

Study of dissolved copper (ii) speciation at Pulau Pangkor, Perak, Peninsular Malaysia

ABSTRACT

The profile of seawater samples was analyzed from a few selected stations at Pulau Pangkor, Perak for dissolved copper speciation analysis in order to determine the concentration level of toxic cupric ions (Cu^{2+}) in seawater. The concentration of natural organic Cu(II)-ligand binding (CuL) and its conditional stability constant ($\text{Log } K'_{\text{CuL}}$) in each sample was determined by using competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-AdCSV) method with salicylaldoxime (SA) as competitive ligand. Our present data have recorded a total dissolved Cu concentration [dCu] ranged between 3.14–7.12 nM and 3.10–9.11 nM at a surface layer and at 15-meter depth, respectively. An organic ligand concentration [CuL] at the surface layer ranges between 4.41-13.25 nM, with its conditional stability constants ($\text{log } K'_{\text{CuL}}$) between 11.55-12.17. However, at 15-meter depth, the [CuL] was recorded between 5.90-11.14 nM with $\text{log } K'_{\text{CuL}}$ ranged 10.93-12.84. On the other hands, a free Cu ion activity, pCu ($\text{pCu} = -\text{log}[\text{Cu}^{2+}]$), was ranged from 8.97-10.35, and was slightly less compared to the pCu values that have been recorded in other coastal waters (>12). The free $[\text{Cu}^{2+}]$ was ranged between 10^{-9} – 10^{-11} pM, which was slightly below the toxicity threshold (10^{-8} pM). This initial study has suggested that dCu was largely complexed by organic ligands ($>99.6\%$), both strong organic ligand (L1: $\text{Log}K > 12$) at surface and weak organic ligand (L2: $\text{Log}K < 11$) at the deeper layer. The presence of these two classes of ligands have buffering the free Cu^{2+} ions, yielding a non-toxic Cu to the microorganisms.

Keyword: Total dissolved copper; Organic ligands; Cupric ions; Cu speciation; Conditional stability constants; Coastal water