Computational studies of mercury (II) chelation by peptide ligands containing cysteinyl residues.

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Clinical chelation therapy for mercury poisoning generally uses thiol containing compounds such as dimercaptosuccinic acid (DMSA) and dimercaptopropanesulfonic acid (DMPS). The present study was undertaken to better understand the chelating interactions of mercury (II) with Cys and Trp-Cys dipeptide. Mercury (II) - peptide binding affinities and associated thermodynamic parameters are evaluated by isothermal titration calorimetry (ITC). Density functional theory calculations have been conducted to investigate structural and thermodynamic aspects of the interactions of mercury (II) with these peptide ligands for comparison with experiment. The results show that small peptide ligands containing thiol-S donor and imidazole-N donor ligating groups are structurally attractive for the rational design of chelators for mercury (II). Experiment and calculations show a strong 1:2 Hg^{2+}–peptide complex whereby sulfur atom from each peptide interacts with mercury. A second weaker 2:2 complex is present at higher Hg^{2+} concentrations.