MICRO FT-IR SPECTROSCOPY OF COAL MACERALS IN THE PALEOCENE LIGNITES FROM THE RAVENSCRAG FORMATION, SOUTHERN SASKATCHEWAN

MONICA D. KRAHE-SOLOMON, BRIAN D. KYBETT, JUDITH POTTER AND E.M.V. NAMBUDIRI

Energy Research Unit
University of Regina
Regina, Saskatchewan
S4S OA2

ABSTRACT

Large quantities of lignite are being mined from the Paleocene Ravenscrag Formation in southern Saskatchewan. They were deposited in deltaic and alluvial deltaic environments. The Ravenscrag lignites overlie Upper Cretaceous non-marine sands, silts and clays.

Coal is developed by the transformation of plant material in the peat deposits, influenced by a series of chemical and physical factors. Thus the different coal macerals (huminites, liptinites and inertinites) are derived from woods, leaves, spores and pollen grains of the peat-forming vegetation. Coal macerals have different chemical compositions, especially in low rank coals, and differ considerably in their reactivity during conversion processes. Micro FT-IR spectroscopy, which can analyse sample areas as small as 5μm by 5μm, can be used to determine the functional groups present in individual coal macerals.

Five lignite samples from the Hart seam (Willowbunch coalfield) and the Souris and Estevan seams (Estevan coalfield) were used in Micro FT-IR analyses. The Hart seam coal is of lower rank than the Souris and Estevan samples. Our results indicate that the eu-ulminite A macerals are chemically more complex than the eu-ulminite B macerals. The latter have more condensed aromatic structure and a lower oxygen content. A decrease in oxygen, nitrogen and hydrogen content with an increase in carbon and aromaticity has been attributed to an increase in coal rank. This is also reflected in the similarities in spectra between the eu-ulminite A of the Estevan seam and the eu-ulminite B in the Willowbunch coalfield. A strong band at 1335 cm^{-1} representing aromatic ethers and phenols is found only in corpohuminites. These perhaps represent the phenolic metabolic products that are built into the humic acid. Inertinites in the two coalfields are mostly similar. However, certain semifusinites are closer to the huminites than other inertinites and are perhaps, partially reactive. The chemical information from micro FT-IR spectroscopy of coal macerals can be used to supplement petrographic data to predict the suitability of coal seams for conversion processes.