New 'nanobead' approach could revolutionize sensor technology

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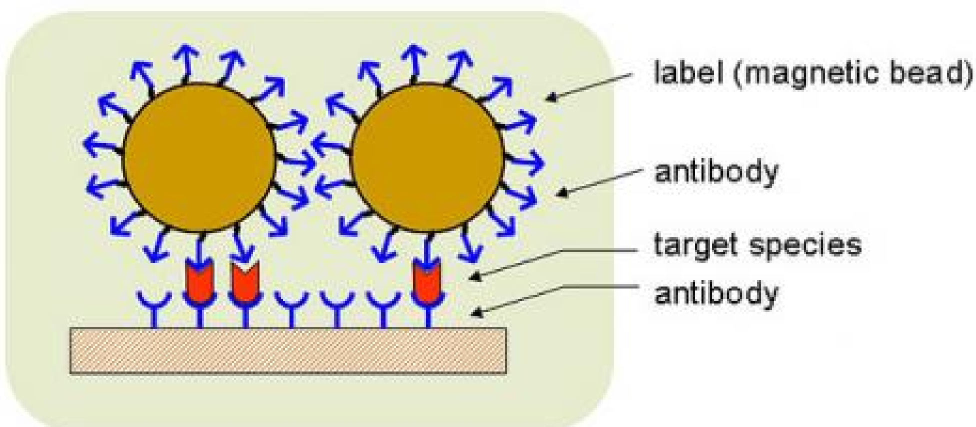


This diagram illustrates how a new sensor technology developed at Oregon State University might work using magnetic beads. (Graphic courtesy of Oregon State University)

Researchers at Oregon State University have found a way to use magnetic "nanobeads" to help detect chemical and biological agents, with possible applications in everything from bioterrorism to medical diagnostics, environmental monitoring or even water and food safety.

When fully developed as a hand-held, portable sensor, like something you might see in a science fiction movie, it will provide a whole diagnostic laboratory on a single chip.

The research could revolutionize the size, speed and accuracy of chemical detection systems around the world.

New findings on this "microfluidic sensor" were recently reported in Sensors *and Actuators*, a professional journal, and the university is pursuing a patent on related technologies. The collaborative studies were led by Vincent Remcho, an OSU professor of chemistry, and Pallavi Dhagat, an assistant professor in the OSU School of Electrical Engineering and Computer Science.

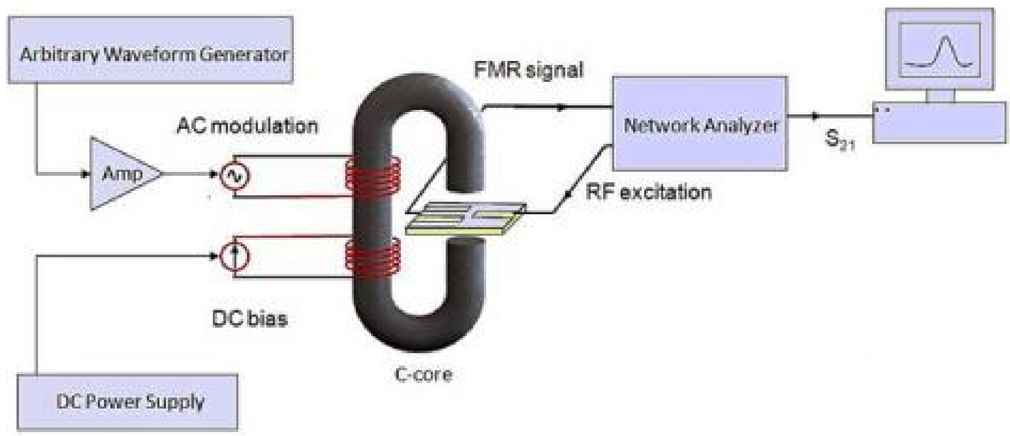
The key, scientists say, is tapping into the capability of ferromagnetic iron oxide nanoparticles –extraordinarily tiny pieces of rust. The use of such particles in the new system can not only detect chemicals with sensitivity and selectivity, but they can be incorporated into a system of integrated circuits to instantly display the findings.

"The particles we're using are 1,000 times smaller than those now being used in common diagnostic tests, allowing a device to be portable and used in the field," said Remcho, who is also associate dean for research and graduate programs in the OSU College of Science.

"Just as important, however, is that these nanoparticles are made of iron," he said. "Because of that, we can use magnetism and electronics to make them also function as a signaling device, to give us immediate access to the information available."

According to Dhagat, this should result in a powerful sensing technology that is fast, accurate, inexpensive, mass-producible, and small enough to hold in your hand.

"This could completely change the world of chemical assays," Dhagat said.



New technology developed at Oregon State University uses ferromagnetic "nanobeads" to develop a powerful, small new type of sensor. (Graphic courtesy of Oregon State University)

Existing assays are often cumbersome and time consuming, using biochemical probes that require expensive equipment, expert personnel or a complex laboratory to detect or interpret.

In the new approach, tiny nanoparticles could be attached to these biochemical probes, tagging along to see what they find. When a chemical of interest is detected, a "ferromagnetic resonance" is used to relay the information electronically to a tiny computer and the information immediately displayed to the user. No special thin films or complex processing is required, but the detection capability is still extremely sensitive and accurate.

Essentially, the system might be used to detect almost anything of interest in air or water. And the use of what is ordinary, rusty iron should help address issues of safety in the resulting nanotechnology product.

Rapid detection of chemical toxins used in bioterrorism would be possible, including such concerns as anthrax, ricin or smallpox, where immediate, accurate and highly sensitive tests would be needed. Partly for that reason, the work has been supported by a four-year grant from the Army Research Laboratory, in collaboration with the Oregon Nanoscience and Microtechnologies Institute.

However, routine and improved monitoring of commercial water treatment and supplies could be pursued, along with other needs in environmental monitoring, cargo inspections, biomedical applications in research or medical care, pharmaceutical drug testing, or even more common uses in food safety.

Other OSU researchers working on this project include Tim Marr, a graduate student in electrical engineering, and Esha Chatterjee, a graduate chemistry student.

The concept has been proven in the latest study, scientists say, and work is continuing with microfluidics research to make the technology robust and durable for extended use in the field.

Provided by Oregon State University

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