

Polymer lung clears diesel engine smoke

The grimy fumes of diesel engines blacken the air, irritate the senses and spew particles that may cause cancer. Cleaner diesel exhaust would clearly represent a welcome improvement.

Engineers at Argonne (Ill.) National Laboratory have now taken a step toward eliminating the sooty smoke. Bundles of semipermeable, spaghetti-thin tubes hooked into a diesel engine can serve as an antipollution "lung" by enriching the oxygen content of air entering the combustion zone, they report. With the extra oxygen content — about 35 percent instead of the normal 21 percent — a stationary test engine equipped with the polymer lung "completely" burned diesel fuel, dramatically decreasing most exhaust emissions, says Raj Sekar of Argonne. He contends that turbochargers, which produce related effects by forcing larger volumes of air into an engine, have reached their performance limit.

Though optimistic that the lung technology could lead to a fleet of cleaner diesel vehicles, Sekar admits that environmental and technical obstacles remain.

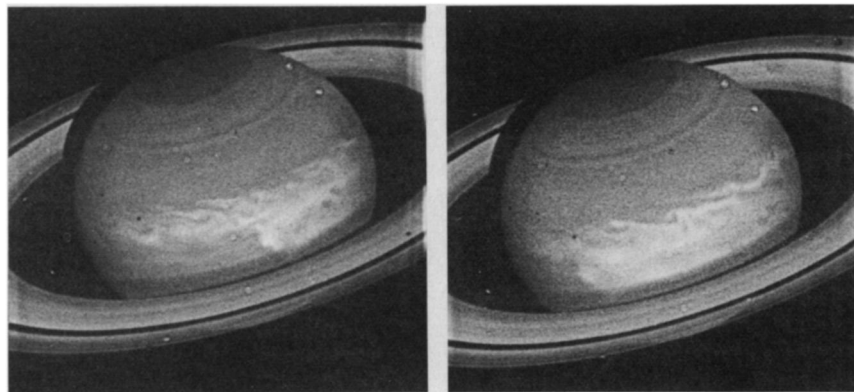
The good news: A test engine fitted with the lung ran just as efficiently as an unfitted engine, but spewed only one-seventh the amount of smoke particles and fewer than half the smaller particulates linked to human cancers in an EPA report issued last summer. The test engine also released virtually no carbon monoxide.

The bad: In their present form, the lungs are so bulky that truck designers would have a hard time finding room for them. Moreover, with higher oxygen levels, diesel engines operate at higher temperatures, producing more nitrogen oxide pollutants, which contribute to acid rain and smog. But Sekar says that reducing the combustion temperature by mixing the fuel with a little water, or by adjusting the fuel injection timing, can keep these emissions at typical levels.

And the not-so-ugly: "The characteristic black exhaust of a running diesel becomes clear when the oxygen enrichment system is used," Sekar says.

He and his co-workers completed their first testing phase in October, using a single-piston stationary diesel engine. Next, they plan to add lungs to a six-cylinder engine. Each lung includes about 20,000 tubes, made primarily of the polymer polysulfone. As intake air pushes through the tubes, oxygen molecules permeate the polysulfone walls more rapidly than nitrogen molecules, says Earl Beaver of Permea, Inc., in St. Louis, which markets the polymer. The oxygen-enriched airstream then feeds into the diesel engine, which emits a barely visible exhaust, Sekar says. — I. Amato

New white spot on Saturn grows, changes



Photos: NASA

A huge "white spot," discovered in Saturn's atmosphere in late September (SN: 10/13/90, p.228), has developed into a wide band that now encircles the planet's equator. These photos, taken Nov. 9 (left) and Nov. 11, are the Hubble Space Telescope's first images of the dramatic feature.

The clouds probably consist of ammonia ice crystals, says James A. Westphal of the California Institute of Technology in Pasadena. The Hubble images, sharper than photos taken through Earth's atmosphere by ground-based telescopes, reveal structural details of what Westphal calls "a very turbulent atmosphere that is very similar to the cloud system that trails the Great Red Spot on Jupiter." Indeed, he says, "maybe Saturn is turning into another Jupiter, and is in the process of developing the same kind of prominent banded structure in its atmosphere."

Astronomers have sighted fewer than two dozen white spots on Saturn during the last two centuries. Only four of these unusual features (the most recent detected in 1933) were "great white spots" lasting more than a few weeks, and none seemed nearly as big as the present one.

The small white and black spots in these photos are artifacts caused by such factors as cosmic rays hitting the camera, Westphal says.

Brain study offers clues to hyperactivity

Adults suffering from hyperactivity since childhood display markedly reduced metabolism in brain regions regulating motor activity and attention, according to a report in the Nov. 15 NEW ENGLAND JOURNAL OF MEDICINE.

The finding, obtained with PET scans, points to new avenues of research for hyperactivity investigators, says study director Alan J. Zametkin of the National Institute of Mental Health in Bethesda, Md. For instance, scientists can now establish whether stimulant medications — commonly used to treat hyperactivity — increase metabolism in the observed brain areas.

While the report offers clues to the biology of hyperactivity, "it would be premature to conclude that the underlying cause is now established," writes psychiatrist Gabrielle Weiss of Montreal Children's Hospital in an accompanying editorial.

Controversy will undoubtedly persist concerning overdiagnosis of hyperactivity among schoolchildren and overmedication of those so diagnosed, and concerning the family's role in promoting hyperactivity (SN: 6/18/88, p.399).

Zametkin and his colleagues studied 25 adults who had been diagnosed as hyperactive in childhood and who were parents

of hyperactive children. None of the hyperactive adults had taken amphetamines as a treatment for their condition. A comparison group of 50 nonhyperactive adults also took part in the project.

The researchers administered PET scans of the brain's glucose metabolism, a measure of its energy use, while volunteers performed an attention task requiring them to press a button upon hearing a tone. Hyperactive adults showed less overall brain metabolism than did controls, with the most pronounced deficits in two areas involved in attention and motor activity.

However, lifelong hyperactives with hyperactive children probably represent only a subgroup of people with the disorder, Weiss notes. Further work must establish whether the results apply to a broad spectrum of hyperactive adults, and whether the same metabolic pattern applies to hyperactive children and perhaps to children with other behavior disorders.

Zametkin, who has initiated PET studies of hyperactive teenagers, says finding suitable volunteers for future studies may prove difficult, since most individuals diagnosed as hyperactive almost immediately receive metabolism-altering stimulants. — B. Bower