Freshwater oysters could be key to developing stronger, 'greener' adhesives

September 17 2024, by Federica Giannelli

Credit: Magda Ehlers from Pexels

If you think oysters are just delicious seafood, think again. Freshwater oysters produce an adhesive that may hold the secret to developing more environmentally friendly glues with applications from dental care to construction and shipping. An international research team recently used the Canadian Light Source (CLS) at the University of Saskatchewan (USask) to determine what the unique adhesive is made of.

Thriving in African rivers and lakes, Etheria elliptica oysters produce a special material that helps them stick to wood or other oysters, creating complex underwater reefs. Never studied before, this oyster glue has characteristics rarely found in similar organisms: it's made of a mineral called aragonite that the oyster arranges so that it is soft on the outside and progressively harder on the inside.

"These oyster shells aren't exactly like our teeth and our bones, but there are a lot of similarities," says Rebecca Metzler, professor of physics at Colgate University in New York State. "And so, if the adhesive can work for the oyster shell, maybe it could work pretty well for what's happening inside of us."

Metzler and her team found that the oyster glue is so sticky because it combines the aragonite with special proteins that the oyster produces. This information could pave the way for the development of better synthetic, "green" glues that mimic the properties of the oyster's adhesive.

The work is published in the journal *Advanced Materials Interfaces*.

"Because I'm looking at this biological tissue, I need a certain energy range, and the Canadian Light Source has that sweet spot of having both the microscope and the energy range," says Metzler. "You can look at your sample, get the spectral data that you need to be able to answer questions about what this is made up of, and how these things are structured."

Her team discovered that the oyster glue is made up of tiny particles of aragonite that clump together into crystals of random shapes, sizes and orientation, information, says Metzler, that can be used to create synthetic versions in a lab. This research also relied on data gathered at the Advanced Light Source (ALS) synchrotron.

What they've learned could have multiple applications, Metzler says. Glues synthesized from the oyster's adhesive could be used to bind dental implants, replace glues currently used in the packaging industry with biodegradable alternatives, or even build structures underwater.

Metzler's research may also prove critical for the ecological conservation of Etheria elliptica oysters. With freshwater mussel populations declining globally, understanding how these organisms create underwater reefs is key to preserving habitats that ensure the oysters' survival in a warming climate, as well as informing local populations about sustainable oyster harvesting.

Because the oysters used in Metzler's study were collected years ago, a next step will be investigating the impact of climate change on more recent samples.

"Whether there's been a change similar to what we're seeing in other organisms: That would be another thing we'd be interested in trying to figure out," Metzler says.

More information: Metzler, Rebecca A. et al, Exploring the Mineral Composition, Structure, and Function of a Freshwater Bivalve Adhesive. *Advanced Materials Interfaces* (2024). DOI: 10.1002/admi.202300954

Provided by Canadian Light Source

Citation: Freshwater oysters could be key to developing stronger, 'greener' adhesives (2024, September 17) retrieved 9 November 2024 from https://phys.org/news/2024-09-freshwater-oysters-key-stronger-greener.html