

Cheap charcoal air filters offer improvements to in-vehicle air quality

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A cheap charcoal air filter can reduce nitrogen dioxide (NO₂) inside vehicles by as much as 90%, compared to levels outside the vehicle.

Research presented in a report by WM Air, the West Midlands Air Quality Improvement Programme at the University of Birmingham, shows that charcoal filters, which costs around £10-£20, can effectively remove NO₂ from the air within vehicle cabins.

NO₂ is a common air pollutant that can aggravate diseases such as asthma and increase the risks of respiratory infections. Traffic emissions are a dominant source of NO₂, and so [road users](#) inside vehicles are exposed as air circulates into vehicle cabins from outside through open windows and [ventilation systems](#).

While ventilation systems do currently filter air, this is typically via a pollen filter. These prevent tiny particles and pollen getting inside the vehicle, but they have little effect on gases such as NO₂. The activated carbon filters, in contrast, remove NO₂ through a process called adsorption, in which the NO₂ reacts with the carbon to stick to the surface area of the filter.

As with the pollen filter, the effectiveness of the carbon filter decreases over time, meaning it should be replaced regularly when the vehicle is serviced.

Lead researcher Dr. Vasileios Matthaïos said, "Our findings show clearly that there are benefits to switching to activated carbon air filters, reducing exposure to NO₂ and the risk of related adverse health effects. These filters are simple, effective and inexpensive and should be considered, particularly for people who spend long periods of time in vehicles such as professional drivers."

A [research paper](#) outlining the findings is published in *Science of the Total Environment*. In this study, the researchers tested NO₂ in 10 different vehicles, ranging in size and type (petrol, diesel, hybrid and electric were all included). Air quality measurements inside the vehicles

were taken with a range of ventilation conditions (AC turned on or off and windows either closed or partially open).

Each vehicle was tested three times, firstly with its original air filter in place, then with a pollen filter, and lastly with the activated charcoal filter.

The researchers found that overall, in-vehicle NO₂ concentrations were on average 1.6 times lower when the windows were closed and the ventilation system recirculated air, compared to levels when the windows were open. When new standard pollen filters were fitted, NO₂ concentrations were almost unchanged between closed windows and fresh air coming through the ventilation system and with windows open.

However, with activated carbon filters fitted, in-[vehicle](#) NO₂ levels were on average 14.3 times lower with closed windows and recirculated air. Even with fresh air coming through the ventilation system, NO₂ levels were 6.6 times lower than levels with windows open. Maintaining appropriate ventilation is also important to prevent drowsiness.

Professor William Bloss, co-author on the paper, said, "These results show a fairly simple way to improve air quality inside vehicles, although as the main source of NO₂ in our cities is diesel vehicles, reducing [traffic emissions](#) overall will bring the greatest air quality benefit across the general population."

More information: Vasileios N. Matthaïos et al, NO₂ levels inside vehicle cabins with pollen and activated carbon filters: A real world targeted intervention to estimate NO₂ exposure reduction potential, *Science of The Total Environment* (2022). [DOI: 10.1016/j.scitotenv.2022.160395](https://doi.org/10.1016/j.scitotenv.2022.160395)

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