Methylmercury Cycling in the Yellow Sea and Bohai Sea, China: Sources/Sinks and Controlling Factors

YANBIN LI[12*] LUFENG CHEN[3]

[1]Key Laboratory of Marine Chemistry Theory and Technology, Ministry of Education, Ocean University of China, Qingdao 266100, China (*correspondance: liyanbin@ouc.edu.cn)

[2]College of Chemistry and Chemical Engineering, Ocean University of China, Qingdao 266100, China

[3]College of Environmental Science and Engineering, Ocean University of China, Qingdao 266100, China

The Yellow Sea (YS) and Bohai Sea (BS), economically important regions of the western Pacific Ocean, have been facing a variety of environmental problems, including mercury (Hg) pollution. Although methylmercury (MeHg) has been recognized as the most toxic Hg species in the environment, there is still a lack of knowledge on its cycling in the BS and YS, limiting a sound understanding of Hg cycling in both regions. To address these needs, we investigated the distribution and methylation/demethylation of Hg in both regions during two marine science cruises. A decreasing trend from inshore to offshore was observed for both total Hg (THg) and MeHg, suggesting the importance of terrestrial discharge. Methylation in the sediment and photodemethylation in the water were identified as the two most important processes controlling MeHg levels, while SO_4^{2-}, THg, and dissolved organic matter were found to be the most influential environmental factors. By quantifying the in situ production/degradation, along with river input and exchange with nearby seas, sediment was found to be the most important source of MeHg; meanwhile, the water serves as the largest sink in both regions. In comparison with other marine systems, a relatively low ecosystem conversion efficiency of inorganic Hg to MeHg, i.e., low MeHg/THg ratios in the water, was observed in the BS and YS. This may result from the low efficiency of transporting THg from water to the sediment, slow net methylation in the sediment, and quick demethylation in the water. The low conversion efficiency of inorganic Hg to MeHg may be one of the convincible reasons for the low Hg levels detected in the YS and BS organisms, in comparison to the high THg concentrations in the water.