

Silver News

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Silver-Based 'Microbots' Zap Bacteria in Water Supply



Microbots coated with silver kill germs as they travel through water. Click on image to view video.

“... Janus microbots decorated with AgNPs [silver nanoparticles] are an efficient bactericidal tool for water disinfection.”

Like the classic video game where Pac-Man gobbles up colored dots, scientists at the Max-Planck Institute for Intelligent Systems in Stuttgart, Germany and the Institute for Bioengineering of Catalonia (IBEC) in Barcelona, have developed ‘microbots,’ tiny waterborne robots that attack life-threatening bacteria as they swim through a contaminated water supply.

These self-propelled ‘Janus microbots’ -- named for the Roman god usually depicted as having two faces -- are composed of two spherical layers.

One face is made from magnesium, which, when dropped in water, produces hydrogen bubbles that propel the microbots. The other face is made from iron and gold layers coated with silver nanoparticles. As the microbots swim through the water, bacteria tend to stick to the gold and are killed by the nanosilver. Experiments have shown that the microbots can move through the water for about 15 to 20 minutes before the magnesium is used up and the hydrogen propulsion system is spent.

After the microbots have done their job, they are removed by sweeping a magnet through the water which attracts the iron in them.

Tests have shown that the system killed more than 80% of *E. coli* bacteria which was introduced into water at high concentrations. Adding more microbots would increase the kill rate, researchers say, without leaving behind any chemical contaminants.

“The use of conventional disinfectants produces harmful byproducts, and some pathogens have developed resistance to them, thereby exiting an urgent need to develop more effective, innovative, low-cost, robust, and safe water-cleaning methods,” the team wrote in their report. “We have demonstrated that Janus microbots decorated with AgNPs [silver nanoparticles] are an efficient bactericidal tool for water disinfection.”

The research was reported in the journal [ACS Applied Materials & Interfaces](#).

Silver Quarter Honors Ozark Waterway

The Ozark National Scenic Riverways (Missouri) is being honored with the U.S. Mint's production of a 2017 uncirculated, five-ounce silver coin composed of 99.9% silver.

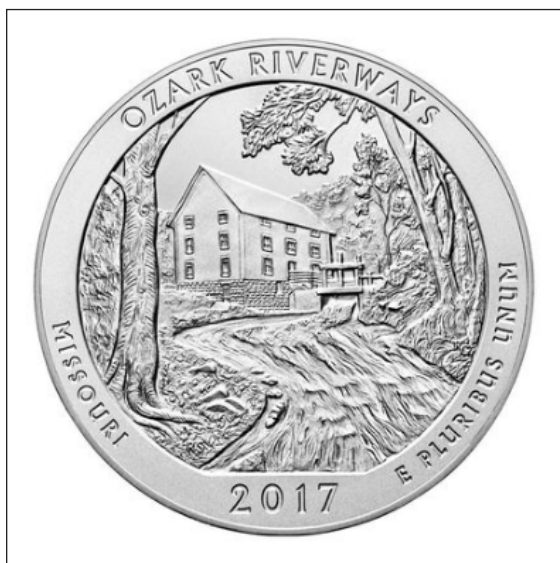
The coin is part of a 56-coin, multi-year series in the *America the Beautiful Quarters* program.

The reverse shows Alley Mill, a steel roller mill built in 1894 that produced flour from wheat. Most of the mill is still intact and open to visitors. The site is six miles west of Eminence, Missouri.

The Ozark National Scenic Riverways was established in 1964 to preserve 134 miles of the Current and Jacks Fork Rivers in the Ozark Highlands of southeastern Missouri. The 81,000-acre park includes a large spring system and more than 400 caves. The park manages 249 historic structures on its property as well as preserving the history and relics of prehistoric peoples who settled in the region over a span of 12,000 years.

The coin is available from the [U.S. Mint](#) for US\$149.00

The Ozarks coin is the third *America the Beautiful Quarter* issued this year. The program began in 2010 when the Mint issued the first coins displaying national parks and other national sites. Five coins are issued annually with the last coin to be minted in 2021. [For a list of all coins click here.](#)



Alley Mill in Missouri is depicted on the Ozark National Scenic Riverways coin produced by the U.S. Mint as part of the *America the Beautiful Quarter* series.

