Titanium dioxide coating + sunlight = self cleaning surfaces

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Unlike Alcoa EcoClean coating for panels which was developed to clean the air around us, the researchers from the *Fraunhofer Photocatalysis Alliance*, which includes researchers from ten Fraunhofer institutes, have decided to combine their expertise in this field to use titanium dioxide particles in a coating which could be used to destroy bacteria, fungi and similar organisms on various surfaces.
Aside the fact those particles are still under research for their influence on our health (we wrote something about that issue in our article about bio-inspired sunscreens), the coating could enable those surfaces to become self-cleaning once the sun shines on them. When these titanium dioxide molecules are 'activated' by the UV light from sunlight, they act as a kind of catalyst, triggering an electrochemical reaction which produces free radicals.

These and other active molecules destroys bacteria, fungi and similar organisms, by destroying their cell walls and then penetrating the cytoplasm – the substance that fills the cell – and damaging the bacteria's DNA. As a result, the organic substances are destroyed instead of remaining stuck to the surface.

In order to discover how effective these photocatalytic coatings are, and what organic elements do they destroy or can't destroy, the researchers at the Fraunhofer Institute for Interfacial Engineering and Biotechnology (Fraunhofer IGB) in Stuttgart performed various experiments on conventional plastic surfaces and plastic surfaces coated with photocatalyst.

Dr. Iris Trick, group manager at the Fraunhofer IGB, and her team sprayed the coated and uncoated plastic armrests with a mixture of various bacteria, mosses, algae and

fungi and then left them exposed to the weather for two years. At the end of the test, it was almost impossible to remove the layer of dirt from the normal armrests – yet the armrests made from photocatalytic plastics were nearly completely clean and white, even after spending two years outside.

Much more practical usage of this technology could be on building façades and researchers from the Fraunhofer Institute for Manufacturing Engineering and Automation (Fraunhofer IPA) in Stuttgart are working on paints for building which contain titanium dioxide particles. For example, if the wall gets dirty, the photocatalysis could degrade the organic contaminants and the paint stays reasonably clean. Since there's a version of the coating suitable for usage on glass surfaces, it could also lead to self-cleaning displays or windows.

"If you apply a thin coating of titanium dioxide to a glass surface such as a smartphone screen, the skin oils and fingerprints gradually disappear from the display by themselves", said Dr. Michael Vergöhl, head of department at the Fraunhofer Institute for Surface Engineering and Thin Films (Fraunhofer IST) in Braunschweig and head of the Fraunhofer Photocatalysis Alliance.

The researchers claim that their coating requires only one hour of sunlight to finish the job, while previous photocatalytic surfaces require the smartphone to be left in the sun for three days. Their next goal is to develop new materials that can also be activated by artificial light.

Although it proved to be successful when it comes to fight against bacteria, algae and other malignant organisms, I wonder about the influence of the coating on well-being of benign or useful microorganisms, and I'm still not sure about the porosity of these coatings and the impact it might leave on our environment.

You could even question our safety when we get in touch with these surfaces in real-world scenarios, where you could frequently touch the surface which gets reactivated by sunlight when you move away your arms, or in case you are in contact with that surface for a longer period of time.