IODIMETRY SOLID-SPECTROPHOTOMETRIC DETERMINATION OF THIOSULPHATE BY MEANS OF ITS OXIDATION TO TETRATHIONATE BY IODINE

A new iodometric solid-phase spectrophotometric (SPS) technique for the detection of thiosulfate anions in aqueous solutions by their oxidation into tetrathionate anions with iodine followed by the extraction and detection of the unreacted iodine on the ether-based polyurethane foam (PUF) was developed.

Reagent solutions were prepared using degassed distilled water. A standard solution of iodine was prepared by acidifying an aqueous solution containing an iodate salt and an excess of iodine with sulfuric acid to pH=1: $IO_3^- + 8I^- + 6H^+ \rightarrow 3I_3^- + 3H_2O$. PUF was cut in the form of cylinders with the diameter and the height of 15 and 3.0 mm, respectively.

SPS detection of thiosulfate is based on its reaction with known excess of Iodine at pH~5: $2S_2O_3^{2-} + I_3^- \rightarrow S_4O_6^{2-} + 3I^-$. Iodine was added to a solution containing a thiosulfate salt. The unreacted iodine was extracted with PUF. The light absorption of PUF (at 370 nm) changed proportionally to the concentration of the thiosulphate anions in the solution. The value $\Delta A = A_0 - A_x$ was taken as the analytical signal at 370 nm. Herewith A_0 is the light absorption of PUF with the known concentration of I_3^- in aqueous solution in the absence of the thiosulfate salt (e.g., 18.9 μM), A_x is the light absorption of PUF containing the known amount of the thiosulfate salt. A calibration chart is described by equation $\Delta A = -(0.01 \pm 0.01) + (0.16 \pm 0.03) \cdot C$ (mg/L), (R=0.999). The value of detection limit is 0.04 mg/L calculated with 3σ-criterion. The linearity of the calibration chart remained until the concentration of 4.5 mg/L for the thiosulfate salt in aqueous solution was reached (the test volume = 10.0 mL). The sorption of the hydrophobic iodine on PUF is rather selective. Any additional components in the analyzed aqueous solution do not affect the extraction of the iodine on PUF.

The described iodometric SPS technique for the detection of thiosulfate anions using the indicator system I_2-PUF in nature water is simple and ecologically safe. Although the technique is based on the reaction that is widely used for the titrimetric and spectrophotometric detection of thiosulfate anions, it has much better sensitivity (by a factor of 10). Concomitant compounds which can be found in natural water do not affect the quantitative determination of the anions.

Key words: thiosulfate, iodometry, polyurethane foam, solid phase spectrophotometry.