

# Mid-IR Spectroscopy and UV/VIS Fluorescence Imaging of Breast Tissues Utilizing Intrinsic Contrast Agents

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Breast Cancer is the second leading cause of death for women and the leading overall cause of cancer death in women between the ages of 20 and 59. In the United States, breast cancer is expected to be newly diagnosed every three minutes, and a woman will die from breast cancer every 13 minutes. Inflammatory breast cancer (IBC) is an aggressive type of breast cancer that has a 25% to 50% **lower** five year survival rate than normal breast cancer. IBC occurs in the superficial skin, thus is an ideal target disease for optical technologies that do not provide significant depth penetration. There is an immediate need for healthcare professionals and scientists to develop early detection sources for breast cancer. The purpose of our research is to develop noninvasive imaging devices that can be used to categorize breast cancer as early as possible. We start by looking at the spectra of cancerous and non cancerous tissues.

We study intrinsic contrast agents for the differentiation of cancer and normal breast tissues; the methods used are Fourier Transform Infrared spectrometry (FTIR) and fluorescence imaging. FTIR, a standard transmission configuration was used to study the spectra of cancerous and normal tissue samples obtained in the mid-IR range of  $815\text{cm}^{-1}$ - $1715\text{cm}^{-1}$ . We cut the tissues to  $10\mu\text{m}$  in thickness using a cryostat and placed the slices on ZnSe before taking the spectra. We compared the spectra of both normal and cancerous tissues looking for variations in the intensity. This data will serve as an initial study for a Quantum Cascade Laser (QCL) imaging device for breast tissues. Fluorescence imaging is a technique that relies on the emission of light from a molecule after absorption of light with a shorter wavelength. The fluorescence images of the breast tissues were analyzed together with their corresponding FTIR spectra. The FTIR method provided us with contrast agents in the mid-IR, whilst the fluorescence method gave us intrinsic contrast agents in the visible wavelength range. Figure A, below, depicts a representative FTIR spectra of the cancerous tissues and the corresponding fluorescence image is depicted in figure B.

A.

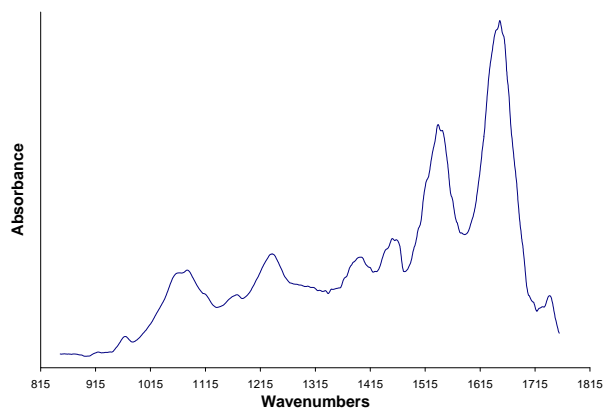


Fig. A.  
The mid-IR spectra of a cancerous tissue.

B.



Fig. B.  
Fluorescence image of cancerous tissue