

# Detecting lethal diseases with rust and sand

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The next big thing in medical diagnostics could be minutes particles of rust, iron oxide, coated with the material from which sand is formed, silicon dioxide. These magnetic nanoparticles, a mere 29 to 230 nanometers across, can be used to trap antibodies to the virus that causes cervical cancer and to the bacteria that causes potentially lethal diarrhea.

According to scientists in Vietnam, it is relatively straightforward to immobilize on nanoparticles, synthetic or [monoclonal antibodies](#) that respond to the human papilloma virus, HPV18, and the toxic gut microbe *Escherichia coli* O157:H7. Once trapped in this way the antibodies can be exposed to a potentially contaminated sample. If pathogen particles are present some will stick to the antibodies and this change can then be detected by a conventional test, or assay.

Conventional techniques without the benefit of nanoparticles can be accurate, but the [magnetic nanoparticles](#) improve the limits of detection by allowing just these particles to be separated from the sample before carrying out the assay so that residual cells and other substances do not interfere with the test.

*E. coli* could be detected if it is present in a sample at much lower numbers of [bacterial cells](#) than normal allowing contamination to be traced back to source with potentially much greater precision and faster. The improved detection limit for the presence of HPV18 in cells of the cervix could offer a way to screen for cancer of this tissue that reveals problems sooner than standard screening tests and so improve the chances of successful treatment for [cervical cancer](#).

Tran Hoang Hai of the Ho Chi Minh City Institute of Physics and colleagues explain how cervical cancer is the second most common cancer after breast cancer in women worldwide, but the conventional enzyme-linked immunosorbent assay (ELISA) diagnosis does not reveal the presence of [cancerous cells](#) at the very earliest stage. The magnetic nanoparticle approach could remedy this situation.

Similarly, *E. coli* O157:H7 is an increasingly common cause of severe diarrhea, which can also lead to kidney failure and sometimes death. Infection spreads very quickly through ingestion of contaminated material, whether food or fecal matter, so a rapid test that can spot contamination early is essential for halting the spread of the disease.

**More information:** "Immobilising of anti-HPV18 and *E. coli* O157:H7 antibodies on magnetic silica-coated Fe<sub>3</sub>O<sub>4</sub> for early diagnosis of cervical cancer and diarrhea" in *Int. J. Nanotechnol*, 2011, 8, 383-398

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