Mobile Voltammetric Analysis System for the Determination of Dissolved Copper in Surface Seawater off the West Coast of Ireland

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A mobile, in-line voltammetric system has been developed for the real time analysis of dissolved copper (and other trace metals) in the surface waters of Galway Bay, the Shannon Estuary, and the adjacent continental shelf region. The system includes a trace metal free sampling fish, in-line filtration and UV-digestion units, and a voltammetric analyser and electrode controlled by a portable PC. Analysis of samples is completed using adsorptive cathodic stripping voltammetry (AdCSV) using oxine (8-hydroxyquinoline) as the added ligand and tris (2-amino-2-hydroxymethyl-1,3-propanediol) as the pH buffer. The advantages of this system include a high frequency of measurements (3-4 measurements per hour) and decreased risk of sample contamination by reducing handling in the storing and transport stages of sample collection.

This real time sampling and voltammetric analysis system can be used for both shipboard and shore-based monitoring. A shipboard survey of the 150 km coastal zone between the Shannon Estuary to the south and Galway Bay to the north has been completed. Results from this cruise indicate that copper concentrations correlate with salinity measurements, and several distinct chemical signatures for different water sources in this region were observed. Shore-based monitoring using the same system deployed from a mobile laboratory has also been conducted at a number of selected sites in this area over a 13 hour tidal cycle. Results here also show how copper concentrations vary with salinity and location.

It has been reported that speciation of dissolved copper is dominated (greater than 99.9%) by complexation with strong organic ligands (Well et al., 1998; Bruland et al., 2000). The resulting organic copper complexes, which are very stable with conditional stability constants on the order of $10^{10}-10^{13}$ (Bruland et al., 2000), effectively provide a conservative tracer of water movement. Further work is planned to obtain a higher resolution data grid for this region, and it is expected that from this high resolution data an accurate model of water movement in this region can be developed.