Writing with an Electron Beam in Silver for the First Time

If you want to deposit extremely fine features onto another material, nothing beats Electron-Beam-Induced Deposition or EBID. Although most people haven't heard of this process, it's quite common in sophisticated manufacturing products such as micro-miniature electronic components and equipment.

The process uses a scanning electron microscope to shoot a beam of electrons that deposit or 'write' nanoparticles of gold, platinum, copper and other metals except for silver -- until now.

A team of German and Swiss scientists have succeeded in depositing silver nanoparticles onto a plastic surface. This opens opportunities to produce highly sensitive sensors for explosives or other toxic compounds because of silver's unparalleled reflective properties.

The scientists from the Helmholtz-Zentrum Berlin for Materials and Energy in Germany (HZB) and the Swiss Federal Laboratories for Materials Science and Technology found that writing with silver was challenging because silver is difficult to evaporate and highly reactive during the depositing process. For example, silver tends to combine with the reservoir walls of the injection unit during heating. They solved the problem by designing a new injection unit and using a different silver compound: silver dimethylbutyrate.

"It took us a lot of time and effort to design a new injection unit and find a suitable silver compound," said HZB team physicist Katja Höflich, PhD., in a prepared statement. "Finally, we managed it. The compound silver dimethylbutyrate remains stable and dissociates only in the focus of the electron beam."

The test results were published in the [American Chemical Society's ACS Applied Materials Interfaces](#).

ICE Will Run LBMA Silver Price Auction

ICE Benchmark Administration (IBA) has been chosen as the new administrator for the London Bullion Market Association (LBMA) silver price and will assume responsibility in autumn 2017, according to IBA officials.

"We are pleased to become the administrator for the LBMA Silver Price," said Finbarr Hutcheson, President, IBA, in a prepared statement. "The decision by the LBMA membership reflects our commitment and investment in making the LBMA Gold Price IOSCO [International Organisation of Securities Commissions] compliant over the last two years. Our centrally cleared model has already enabled broader participation and we continue to expand the gold auction. We anticipate this will support expanded participation in silver as well. We are excited to build on our work with the LBMA to ensure strong governance and the evolution of these important benchmarks."

The benchmark is used by silver producers and consumers globally to price contracts.

Getting Silver From Rice? Really

Botanists and farmers have known for centuries that plants and vegetables absorb nutrients and other substances from the soil.

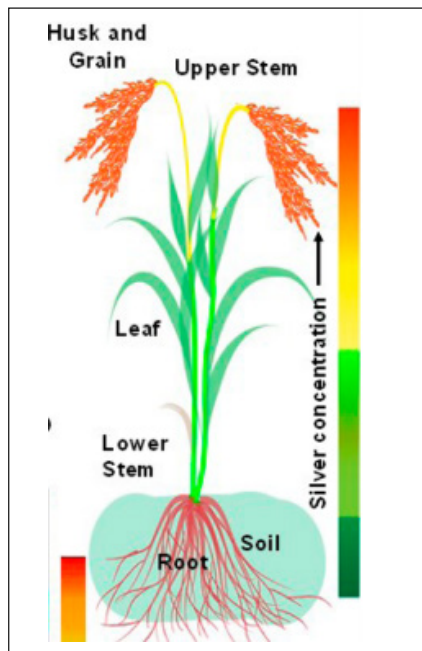
One variety of rice in particular is adept at accumulating naturally occurring silver at high levels, and this phenomenon is causing scientists in India to take notice.

The rice variety known as Garib-sal, originally from West Bengali and still grown there, is capable of collecting 17 milligrams of silver per kilogram of the plant's weight. Even when the soil contained only 0.15 mg per kg, this type of rice was able to accumulate unusually high levels of silver, according to researchers at the Indian Institute of Technology (IIT), Madras. The group tested 505 varieties of rice before claiming that Garib-sal was the most silver absorbent. Nine other rice varieties also were high absorbers of silver, but Garib-sal was the highest.

According to T. Pradeep of IIT's chemistry department the high concentration of silver can be extracted from the plant's bran by traditional polishing methods.

