Microfabricated coil detector for bacteria detection with magnetoelastic biosensors

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This research demonstrates a newly developed microfabricated coil that allows food surfaces to be scanned for the presence of pathogenic bacteria in real time. The coil is used to measure the resonant frequencies of magnetoelastic (ME) biosensors that are placed on a food's surface. The ME biosensor is composed of a freestanding, strip-shaped ME resonator coated with E2 phage, which is engineered to specifically bind with *S.* Typhimurium. When the ME biosensor comes into contact with target bacteria cells, the bacteria are captured and bound to the biosensor's surface. The bound bacteria cause the mass of the biosensor to increase, resulting in a decrease in the resonant frequency. The frequency change is directly proportional to the additional mass of the bacteria attached to the biosensor surface. In this research, the biosensors were directly placed on fresh food surfaces and the new microfabricated coil used to scan the surface, measure resonant changes in the ME biosensors, analyze the resonant frequency changes and determine if pathogenic bacteria contaminate the surface.

We have previously reported the possible use of ME biosensors for the direct detection of pathogenic bacteria on food surfaces. These biosensors were placed directly on food surfaces and found to bind specifically with target pathogenic bacteria under proper humidity conditions. However, the previous method required the collection of the biosensors from the food surfaces for subsequent resonant frequency measurements, which hinders rapid, user-friendly testing as well as adds to measurement errors. Figure 1 compares the old and new method. This newly designed hand-held detector can be used to scan the food surfaces and read resonant frequencies of multiple ME biosensors at the same time (Figure b1). In addition, this coil can largely improve the detector's standoff distance, which enables the detector to evaluate fruits and vegetables with surfaces of large curvature and roughness.

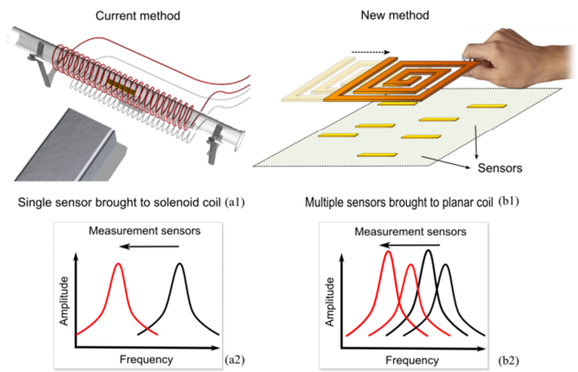

FIGURE 1. Comparison between old and new measurement methods: (a1) Old Measurement Method, (a2) Resonant frequency changes due to attachment of bacterial (Old Method), (b1) New Measurement Method, (b2) Simultaneous Measurement of multiple ME biosensors (New Method).

References

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