Startup using microorganisms to make 'green' cement

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A Colorado company is channeling the industriousness of microorganisms to grow zero-carbon cement in a process that is similar to the way corals build reefs or oysters produce shells.

The startup Prometheus Materials recently closed an $8 million Series A financing round that included participation by the Microsoft Climate Innovation Fund and Sofinnova Partners, a European venture capital firm.

The technology is groundbreaking, but its basis has been around for billions of years, according to Loren Burnett, the company's co-founder and CEO.

Production of what will ultimately be building materials starts with microalgae and providing them what they need to do what they do naturally: biomineralization. That's the process of living organisms producing minerals that form structures such as shells and reefs.

What began as research by four professors at the University of Colorado in Boulder has moved to a production site in Longmont. There, the company will make bio-cement, a zero-carbon alternative to what's called portland cement, the most common type of cement and a basic ingredient of concrete.

Concrete is one of the most widely used materials in the world, Burnett said. "And cement, which is the key component for concrete, is responsible for 7 to 8% of the Earth's carbon dioxide emissions on an annual basis."

The world's building stock is projected to double by 2060 even as the need to cut greenhouse-gas emissions increases, he added. Burnett, a self-described serial entrepreneur, met with the CU professors, decided to license the technology and, with the professors, formed Prometheus Materials, the sixth company he has started.

"I realized very quickly that what they were working with had tremendous potential to have a significant impact on the Earth by

decarbonizing concrete," Burnett said.

Wil Srubar III was the lead principal researcher of the CU scientists and engineers working under a Department of Defense grant. The professors' fields of expertise include microbiology, biochemistry, material sciences and structural engineering.

Srubar is a co-founder and chief technology adviser for Prometheus Materials. Professors Jeff Cameron, Sherri Cook and Mija Hubler are also co-founders.

As for how the team settled on microalgae, Srubar said he believes nature has figured out a lot of things. "We just need to pay closer attention."

The scientists looked at a variety of microorganisms that create calcium carbonate, a main component of limestone, through their own metabolic activity.

Limestone, formed by skeletal fragments of marine organisms, is mined, ground and heated to about 2,600 degrees Fahrenheit to make cement. The process releases carbon dioxide, the major heat-trapping gas causing climate change.

The researchers explored whether there was "a more efficient, harmonious way" to produce the material, Srubar said. "We were very inspired by natural processes and the innate ability of microorganisms to do this."

The microalgae produce the minerals using photosynthesis, Srubar said. "We don't even have to feed them anything. They're powered by the sun, carbon dioxide."

The company uses sea water to grow a culture of the microalgae, which are creating the mineral. When water is removed, what's left is called biocement. It is combined with rocks and sand to form concrete.

The materials needed to produce the biologically-based cement are readily available around the world, Srubar said. The carbon dioxide can simply be piped in from the atmosphere.

Burnett said the goal is to license the technology, whose patent is pending, to large companies that can produce and distribute the biocement on a wide-scale basis. The cement will be marketed to architects, engineers, property developers and others in the construction industry.

Prometheus recently completed a pilot project with its product with a large company Burnett declined to disclose. The bio-cement has been tested at CU and will go through a formal certification process with the American Society for Testing and Materials.

"I have never been with a company where I felt like we had a clear path to being able to make a significant worldwide impact and this does," Burnett said.

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