"The rice variety has the ability to accumulate silver about 100 times more than any other rice," adds Pradeep.

He concluded that most rice is sold after milling so the food value remains even if the silver is removed. Pradeep wrote: "We suggest growing this [domesticated crop] as a possible means of agricultural extraction of the noble metal from the rice bran after polishing the grain. A majority of marketed rice in South Asia is sold as polished grain from which the bran is removed. The removed bran from the polished Garib-sal rice may be used for the extraction of silver. Furthermore, we endorse the genius of traditional indigenous medicinal knowledge of the use of this particular silver rice in the treatment of GI infections. Because silver ions are known to be detrimental to pathogenic microbes, the Ag-fortified rice is likely to be a potent curative of GI microbial infections."



LIEDL/HOHMANN (NIM)

The Garib-sal rice variety absorbs more silver from the soil than any other type of rice tested. The highest concentration is in the bran.

Building Nanosilver Structures With Bananas

Producing complex-shaped silver nanostructures for use in sensitive chemical sensors usually requires toxic or corrosive chemicals to help force a particular shape. Recently however, scientists have learned how to use a section of banana plants to synthesize these structures, eliminating the need for dangerous compounds.

Researchers at India's CSIR National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram, have devised a way to employ biodegradable cellulose fibers from the banana plant's pseudostem (a structure that looks like a plant stem but is composed of layers of leaves) to tune and shape silver nanoparticles into a desired shape. The silver nanoparticles use the cellulose fibers as a kind of armature upon which to grow.

Once formed, the flower-shaped nanosilver structure is used as a platform for Surface-Enhanced Raman Spectroscopy (SERS), considered the most accurate technique for detecting chemicals. In their tests, the scientists were able to detect extremely small molecules such as those present in the early stages of cancer and Alzheimer's disease, as well as environmental pollutants.

This new technique overcomes the drawback of some silver nanostructures that are unstable because of their small size and shape by forming the more stable flower-like structure.



INDIAMART

Plant fibers from the banana plant's pseudostem are being used to produce specific shapes of nanosilver crystals.

Silver-Silica and Antibiotic Combination Lethal to Germs

By coating silver-silica nanoparticles with an antibiotic, Brazilian scientists have found a more powerful way to kill drug-resistant bacteria.

Normally, silica compounds – silica is the mineral quartz – are toxic when inhaled, causing the disease silicosis in which the particles scar the lungs making it difficult to breathe. Silicosis often is seen in foundry workers, glass makers and those who work in rock quarries.

However, when the research team wrapped the antibiotic ampicillin around silver-silica it renders it harmless allowing both the silver ions and antibiotic to kill germs without harming human cells.

The combination has not been tested on people, but laboratory results show that it overcame a strain of *E. coli* that was resistant to antibiotic drugs alone.

“There are commercial drugs that contain nanoparticles, which typically serve to coat the active ingredient and extend its lifetime inside the organism. Our strategy is different. We decorate the surface of the nanoparticles with certain chemical groups that direct them to the site where they’re designed to act, so they’re highly selective,” said Mateus Borba Cardoso, lead study author and a researcher at Brazil’s National Energy & Materials Research Center (CNPEM) in an interview in [Phys.org](#).

“We used molecular modeling to find out which part of the ampicillin molecule interacted most with the bacterial membrane,” he added. “We then arranged all the molecules of the drug so that this key part was facing outward from the nanoparticle, increasing the likelihood of interaction with the pathogen.”

The silver-silica/antibiotic treatment has a drawback. Silver-silica is inorganic and humans don’t metalize it, so it could build up in the body. Cardoso said that his group is studying this issue to learn whether it presents a danger or not. He plans to do animal testing. One possibility is to develop a nanoparticle that can be excreted through urine. He suggests, though, that for patients for whom no other cure exists for their bacterial infection, the silver-silica/antibiotic mixture offers hope where none is available.

