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News Item

Zeolite 'Sponge' Soaks Up Pollution

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BOC, a British manufacturer of industrial gases, intends to turn airborne muck into brass by extracting potentially valuable gases from exhaust pollution that would otherwise be vented into the atmosphere. The exhaust gases come from chemical plants and power stations and are usually rich in nitrogen and in carbon dioxide, a major contributor to global warming.

Anticipating regulations that will in future force companies to reduce carbon dioxide emissions, BOC sought a way to extract it from exhaust streams. The company's researchers also realised that at some installations it would make sense to extract other gases such as argon.

Ramachandran Krishnamurthy and Mark Andrecovich of BOC's research centre in New Jersey have devised a process that could theoretically harvest 6 tonnes of nitrogen and a tonne of carbon dioxide from each 10-tonne batch of exhaust gases.

Krishnamurthy explains that the system, which has been demonstrated in the laboratory, is composed of a combination of well-known techniques. The first step is to remove particles from the exhaust stream. The gases are then passed to a pressurised chamber where the nitrogen and carbon dioxide are separated using a process called pressurised swing adsorption.

A mineral called a zeolite acts like a molecular sponge and soaks up carbon dioxide at one pressure and releases it at another. While the carbon dioxide is being adsorbed, the gas stream leaving the chamber is rich in nitrogen. During the desorption phase, it is rich in carbon dioxide. The system switches periodically from one pressure to the other, and sends the gas streams that are rich in nitrogen and in carbon dioxide through different circuits of pipe so that the system can work continuously.

The researchers purify the carbon dioxide by liquefying it under pressure and then distilling it to remove contaminants. They purify the nitrogen-rich fraction and extract argon by freezing it to $-173°C$, the same means by which nitrogen is routinely extracted from air.

Krishnamurthy says that in the chemical industry, nitrogen is normally vented in exhaust gases during hydrogen manufacture, but with the new system it could be extracted for making ammonia. The system may also prove economic at huge power stations which could generate hundreds of tonnes of gas each day.