Newly Discovered Bacterium Can Transform Waste from Copper Mining into Pure Copper

2021-04-30

Writing in a paper published on 23 April in the journal Science Advances, a group of researchers introduce a newly discovered bacterium capable of synthesising single-atom copper from copper mining waste, opening the door to an inexpensive way of synthesising the metal and cleaning up polluted environments.

A crucial component of consumer electronics, solar cells, and antimicrobial coatings, copper is typically recovered from ores containing a mixture of copper with carbonate, sulphate, phosphate, and oxide minerals.

Ionic (charged) copper which accumulates in the environment during the mining process is extremely harmful to human health, causing everything from headaches and vomiting to kidney failure and even death upon ingestion.

As it happens, ionic copper is also harmful to many other organisms, which is why the newly discovered bacterium – Bacillus sp. strain 105 – mobilises a protein called ferritin, as well as other cellular mechanisms, to convert the metallic substance into something less hazardous.

“They detoxify but there’s a price for them, and at the same time they try to get from other places in the environment… the energy to be able to make this conversion,” said co-author Professor Debora Rodrigues from the University of Houston.

In the past, researchers have demonstrated that certain bacteria and fungi are capable of synthesising silver, gold, and even copper in nanoparticle form, but this is the first time that a similar bacterial process was shown to produce monoatomic copper.

Rodrigues and her colleagues are positive that the newly discovered bacterium is only “the tip of the iceberg”, meaning that there could be many other strains likely capable of producing single-atom metals, such as gold, silver, and copper.

While the exact procedure for using these bacteria to produce monoatomic copper on a mass scale remains to be determined, the findings show great promise and could eventually lead to new, nature-inspired, and environmentally sustainable production methods.

“This study opens a new field of research of environmental micro-organisms that potentially are able to synthesise other monoatomic metals for applications in science, technology, engineering and medicine,” Rodrigues said.

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