Silver Helps Eliminate ‘Yogaroma’

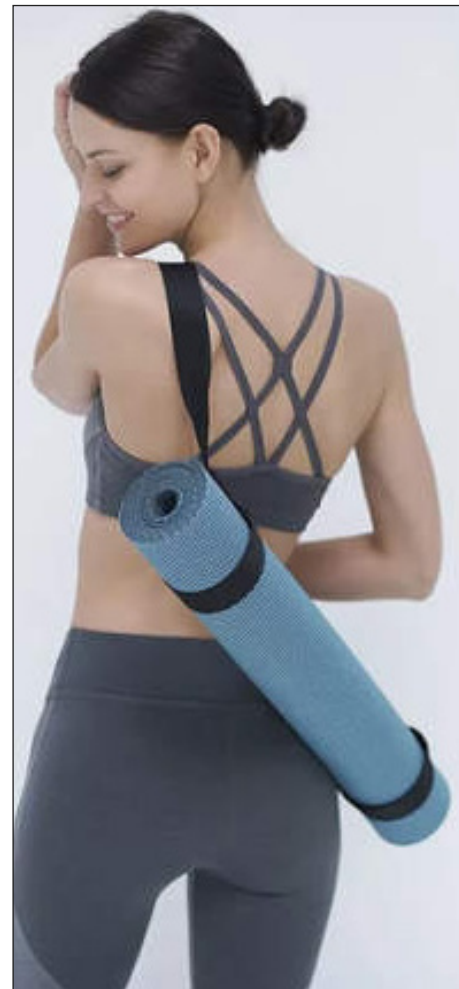
Hoping to stamp out ‘yogaroma’ – the accumulated odor from yoga mats – [Blank Yoga](#) has produced what it boasts is “the first antimicrobial silver-infused yoga mat that doesn’t stink no matter how intense you practice.”

Potential customers are on board if the company’s Kickstarter program is any indication. With almost a week to go, 119 backers have pledged US\$13,652 -- far exceeding their US\$10,000 goal.

The 100% natural rubber mat, from non-Amazonas forests, is infused with silver salts during the manufacturing process, company officials say. They also say that the mats are produced in an energy-efficient facility producing no pollution or waste and using no chemicals or toxic substances.

Company officials note: “This technology is being used by many athletic clothing brands, like Adidas, Lululemon, and Converse, but we are the first to bring it to premium yoga mats. Why, you’ll ask? Because we don’t shy away from stinky issues when it comes to sweaty matters. And it might as well start with the mat. You need to breathe when you lower yourself down for a Savasana, you know.”

A retail price has not yet been set, but the range will be from US\$74 to US\$89 depending upon size.



BLANK YOGA

This silver-infused rubber yoga mat promises to be odor free despite heavy use. Click on image to view video.

Upcoming Events



The Silver Institute has announced speakers for the Silver Industrial Conference, hosted by the Institute on October 26-27 in Washington, DC.

Speakers and their topics include:

- Silver Market Overview – Bart Melek, Global Head of Commodity Strategy, TD Bank
- Silver’s Role in the Automotive Industry – John Bozzella, President and CEO, Global Automakers
- Silver and the Ethylene Oxide Market – Brian VanderWilp, Business Director, CRI Criterion
- How the Silver Refining Industry Helps to Fuel Industrial Demand – Jason Rubin, President, Republic Metals Corporation
- Silver and Electronics – Philip Newman, Director, Metals Focus
- The Silver Lining Providing a Safe Water Supply – Dr. Theresa Dankovich, Chief Technology Officer, Folia Water
- Silver and Healthcare: Past, Present and Future – Dr. Trevor Keel, Director, Agility Health Tech
- Silver’s Role in Solar Power Technologies, Heraeus Photovoltaics Global Business Unit

The Conference will also feature a panel discussion on the outlook for silver and its role in the industrial sector including:

- Grant Angwin, Executive Vice President, Asahi Refining USA
- Mitch Krebs, President and CEO, Coeur Mining
- Miguel Perez-Santalla, Global Business Unit, Heraeus Metal Management
- Suki Cooper, Executive Director, Precious Metals Analyst, Standard Chartered
- Jonathan Butler, Precious Metals Strategist & Business Development Manager, Mitsubishi Corporation

The Silver Industrial Conference will be held at the Embassy Suites Hotel in downtown Washington, D.C. An opening reception will take place on the evening of October 26. The Conference program on October 27 will include the presentations and panel discussion.

To register for the conference, click this link: [Silver Industrial Conference Registration](#).

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