

THE SULPHUR-MERCURY(II) SYSTEM IN NATURAL WATERS

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ABSTRACT. Sulphur is an essential element for aquatic biosystems, the life processes of which lead to the formation of low molecular weight S compounds in the water. The results of our calculations indicate a pronounced tendency for Hg(II) to form HgS (or HgOHSH) and Hg(SR)₂ complexes in the presence of H₂S and thiols. Likewise, MeHg will form CH₃HgSH and CH₃HgSR complexes, but in this case the chloride complex will dominate at low concentrations of H₂S and thiols. In acidic low salinity water, CH₃HgCl is the dominant MeHg species at the lowest concentration of sulphide/thiols (0.1 nM), whereas a hundredfold increase of the sulphide/thiol concentration, or an increase of the pH to neutral or slightly alkaline conditions, will result in a total dominance for CH₃HgSH and CH₃HgSR.

1. Introduction

Aquatic biosystems require a series of S-containing compounds. These compounds are biosynthesized by assimilation and reduction of sulphate ions (Andreae, 1990; Dyrssen, 1989). Upon degradation of the organic matter, several low molecular weight S compounds are formed (Cutter and Krahforst, 1988). Some of them, such as H₂S and thiols, form strong complexes with Hg²⁺ and CH₃Hg⁺. Previously, we have calculated the state of trace sulphide in seawater (Dyrssen and Wedborg, 1989). In this paper we shall examine the state of Hg(II) (0.01 nM) and MeHg (0.001 nM) as functions of pH (4 to 9), pCl (0.3 to 3.7), and total concentrations of H₂S and thiols within the range 0.1 to 10 nM.

2. Materials and Methods

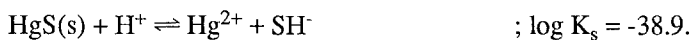
2.1. ESTIMATION OF STABILITY CONSTANTS

The following constants have been experimentally determined and can be found in various tables of stability constants (Sillén and Martell, 1964, 1971; Smith and Martell, 1976; Martell and Smith, 1982; Smith and Martell, 1989). For our estimations, the ionic strength dependence may be neglected.





The solubility constant was calculated by Dyrssen and Kremling (1990):



The following constants were found to fit the titration of thiols (Dyrssen and Wedborg, 1986):

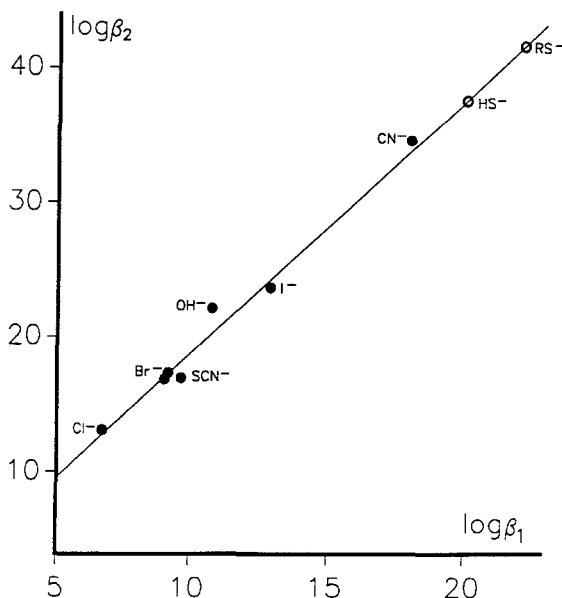


Fig. 1 Stability constant for the formation of HgL_2 complexes plotted vs the constants for HgL^+ . The straight line of $\log \beta_2 = 1.87 \log \beta_1 + 0.3$ was used to estimate $\log \beta_1$ for the complexes HgSH^+ and HgSR^+ .