The latest revelation in cleaning up oil spills was inspired by, among other things, butterfly wings, shark skin and lotus leaves. Butterfly wings and lotus leaves repel water. Sharkskin can repel bacteria.

Ohio State University researchers looked at all three and tried to replicate them. It’s a scientific field called biometrics, or biomimickry.

“We created surfaces that were inspired by nature,” said Bharat Bhushan, a professor of mechanical engineering at Ohio State and director of its Nanoprobe Laboratory for Bio- & Nanotechnology and Biomimetics.

“Nature uses very basic materials — silica, etc. — and doesn’t have any manufacturing processes. It just uses a layered approach. And we thought we could imitate that.”

Bhushan and Philip Brown, an OSU postdoctoral researcher, played with a few different materials until they

Inspired by nature, mesh captures oil

By Laura Arenschield
THE COLUMBUS DISPATCH

The coating, its creators say, could help crews clean up oil spills in the ocean some day.

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figured out how to repel and attract water and oil. Now, they believe they have devised a way to clean up oil spills using a fine mesh coated with nanoparticles.

Nanoparticles are smaller than the finest speck of dust. But combined in the right way, they can do big things.

Take this mesh, for example. Bhushan and Brown coated it with a fine layer of hydrogen and carbon, putting the elements together in such a way to attract water and repel oil. (New words you can try at your next science-theme cocktail party: hydrophilic and oleophobic. Hydrophilic substances love water. Oleophobic substances can't stand oil.)

The hydrophilic-oleophobic coating essentially allows water to filter through the mesh while it captures oil. The mesh separates the two, no matter how mixed up they might be.

When the researchers tested the coated mesh in the lab, they mixed oil and water in a beaker, then poured the mixture onto the mesh. The water filtered out through the mesh. The oil collected on top.

"In the lotus leaf, you see that it has this level of roughness, which helps it repel water," Brown said. The nanoparticles they use offer that same roughness, he said.

The ones they use measure about 7 nanometers, or thousandths of the width of a human hair. That allowed Brown and Bhushan to create a coating that is rough, sturdy and transparent.

"If you actually want to use these coatings for any sort of application, then the durability becomes an issue," Brown said. "If you don't have that hard coating, then it starts to wear away, which is not something you want."

Their work was published recently in the journal Nature Scientific Reports.

Bhushan and Brown created four types of coatings — one that attracts water and repels oil; one that attracts oil and repels water; one that attracts both; and one that repels both.

Other scientists have explored how small particles could help deal with oil spills. For example, a team of MIT engineers in 2012 devised a way to pull clean water and reusable oil from spills using nanoparticles. And two Michigan Tech University professors published research in 2011 about a fine mesh they coated with nanotubes to attract oil and repel water. Nanotubes are slightly larger than nanoparticles.

Yoke Khin Yap, a physics professor at Michigan Tech who co-wrote that study, said Bhushan and Brown's findings could improve water-purification methods.

To work on large oil spills, though, the OSU mesh would have to be capable of performing on a much larger scale, Yap said. "We're not talking about filtering 100 milliliters of liquid — we're talking about a big volume for an oil spill in the oceans. So it really depends on the speed of this kind of separation process."

It likely will be years before the technology is developed on a large enough scale to be useful in an ocean spill, Bhushan said. "We're scientists; we're not product developers."

Still, Brown said, their findings could be used in a variety of ways.

The coatings, for example, can go on almost any substance, Brown said. That means they could, down the road, be used to create self-cleaning windshields or filters for cleaning oil.

"That's the beauty of this type of work," Brown said. "We can swap out the chemicals to create whatever we need."