, the Dutch organization for applied research, disagree: they need to add nitrate and phosphates to enhance bacterial metabolism in their laboratory systems.

The new application of the system will be for farms. Intensive animal husbandry poses large problems because of dung and the emission of ammonia. Both contribute significantly to the acidification of the environment. And bad smells from stables are a further nuisance to people. Now Clair Tech will try to develop an economically feasible installation to alleviate dung odor and ammonia problems.

The dung itself unfortunately, will remain for a while—the biofiltration system, as developed, only works for gases. **—Joost van Kasteren**