

Terahertz Imaging of Freshly Excised Murine Breast Cancer Tumors

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Terahertz (THz) technology has been developed for a wide variety of biomedical applications in recent years. Imaging in the terahertz range has shown reasonable inherent contrast between tumors and healthy tissue in cancers of the breast, liver, colon, skin, and brain. For breast cancer in particular, terahertz has shown promise in the detection of cancer in surgical margins of excised tumors. Previous work by our group has demonstrated the effectiveness of terahertz imaging in distinguishing between cancer and healthy tissue for both infiltrating ductal carcinoma and lobular carcinoma prepared as formalin-fixed, paraffin-embedded tissue sections or paraffin blocks. In order to further develop the use of THz imaging for margin assessment, fresh tissue models are required.

This work presents the use of THz imaging with a murine tumor model as a significant step toward THz imaging in fresh breast cancer tissues. C57BL/6 mice are maintained on a high-fat diet in order to induce obesity that provides a fatty tissue background in which to grow breast cancer tumors. The mice are then injected with a breast adenocarcinoma cell line E0771 in order to develop palpable tumors within the fatty deposits. Once these tumors grow to a sufficient size, they are then excised and imaged using a pulsed THz imaging system at the University of Arkansas. Images are performed using a reflection setup where the THz signal passes through a polystyrene plate on which the sample is mounted. A second polystyrene plate is used to apply gentle pressure to the tumor in order to enforce uniform contact of the tissue with the imaging plane. Tumors are imaged both as the surgically excised bulk, in order to simulate the margin assessment of an excised tumor, and are also bisected in order to obtain the cross-sectional THz image of the tumor. This cross-sectional scan is correlated with the histopathology assessment of the sample provided by the Oklahoma Animal Disease Diagnostics Laboratory. The obtained results show the effectiveness of THz imaging for detecting cancer in the surgical excision for fresh tissue.