Lotus effect shakes off dirt

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The lotus - a flowering wetland plant native to Asia - may not, at first glance, be of interest to the nanotechnologist. But researchers at German chemical company BASF are developing a spray-on coating that mimics the way lotus leaves repel water droplets and particles of dirt.

Lotus plants have superhydrophobic surfaces: water droplets falling onto them bead up and, if the surface slopes slightly, will roll off. As a result, the surfaces stay dry even during a heavy shower. What's more, the droplets pick up small particles of dirt as they roll, so that the lotus leaves are self-cleaning.

Wilhelm Barthlott, a botanist from the University of Bonn in Germany, first explained the phenomenon and now owns a patent and the Lotus Effect trademark. The effect arises because lotus leaves have a very fine surface structure and are coated with hydrophobic wax crystals of around 1 nm in diameter. Surfaces that are rough on a nanoscale tend to be more hydrophobic than smooth surfaces because of the reduced contact area between the water and solid. In the lotus plant, the actual contact area is only 2-3% of the droplet-covered surface.

The nanostructure is also essential to the self-cleaning effect - on a smooth hydrophobic surface, water droplets slide rather than roll and do not pick up dirt particles to the same extent.

BASF's lotus-effect aerosol spray combines nanoparticles with hydrophobic polymers such as polypropylene, polyethylene and waxes. It also includes a propellant gas. As it dries, the coating develops a nanostructure through self-assembly. BASF says that the spray particularly suits rough surfaces such as paper, leather, textiles and masonry: the self-cleaning shoe may soon be a reality.

That said, in its current form, the spray may affect the colour of dark surfaces as its layers are slightly opaque. The coating
can also be mechanically unstable on smooth surfaces. But BASF is working to overcome these problems. The company even aims to develop a product that will retain its lotus effect after abrasion with sandpaper. Dubbed lotus stone, the material has potential for use in the construction industry, in applications such as facing tiles.

**About the author**

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