MANGANESE CONCENTRATION AND SPECIATION IN COASTAL RAINWATER, SOUTHEASTERN NORTH CAROLINA

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A Thesis Submitted to the
University of North Carolina Wilmington in Partial Fulfillment
Of the Requirements for the Degree of
Master of Science

Department of Chemistry and Biochemistry

University of North Carolina Wilmington

2006

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ABSTRACT

Manganese exists in mainly two oxidation states in the atmosphere, Mn(II) and Mn(IV). Divalent manganese, Mn(II), is a soluble oxidation state whereas tetravalent manganese, Mn(IV), is found as a particulate. Mn(II) is therefore found in higher concentrations in rainwater. Manganese is released into the atmosphere by natural and anthropogenic sources. Rainwater is thought to be a main removal mechanism for atmospheric manganese. The concentration and speciation of manganese were determined in rainwater from Wilmington, NC, from April 2, 2005 to March 24, 2006. Volume weighted averages for Mn_{total}, Mn(II), and Mn(IV) were 11 ± 3 nM, 11 ± 3 nM, and 1.2 ± 0.4 nM respectively.

All manganese species were present in all seasons with higher concentrations of Mn_{total} and Mn(II) in winter relative to summer season with no significant difference in Mn(IV) between seasons. All manganese species were considerably lower during the fall. Concentrations of Mn_{total} and Mn(II) were higher in terrestrial storms relative to marine storms with no significant difference in Mn(IV) between storm types. Diurnal variation was seen where Mn_{total} and Mn(II) concentrations were lowest during the afternoon hours when Mn(IV) was at a maximum. Mn(II) and Mn(IV) concentrations were not correlated with one another. Mn(IV) showed a positive correlation with Fe_{part} whereas Mn(II) correlated with Fe_{diss} and Fe_{part}. A positive correlation was observed between Mn(II) and the pollutant indicators H^+, NO_3^-, and NSS. No correlation was observed for Mn(IV) and the pollutant indicators. Highest concentrations of manganese species occurred in small volume rains and lowest concentrations in high volume.

Atmospheric global inputs by natural and anthropogenic sources, 3.28×10^{11} g per year or 6.0×10^{9} moles per year, as compared to calculated total global flux of manganese removed via wet deposition, 2.47×10^{11} g per year or 4.5×10^{9} moles per year, suggests that

approximately 75% of atmospheric Mn is removed by wet deposition with the remaining 25% removed by dry deposition.

ACKNOWLEDGMENTS

I would like the thank my advisors Dr. Robert Kieber, Dr. Steve Skrabal and Dr. Joan Willey for all their help with every aspect of this project and always having time to answer a 'quick' question. Thank you to my family for all the love and support throughout my academic career and always encouraging me when I needed it most. Thank you to all my MACRL and dub friends for the countless laughs and great times both in and outside of lab. I could have never accomplished any of this without your help and keeping me smiling when things didn't go exactly like they were intended. A very special thank you is in need for two of my closest friends Darren Melton and Mellissa Dionesotes. Your friendships mean the world to me and both of you have been very influential in my life. I'm finally done…yeah!!!!!!

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