

Diesel-engine exhaust filter reduces harmful particles by 98 percent

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A commercially available particle trap can filter microscopic pollutants in diesel-engine exhaust and prevent about 98 percent of them from reaching the air, according to research reported in *Circulation: Journal of the American Heart Association*.

Inhaling exhaust particles increases the risk of dying from heart and lung diseases. [Air pollution](#), including diesel exhaust as a major contributor, causes 800,000 [premature deaths](#) annually in the world, according to the World Health Organization.

"This study focused on cardiovascular effects in men exposed in the laboratory to diesel fumes. Equipping diesel-powered vehicles with particle filters could significantly reduce heart disease," said David E. Newby, M.D., Ph.D., co-senior author of the study and the British Heart Foundation John Wheatley Chair of Cardiology at the University of Edinburgh in Scotland.

Newby and Anders Blomberg, M.D., Ph.D., of the Umea University in Sweden, led an international research team in the diesel-exhaust study that involved 19 healthy, non-smoking men with an average age of 25.

The study's primary endpoints include the ability of blood vessels to constrict and dilate and the formation and dissolution of blood clots.

The volunteers breathed filtered air, unfiltered dilute diesel-engine exhaust and dilute diesel-engine exhaust after it passed through a particle

trap. Participants inhaled each gas for one hour in an exposure chamber during which they did two 15-minute periods of moderate exercise. At least one week separated each inhalation session. Researchers randomized the order in which each man breathed the three gases.

The particle trap oxidized nitric oxide (NO) into nitrogen dioxide (NO₂), both important nitrogen-containing reactive gases in diesel exhaust.

"We have previously exposed people to nitrogen dioxide alone and seen no effect on the body," Newby said.

Among the study's findings:

- The particle trap removed about 98 percent of all particles in the diesel exhaust and 99.8 percent of the smallest and most damaging particles (less than one micrometer).
- Compared to filtered air, artery dilation (widening) was significantly reduced six to eight hours after exposure to unfiltered diesel exhaust when the men were tested with bradykinin, acetylcholine and verapamil – compounds that cause arteries to widen, or dilate (vasodilators).
- The blood's tendency to clot differed between groups. Compared to men inhaling unfiltered diesel exhaust, those breathing filtered exhaust showed significantly greater release of tissue plasminogen activator (t-PA), a naturally occurring protein that dissolves blood clots – one of the body's built-in mechanisms for preventing heart attacks or strokes.
- In another test for blood-clotting ability, a significant increase in blood clotting occurred in men who had breathed diesel exhaust

versus those who inhaled filtered air. There was no difference in the blood's clotting ability between men who inhaled filtered [diesel exhaust](#) and filtered air.

In an accompanying editorial, Robert D. Brook, M.D., an associate professor of medicine at the University of Michigan in Ann Arbor said, "The study has provided an important piece to the puzzle of how air pollutants can affect human cardiovascular health."

Brook, who chaired the writing committee for the American Heart Association's scientific statement on air pollution and cardiovascular disease, added that inhaling combustion-related particles is clearly capable of posing an "immediate threat to the cardiovascular system," and that the demonstrated benefits of a commercially-available particle trap "adds justification to U.S. 2007 emission standards for heavy-duty trucks and busses."

Among the study's limitations, researchers didn't have the statistical power to detect changes in some secondary endpoints because of the small number of participants. They also only studied young, healthy men; thus, additional studies must assess whether particle traps can reduce adverse cardiovascular effects in women, in people of all ages and in those with heart and lung diseases.

Provided by American Heart Association

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