IIT Hyderabad scientists convert fly ash into waterproofing material

Treating fly ash with stearic acid, used in soaps and shampoos, modified the nature of fly ash and helped develop materials with contrasting adhesion behaviours — high adhesions like a rose petal and low adhesion like a lotus leaf

A file photo of fly ash released into Renuka river by a coal-based thermal plant at Obra in Sonbhadra district of Uttar Pradesh. Photo: Meeta Ahlawat

Researchers from the Indian Institute of Technology Hyderabad (IIT H) have found that fly ash — waste byproduct of power plants that poses a threat to the environment — can be modified into a waterproofing material.

The researchers have converted fly ash into a water proofing material by treating it with stearic acid, which is commonly used in soaps and shampoos.

Stearic acid is a surface active agent whose key ingredient binds to dirt particles during the process of washing, while its hydrophobicor water-repelling part remains free. As a result, dirt particles bound with stearic acid separate out just like oil separates from water.

Using this binding ability of stearic acid, researchers have developed superhydrophobic fly ash particles.

In recent years, scientists have been looking to nature for inspiration when it comes to designing new water repelling surfaces and materials.

For example, leaves of pitcher plant are superhydrophilic and help the plant to capture prey, while leaves of lotus are superhydrophobic and enable self-cleaning. Rose petals are somewhat in the middle — water particles stay on them but do not roll off like with lotus leaves.

In the case of fly ash-based waterproofing material, the activity varied according to the type of fly ash used. It was found that when fly ash with varying sizes and shapes was used, it produced superhydrophobic material that behaved like a lotus leaf. Water did not roll away immediately.

This happens when hydrophobic particles of different sizes pack together to form surface with pits and mound on very small length scale. When water droplet sits on top of such surface, it cannot wet these small pits and the trapped air facilitates rolling.

In contrast, when fly ash was segregated into particles with almost similar shape and size, it behaved like a rose petal. The material pinned down water molecules. It neither absorbed the water nor let it fall down even when the material was turned upside down.

In this also there are pit and mound at small length scale but they are large enough so that water can penetrate the pits easily.

"We have been able to modify the very nature of fly ash and develop materials with contrasting adhesion behaviours — high adhesions like a rose petal and low adhesion like a lotus leaf," explained Mudrika Khandelwal of the Department of Materials Science and Metallurgical Engineering, while speaking to India Science Wire.

The study results have been published in journal Chemistry Select.

"The new material is highly cost-effective. While the fly ash itself is after all merely a waste, stearic acid is also not an expensive chemical," said Atul Suresh Deshpande, co-author of the study.

"The synthesis process is so simple that even an untrained individual can prepare these superhydrophobic materials with ease," he added.

Source: Down to Earth

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