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LETTER

Response to Article "Development of a Magnetically-Assisted SERS Biosensor for Rapid Bacterial Detection" [Letter]

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Dear editor

Infections by bacteria cause significant health issues, affecting approximately 258 million people globally and leading to 280,000 deaths every year.[1] In particular, *Staphylococcus aureus* and *Pseudomonas aeruginosa* are the dangerous, often causing pneumonia, and bone and heart infections.[2] At present, polymerase chain reaction (PCR) has been widely used as a reliable and excellent diagnostic technique at the genetic level to confirm and identify the infected pathogen.[3] However, the PCR technique is expensive, time-consuming and some specific primers are used to identify different microorganisms, physicians often need to list potential microorganisms before performing selective PCR. Therefore, providing accurate and rapid identification for microorganisms has become mandatory for wide applications. In recent research, Cheng and his group developed a sandwich SARS immunoassay using magnetic nanoparticles (MGNP), wheat germ agglutinin (WGA), and gold nanostars (AuNS) for identifying bacterial pathogens.[4] As indicated in this research, nanomaterials are commonly used to enhance the Raman signal for diagnosing pathogenic bacteria.[5]

Cheng et al used specific antibodies for *S. aureus* and *P. aeruginosa*, conjugated with MGNP, and used as a capture probe. AuNS was modified with WGA and 5.5'-dithiobis-(2-nitrobenzoic acid) and utilized as a signalling complex (SERS tag). Target bacteria were captured by antibody-conjugated MGNPs and combined with SERS tags to form a sandwich complex. Since the performance of the sensor highly relies on the influences of the SERS tag, WGA with MGNPs displayed the highest binding affinity to *S. aureus* and *P. aeruginosa*. This newly introduced SERS tag, modified with WGA and AuNS, proved to have strong binding capabilities, as evidenced by the tag attachments to the surface of the intact bacteria, and increasing the Raman signal. Additionally, the intensity of the Raman signal was enhanced proportionally with the bacterial concentrations, and the limits of detection for *P. aeruginosa* and *S. aureus* were improved to 5 and 7 CFU/mL, respectively. With spiked samples in urine, the researchers used higher concentrations of bacteria (50, 500, and 5000 CFU/mL), and a clear SERS signal was observed. However, it would be better to use lower concentrations of bacteria to match the lower infected levels in urine samples.

Overall, the current research shows pathogen detection potential by using a nanomaterial complex as a platform that can be mimicked with other novel nanomaterials. The novelty of this research work is promising, and this biosensor model could work well for other biomarkers and diagnose diseases at earlier stages. Furthermore, a similar sensing platform might be created to open up new possibilities for high-performance and point-of-care testing.

Disclosure

The author reports no conflicts of interest in this communication.

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