

ABSTRACT

Potential application of Kenyan bentonite for adsorption of iron, cobalt, copper, nickel and zinc and for analysis of electroactive species in water from a polluted water course using a 3-electrode potentiostat and cyclic voltammetry was studied. Polished carbon graphite electrodes were used either bare or modified with Kenyan bentonite using an electrochemically inert adhesive to a thickness of about 0.8 mm. These were used to prepare calibration curves of iron, cobalt, copper, nickel and zinc by plotting cyclic voltammograms of the ions at different concentrations and using 0.1 M sulphuric acid as supporting electrolyte. The slopes of the curves from bentonite-modified electrodes were observed to be higher than those obtained from bare carbon electrodes by a factor of between 1.7 and 24, implying that bentonite enhanced electron transfer kinetics of the metal ions. It was also observed that the magnitude of the ratio depended on the proximity of the element to either filled or half-filled 3d orbitals, which implied that a chemical reaction may have taken place between the bentonite and the ions (chemisorption). Carbon graphite electrodes were modified with bentonite that had been soaked in water samples from a polluted water course at a ratio of 1:1 w/w. The cyclic voltammograms showed clear oxidative and reductive peaks indicating that electroactive species that previously could not be detected on the potentiostat were pre-concentrated on the bentonite and could thus be detected. Thus Kenyan bentonite is observed to chemically adsorb zinc, cobalt, copper, nickel and iron species in aqueous solution and can be used to monitor electroactive pollutants in aqueous systems using electroanalytical techniques.

Key words: Bentonite, heavy metals, surface modified electrodes, cyclic voltammetry, preconcentration, adsorption.