The 18th International Symposium on Polar Sciences (ISPS)
Seogwipo KAL Hotel, Jeju Island, Repubic of Korea, May 22-24, 2012

Onboard Experiments of Photochemical Production and Microbial Consumption of Carbon Monoxide and Molecular Hydrogen during the Amundsen Sea Expedition

Young-shin Kwon and T. S. Rhee

Division of Polar Climate Research
Korea Polar Research Institute
kwonys@kopri.re.kr

ABSTRACTs

Carbon monoxide (CO) and molecular hydrogen (H_2) are important trace gases that have potential for affecting the global climate. The ocean is a minor source for these gases although it covers ~70% of the earth. In the surface of the ocean, CO is produced by photochemical degradation of chromophoric dissolved organic matter (CDOM). CO emitted to the atmosphere is oxidized by active reaction with the OH radical, which is the indicator of oxidation capacity of the atmosphere. On the surface of the ocean, H_2 is supersaturated with respect to the atmosphere and has maximum at surface decreasing with depth in the euphotic zone. So the ocean is one of the natural sources for H_2. However, the production and removal mechanism of H_2 in the ocean is not clear yet. Unlike CO which is produced wherever light and dissolved organic matter exist, H_2 may not be the case.

Focusing on these properties of the two gases, we carried out a series of experiments related to their production and removal in seawater during the expedition in the Amundsen Sea from February to March in 2012, which is the period of transition from summer to fall in the Antarctic. At 15 stations covering from 71°S to 75°S and from 100°W to 140°W, we have collected seawaters. Samples were divided into four experimental groups and each group was given different conditions. The first group, collected from surface water, were put in the light source with non-Hg(that is, there were biological activities) and the second in the light source with ca. 0.2mL Hg(that is, there was non-biological activity.).The third and forth groups collected from deep water were at the same conditions with the first and the second, respectively. Triplicate seawater samples were collected for each group and exposed to the light source for given time periods. CO and H_2 in the headspace of each bottle were analyzed with a gas chromatograph. From these experiments, we learn the differences of the production and removal mechanisms of CO and H_2 between oceanic surface and deep waters.