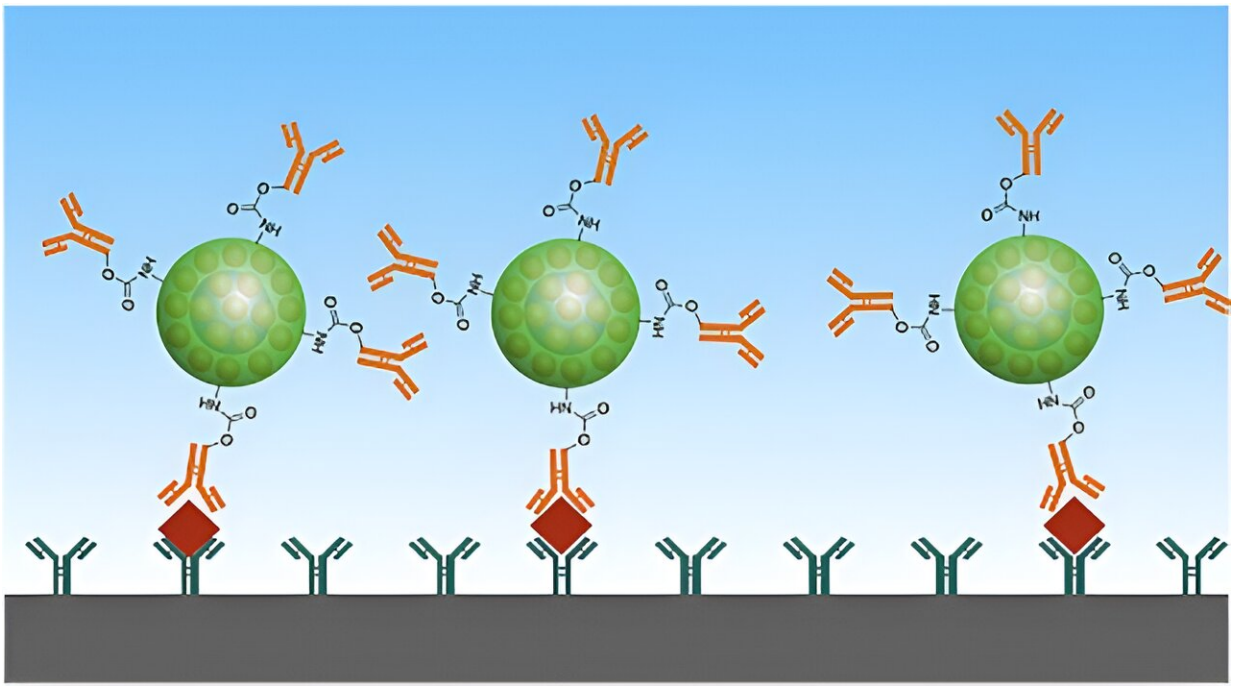
Improving infectious disease testing with gold nanoparticles

April 4 2024



An immunoassay system that uses GNDP particles with antibodies. Credit: *Langmuir* (2024). DOI: 10.1021/acs.langmuir.3c03890

By harnessing the power of composite polymer particles adorned with gold nanoparticles, a group of researchers have delivered a more

accurate means of testing for infectious diseases. Details of their research are published in the journal *Langmuir*.

The COVID-19 pandemic reinforced the need for fast and reliable infectious disease testing in large numbers. Most testing done today involves antigen-antibody reactions. Fluorescence, absorptions, or color particle probes are attached to antibodies. When the antibodies stick to the virus, these probes visualize the virus's presence. In particular, the use of color nanoparticles is renowned for its excellent visuality, along with its simplicity to implement, with little scientific equipment needed to perform lateral flow tests.

Gold color nanoparticles (AU-NP), with their high chemical stability and unique plasmon absorption, are widely employed as probes in immunoassay tests. They exhibit extreme versatility, with their colors fluctuating according to their size and shape. Additionally, their surface can be modified by using thiol compounds.

Conventional tests that use AU-NP often have to amplify AU-NP's optical density, so that scientists can easily measure the strength of the signal produced by the interaction between antibodies and the target substance.

Adding more gold nanoparticles is one means to do this. But because nanoparticles are tiny, it requires a large quantity of them to achieve a strong enough signal for accurate detection.

To overcome this, the researchers proposed a new method called self-organized precipitation (SORP). SORP works by dissolving polymers into organic solvents before adding a liquid that doesn't dissolve the polymers well, like water. After the original organic solvent is removed

by evaporation, polymers assemble together, forming tiny particles.

"Using gold nanoparticle decorated polymers (GDNP) assembled by SORP, we set out to see how effective they would be in detecting the influenza virus, and whether they offered improved sensitivity in detecting antigen-antibody reactions," states Hiroshi Yabu, co-author of the paper and professor at Tohoku University's Advanced Institute for Materials Research (AIMR). "And it did. Our method resulted in a higher optical density than original AU-NPs and GNDPs decorated with smaller AU-NPs."

Yabu and his colleagues' findings reinforce that GNDP particles have broad utility, extending beyond laboratory settings to real-world diagnostic scenarios.

More information: Hiroshi Yabu et al, Gold Nanoparticle-Decorated Polymer Particles for High-Optical-Density Immunoassay Probes, *Langmuir* (2024). DOI: 10.1021/acs.langmuir.3c03890

Provided by Tohoku University