

THE EFFECT OF WATER DISTRIBUTION AND ITS VOLUME CONTENT ON THE DIELECTRIC PROPERTIES OF HETEROGENEOUS BREAST TISSUE

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ABSTRACT Microwave imaging for the early detection of breast cancer is a promising research field and the natural contrast agent is water whose high dielectric property serves as a good discriminant for microwaves. At microwave frequencies, normal breast tissue (high fat, low water, low salt) has low permittivity and loss whereas malignant tumors (low fat, high water, and high salt) have higher permittivity and loss. The purpose of this paper is analyzing the complex dielectric permittivity of breast tissue based on cell geometry, volume content and distribution of water in the cell, cell membrane and intracellular spaces. The effective complex permittivity is simulated using full wave simulation of the reflected and transmitted electromagnetic fields (S parameters) through fatty tissues with different microstructure of the distribution of water and the effective complex permittivity is extracted by inversion of the S-parameters assuming an effectively homogeneous material. The permittivity data that obtained is compared with experimental data to Cole-Cole relaxation models.

KEYWORDS Biological tissues; effective complex permittivity; water distribution

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