

B3.2 Air pollution – Tracking down technology

1 Vacuum cleaner with centrifugal separator (cyclone system)

With this vacuum cleaner, the dirt that is sucked in is collected in a separate bin. You can empty and wash the bin. You do not need any vacuum cleaner bags. That's why we call this device a "bagless" vacuum cleaner.



Cyclone vacuum cleaner without a bag.

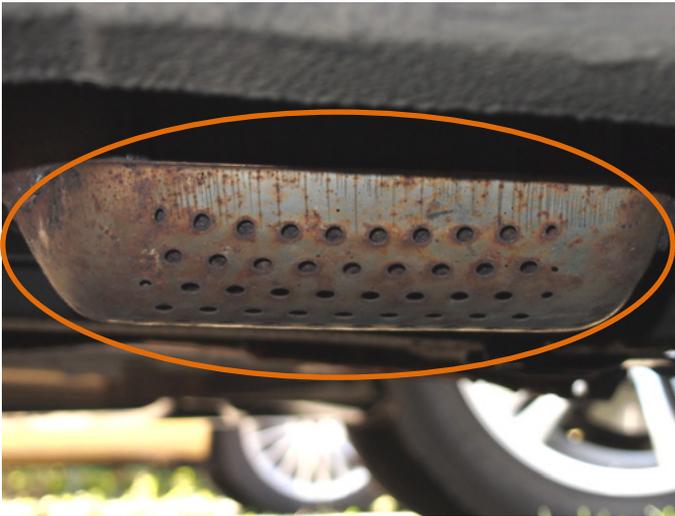
How a cyclone vacuum cleaner works:

Initially, this vacuum cleaner works like any other: A motor drives the fan. As a result, air, dust, and small particles are sucked in. The dirt is then removed from the drawn-in air inside the vacuum cleaner. This happens through what is called centrifugal force.

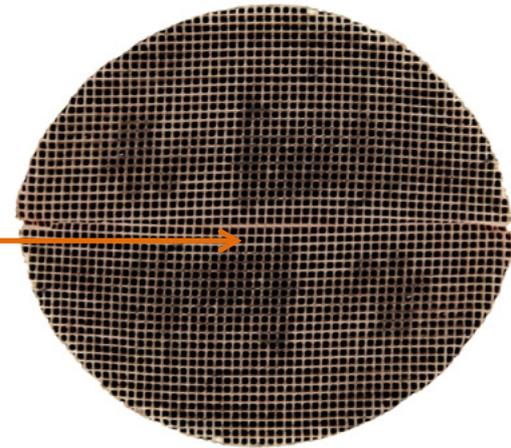
You yourself have probably felt centrifugal force, perhaps when going around a curve while riding in a car or on a carousel: The centrifugal force pulls you toward the outside. This also happens to the dirt particles in this vacuum cleaner: After they are drawn in, they are blown into a conical bin. The particles are set in a rotational motion, resulting in a small "whirlwind" (in the tropics, such a whirlwind is called a "cyclone"). The dust particles, which are heavy compared to the air, are pulled farther and farther to the outside by the centrifugal force. When the dust particles come into contact with the housing, they are slowed down, and they simply drop down into the collection bin. The clean air is expelled. Depending on the technical design, such a vacuum cleaner also needs a paper filter to collect fine dust. You have to clean the filter regularly, or else the vacuum cleaner will lose suction power.

Note: In industrial plants, dirt filters for exhaust gases and waste water also use the same cyclone technology.

2 Diesel particulate filters in diesel vehicles



When you look under a car that has a diesel engine, you see the case containing the catalytic converter and diesel particulate filter in the exhaust pipe.



And this is what the diesel particulate filter looks like: It is made of ceramic and has a rectangular honeycomb structure. (Perhaps you are familiar with hexagonal honeycombs in beehives.)

What a diesel particulate filter does:

Nearly every diesel car today has a catalytic converter that removes toxic carbon monoxide, harmful hydrocarbons, and nitric oxides from the exhaust gas. In addition, modern diesel cars have a filter that removes soot (carbon particles) and the harmful hydrocarbons that adhere to the soot particles. Other harmful substances in the exhaust gas, such as metal oxides and sulfates, are caught in this filter. We refer to all these substances collectively as “particles,” which is why we also say “particle filter.”

Why you need a diesel particulate filter:

Fuel is never fully burned in a diesel engine. Particles are produced and expelled from the engine along with the exhaust gas. These harmful substances in the exhaust gas would not only make trees and houses dirty, but worse, could cause diseases if they entered our bodies. The filter thus ensures a cleaner environment and healthy air for breathing.

How a diesel particulate filter works

When the exhaust gas reaches the diesel particulate filter, it flows through the honeycomb structure and the “particles” remain behind in the walls of the honeycomb. The ceramic walls are thus the filter. Ceramic is a substance that can withstand very high heat (some cookware is made from ceramic). The diesel particulate filter must withstand very high temperatures. To prevent it from getting clogged, it is occasionally heated to a very high temperature to clean it. All particles that are caught in the filter are burned to form carbon dioxide and water. (Modern ovens are also cleaned according to this principle, which is called pyrolysis.)