Rapid Detection and Typing Of Bacteria

Tech ID: 29975 / UC Case 2016-088-0

SUMMARY

UCLA researchers in the Department of Material Science and Engineering have developed a novel method for rapid identification of bacteria using a Surface Enhanced Raman Spectroscopy (SERS) based approach.

BACKGROUND

Bacterial infection requires clinical testing to properly identify the bacterial strain in order to treat the infection with the appropriate antibiotic drug or spectrum of antibiotic drugs. Current clinical practice is to culture the biological sample to determine if the patient has a bacterial infection. Subsequently, gram staining is used to infer the possible types of bacteria that is causing the infection, followed by sub-culturing the bacteria for antibiotic susceptibility testing. Because of the multiple steps of culturing, it usually takes a week or more from when the biological sample is collected to a final determination of the particular species of bacteria. During this time period, the infection may significantly progress in the infected individual. Because of this potential risk, many clinicians may treat a patient with a broad spectrum antibiotic in the hope that antibiotics will be successful against the infection. However, it poses problems related to the overuse of antibiotics and antibiotic resistance. Thus, there is an urgent need for a cost-effective platform and method that can quickly test for and identify the species of bacteria that is present in biological samples.

INNOVATION

Researchers at UCLA have developed a novel hybrid platform using plasmonics-van der Walls material to obtain molecular vibrational spectra (also known as Raman spectra) from bacteria to be used as fingerprints for strain identification. Using this method, the blood sample is incubated for a short period of time to enrich the bacteria relative to other cell types. The incubated sample is then subjected to Surface Enhanced Raman Spectroscopy (SERS) analysis, where the collected vibrational spectra are first analyzed using statistical methods, such as principle component analysis, and then are compared to a spectra database of known bacteria to determine the exact type of the unknown bacterium in the sample.

APPLICATIONS

- Bacteria strain typing in biological samples (i.e. blood, urine, saliva, etc)

ADVANTAGES

- Sensitivity – this platform has been shown repeatedly to render single-molecule level of sensitivity to a range of biomolecules
- Simplicity – this method significantly shortens the sample incubation time, and is less labor intensive
- Specificity – the hybrid platform renders spectroscopic signature of the species of their vibrational spectra, which helps to avoid false positives
- Quantitative – the Raman spectra serves as the build-in gauge of the local electromagnetic filed for quantitative measurements of small molecules

STATE OF DEVELOPMENT

The described method is at the conceptual stage.

PATENT STATUS

Country	Type	Number	Dated	Case

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OTHER INFORMATION

KEYWORDS

Bacteria typing, bacteria strain identification, molecular vibrational spectrum, Raman spectrum, surface enhanced Raman spectroscopy, SERS

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Diagnostics

RELATED CASES

2016-088-0

United States Of America	Issued Patent	11,680,907	06/20/2023	2016-088
United States Of America	Issued Patent	11,428,638	08/30/2022	2016-088

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