# AC Impedance Characterization of Microbes in Skim Milk

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This study presents the characterization of label-free electrochemical impedance-based methods for the rapid detection of microbial contamination. There is a broad history characterizing the dielectric and electrokinetic properties of cells through studies of bulk and interfacial solution properties [1-8]. Skim milk provides a relatively simple food matrix to develop an electrochemical model, although it still contains a wide range of electro-active components.

The performance of two parallel plate electrode configurations and an interdigitated electrode were evaluated. The sensor signal and response to the presence of bacteria was tested with applied dc potentials from 100mV to -100mV in solutions of Tyrode's buffer and skim milk, each spiked with a range of concentrations of *E. coli*. Dilutions of skim milk with buffer were tested to separate the properties of components of skim milk from the presence of the contaminant microbes. Changes in the impedance response to the presence of *E. coli* were significantly influenced by the ratio of slim milk to Tyrode's buffer in the test solution. Increasing the amount of skim milk emphasized differences in the sensor response at high frequencies, >100 Hz, while decreasing the response for frequencies under 100Hz. Characterization of these bulk and interfacial responses was performed through fitting the impedance spectra to equivalent circuit models taking into account the effects of cell membrane bridging, counter-ion diffusion, and interfacial processes [3,7,8]. Results of this study show that this method has potential for a rapid and sensitive method for the detection of microbial contamination of foods.

## References

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