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| Title | Integration of a Hollow, Bipolar Needle Electrode into a Handheld Impedance Measurement Device for Tissue Identification |
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Abstract

A method for identification of tissue types using a handheld impedance measurement device is proposed. An impedance analyzer chip AD5933, driven by an Arduino Nano, is utilized for measurements of the electrical impedance. The electrodes interfacing the tissue consist of two concentric standard hypodermic needles, separated by an insulating layer of PTFE. The electrical contact is established by two-pole splicing connectors. By a prior determination of the cell constant, the conductivity of the penetrated tissue type can be inferred from impedance values. The cell constant determined for the self-fabricated needle electrode is $3.72 \cdot 10^{-3}$ m. For NaCl solutions, percental differences between the conductivities found in this work and literature values are between 0.8 % and 37.7 %. For a test frequency of 100 kHz, only small differences from expected conductivity values (2.1 % for muscle, and 5.8 % for fat) are found in porcine tissue samples, demonstrating the ability to identify unknown tissue types. However, miniaturization of the needle as well as the consideration of the tissue's permittivity is desired to increase detection quality.