DEVELOPMENT OF TREATED MINE WATERS FOR AQUACULTURE: NON IDEAL WATER CHEMISTRY EFFECTS AT DOGWOOD LAKES[1]

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Abstract: Water quality criteria have long been established for freshwater aquaculture, in which the effects of high ion concentrations are neglected, though similar criteria have not been developed for high ionic strength water sources such as treated mine waters. Consequently, this study was initiated to assess the opportunity of using treated mine waters to rear rainbow trout (*Oncorhynchus mykiss*).

Concentrations of dissolved metals were measured in excess of recommended freshwater limits at the study site; however, the trout stocked in the treated mine water had near normal growth patterns, little instance of disease, and low mortalities (~1.4%). Consequently, a rational for the lack of impacts was sought by examining the effects of the high ionic strength and speciation of dissolved metals in the treated mine water. The average active concentration of divalent and trivalent ions at the study site were 32% and 8%, respectively, of analytic concentrations, of the concentration predicted in low ionic strength, "fresh" waters. Consequently, the active concentrations of iron, aluminum, manganese, and calcium were actually below recommended limits, even though analytic concentrations exceeded recommended limits.

In the case of magnesium, the free Mg^{2+} ion is considered to be the most bioavailable species. However, free Mg^{2+} ions have a strong affinity for inorganic ligands such as SO_4^{2-} and OH^-, which are common in treated mine water. Thus, through complexation, soluble magnesium hydroxides and sulfates can be created. To determine Mg speciation, simulations of metal-ligand interactions were preformed under average conditions using *CHemical Equilibria for AQuatic Systems* software. At pH = 8.1 with a specific conductance of 6.7 mS/cm, only 53% of active magnesium was available as free Mg^{2+}, while ~47% was present as the less bioavailable $MgSO_4$. Consequently, non ideal effects of high ionic strength and coordination chemistry of treated mine waters must be considered when assessing the suitability of such waters for aquaculture.

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[1]Paper was presented at the 2004 National Meeting of the American Society of Mining and Reclamation and The 25th West Virginia Surface Mine Drainage Task Force , April 18-24, 2004. Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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