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## Opportunities for Agricultural Research at the Canadian Light Source Mid-IR Beamline

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Infrared (IR) spectroscopy at the Canadian Light Source (CLS) Mid-IR beamline provides a suite of analytical options for investigation of biological samples which include bulk IR, IR imaging, and attenuated total internal-reflectance (ATR) IR-imaging capabilities. Protein, lipids, carbohydrates and other organic molecules possess distinct vibrational band features within the Mid-IR spectrum which provide chemical compositional and conformational information. For instance, IR allows for analysis of lipid acyl chain length or degree of unsaturation on leaf cuticle structure or oilseed crops. Another application area example are investigations into protein secondary structure composition and alteration due to composition and environmental conditions such as adiabatic stress, storage and processing techniques.

This poster aims to provide a brief overview of analytical techniques available at the Mid-IR beamline to high-light relevant agricultural science applications using canola seeds as an example. Particularly with focus on IR imaging capabilities present at the beamline, which combine IR spectroscopy with IR array detectors to provide powerful tools to simultaneously spatially map biomolecular composition of samples with micrometer spatial resolution. As an example, IR imaging can non-destructively measure lipid / protein / carbohydrate distribution simultaneously to map whole plant tissue cross-sections without the use of labeling agents that could alter the chemical composition. Combining IR imaging with high brilliance synchrotron IR radiation allows for further improvement for investigation of minor compositional differences with sub-cellular resolution, such as evaluation of protein secondary structure at an individual protein storage vacuole site within a canola seed. Lastly, the poster will showcase how IR imaging can greatly compliment x-ray techniques measured at other beamlines at CLS (micro computed tomography at the Biomedical Imaging and Therapy (BMIT) beamline and x-ray fluorescence imaging at the Soft X-ray Microcharacterization Beamline (SXRMB) and the BioXAS beamline) with spatially resolved chemical composition on the same or replicate samples.

**Primary author:** Dr TU, Kaiyang (Canadian Light Source)

**Co-authors:** Mr STOBBS, Jarvis (Canadian Light Source); VU, Miranda (Canadian Light Source); PATERSON, Alisa; Dr READ, Stuart (Canadian Light Source); Dr ROSENDAHL, Scott M. (Canadian Light Source); Dr VENGLAT, Prakash; Dr WANASUNDARA, Janitha; Dr KARUNAKARAN, Chithra (Canadian Light Source)

**Presenter:** Dr TU, Kaiyang (Canadian Light Source)

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