

Monitoring pathogenic oral bacteria via impedance-based wireless signal transfer method

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Periodontitis (歯周病), caused by *Porphyromonas gingivalis* (PG), is often found at a late stage of the disease because traditional detection methods are invasive and require time-consuming and expensive laboratory measurements. For an early and rapid detection of periodontitis, we develop a non-invasive device for monitoring PG bacteria.

We use a parity-time symmetric (PT symmetric) wireless system as a sensing device, which has high sensitivity and stability, making it suitable for detecting biological signals with a potential for implantable devices^[1]. We used screen-printed carbon electrodes (SPCE) as the interaction site with PG, where the bacteria were immobilized by antibodies to facilitate specific detection. When bacteria attach to SPCE surface, it causes changes in electrode impedance. We designed a receiver, containing the SPCE, and a transmitter, the latter to read out the signal change, together building up a PT symmetric device (Figure 1).

By combining the PT circuit with SPCE and using a vector network analyzer (VNA) to monitor the impedance changes caused by bacteria, we can achieve an accurate and fast detection of PG bacteria over a distance of several centimeters. This study provides a new approach for rapid and non-invasive oral pathogen monitoring with a potential for the early diagnosis of periodontitis.

Reference

[1] Takamatsu T, Sijie Y, Miyake T, *Advanced Materials Technologies*, 2023: 2201704.

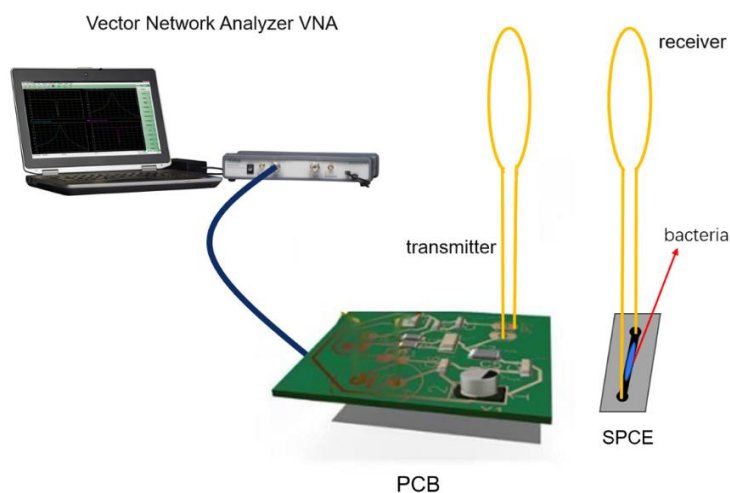


Figure 1. Schematic of the detection system for PG bacteria