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## Phosphorus Spatial Distribution and Speciation in Brassica Oilseeds on the Spectromicroscopy (SM) Beamline at the Canadian Light Source

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Canola contributes around \$30 billion to the Canadian economy each year, from oil processing and as an animal feed due to the high protein content of the meal by-product. Protein and oil occur as discrete bodies in canola seed cells, however, information on the compartmentalization of these discrete bodies (e.g., size, number, arrangement) within cellular ultrastructure to changes in overall oil/protein content is limited. Moreover, phytates and phosphorus have a strong association with proteins, tending to concentrate with protein purification. Former is considered as an anti-nutritive component of proteins. Understanding the relationships between the protein/phytates/phosphorous and the oil/protein ultrastructure is important to further breeding efforts. Imaging techniques, with chemical sensitivity and on sub-cellular spatial resolution are thus required to examine these relationships.

Scanning transmission X-ray microscopy (STXM) which uses X-ray absorption near edge spectroscopy (XANES) as its contrast mechanism, providing element specific information meets both the chemical sensitivity and ultrastructure preservation criteria. With a spatial resolution better than 25 nm STXM is suitable for imaging individual cells in canola seeds. In addition, with a spectral resolution on the order of 100 meV, STXM is sufficient to provide good differentiation of chemical species. Recently, the spectromicroscopy (SM) beamline at the Canadian Light Source (CLS) has commissioned a new monochromator, increasing the photon flux and energy resolving power in the 1800 to 3000 eV energy range. Phosphorous and sulfur K-edges have thus become practical for mapping P and S species, respectively. Cross-sections of canola seeds with high and low oil content and with high and low phytate content were examined at the P K-edge. The distribution of P species in individual cells within the canola seed are reported. This information is expected to help in breeding selection and to facilitate in the development and improvement of oil and protein recovery.

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