5.2: Organometallic Compounds of Mercury

Learning Objectives

In this section you will learn the following

- Dialkymercury preparation.
- Mercury toxicity.
- Mercury poisoning.

Consider this reaction that proceeds due to both electronegativity and hardness considerations.

$$2\,RMgX + HgX_2 \longrightarrow HgR_2 + MgX_2$$

Dialkylmercury compounds are very versatile starting materials for the synthesis of many organometallic compounds of more electropositive metals by transmetallation. However, owing to high toxicity of alkylmercury compounds, other synthons are preferred. In striking contrast to the high sensitivity of dimethylzinc to oxygen, dimethylmercury survives exposure to air.

Mercury Toxicity

The toxicity of mercury arises from the very high affinity of the soft Hg atom for sulfhydryl (—SH) groups in enzymes. Simple mercury-sulfur compounds have been studied as potential analogs of natural systems. The Hg atoms are most commonly four-coordinated, as in $[Hg_2(SMe)_6]^{2-}$.

Mercury poisoning was a serious concern even from early days. Issac Newton, Alfred Stock worked in the early 20th century. Later in 60s awareness came following the incidence of brain damage and death it caused among the inhabitants in Minamata, Japan. Mercury from a plastic company was allowed to escape into a bay where it found its way into fish that were later eaten. Research has shown that bacteria found in sediments are capable of methylating mercury, and that species such $HgMe_2$ and $[HgCH_3]^+$ enter the food chain because they readily penetrate cell walls. The bacteria appear to produce $HgMe_2$ as a means of eliminating toxic mercury ions through their cell walls and into the environment.

References

- Inorganic Chemistry, Principles of structure and reactivity, 4th edition; 1993, J. E. Huheey, E. A. Keiter, R. L. Keiter, Addison-Wesley Publishing Co, New York.
- Advanced Inorganic Chemistry, 6th edition, 1999, F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, John Wiley and Sons, New York.
- Organometallics, A Concise Introduction, 2nd edition (revised), 1992, Ch. Elschenbroich, A. Salzer, Weinheim, Germany.
- Inorganic Chemistry, 3rd Edition, 1999, D. F. Shriver, P. W. Atkins, Oxford University Press, Oxford.
- Inorganic Chemistry, 2nd Edition, 2005, C.C. Housecroft and A. G. Sharpe, Pearson, Prentice Hall, England.