Investigating trends of hydrogen peroxide in Ohta and Kurose rivers and rainwater in Hiroshima prefecture, Japan

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Hydrogen peroxide (H_2O_2) plays a significant role in advanced oxidation process to remove the pollutants from water systems. However, its excess concentration in water has been proven detrimental for many of aquatic life forms under laboratory conditions. For this purpose we determined H_2O_2 distribution in river water (Ohta River: six sites = OR2–OR7 and Kurose River: KR1–KR3, Saijo A, Saijo B, Shitami A and Shitami B) and precipitation (rain and snow at Hiroshima University Higashihiroshima campus) from Hiroshima prefecture, Japan. In both rivers, H_2O_2 concentrations varied spatially with it' s increasing concentrations from upstream (sites: KR1 and KR2; OR2 and OR3) to mid/downstream (K3; OR6 and OR7). The H_2O_2 concentrations ranged between 67–175 nM and 21–195 nM in Ohta and Kurose rivers, respectively. The H_2O_2 ranged from 1.91 μM to 4.23 μM in rainwater and was 0.61 μM in snow samples. The H_2O_2 concentrations at mid/downstream sites in both rivers could be related with anthropogenic activities. For example at two branches of Kurose River (Shitami A and Shitami B) elevated H_2O_2 may be the result of untreated domestic wastewater discharge and agricultural runoff in these streams. Additionally, rainfall also increased the H_2O_2 levels at Shitami A and Shitami B, when measured one hour after rainfall started. In Kurose River higher levels of H_2O_2 were recorded during October compared with H_2O_2 values reported for December month. The H_2O_2 concentrations correlated well with the water temperature (r^2=0.66; $p < 0.001$, n=14) and fairly with solar radiation (r^2=0.41; $p < 0.05$, n=14) in Kurose River. This study suggested that these two parameters are important in determining the H_2O_2 levels in Kurose River. However, in Ohta River and rainwater, no significant correlation of H_2O_2 with water temperature, solar radiation and dissolved carbon was observed, which could be due to scarcity of available data.

Keywords: Hydrogen peroxide, River water, Rainwater, Hiroshima prefecture

