Redox Characterization of the Surfaces of Seven Iron-Bearing Minerals: Use of Molecular Probes and UV-Visible Spectroscopy

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Abstract: Redox properties of iron-bearing mineral surfaces may play an important role in controlling the transport and transformation of pollutants into ground waters. Suspensions of seven iron-bearing minerals were reacted with pH and redox indicators under anaerobic conditions at the pH of the natural suspension. The responses of the indicators to the mineral surfaces were monitored by UV-visible spectroscopy using a scattered transmission technique. The Hammett surface acidity function (H_s) and the surface redox potential (Eh_s) of these iron-bearing minerals were measured. These measured values were used to calculate Eh values for the seven minerals: goethite = +293 mV; chlorite = +290 mV; hematite = +290 mV; almandite = +282 mV; ferruginous smectite = +275 mV; pyrite = +235 mV; and Na-vermiculite = +223 mV. Calculated surface redox potentials of minerals are different from their potentials measured by platinum electrode in bulk suspensions. UV-visible spectroscopy provides a quick and non- destructive way of monitoring organic probe response at the mineral surface.

Key Words: Electron activity • Indicators • Iron-beating minerals • Redox potential • Surface acidity • UV-visible spectroscopy

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