Treating Acid Mine Drainage with Ferrate (Fe VI): A Preliminary Assessment[1]

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Abstract: Ferrate (Fe (VI)) has been earning attention in water treatment applications due to its alkaline properties and strong oxidation potential, but has not been tested as an acid mine drainage treatment option. Our experiment focused on the viability of ferrate as an option for treating net-acid acid mine drainage from a coal mine in western Pennsylvania. We focused on the oxidation of Fe and Mn as well as the removal of Fe, Al, and Mn through sedimentation. The acid mine drainage was dosed with two different treatments: Fe (VI) only or with sodium hydroxide (NaOH) simultaneously. Various dosing levels were tested with standard jar testing procedures and even at stoichiometrically excessive amounts, Fe (VI) alone did not complete the oxidation of Fe and Mn. With the co-addition of NaOH and a Fe (VI) dose of 25 µM over ninety percent oxidative precipitation of iron and manganese was achieved. The formation of Mn (VII) was noted at Fe (VI) dosages above the stoichiometric requirement. This could be problematic in full-scale systems if they are not properly monitored. The resultant Al (III) and Fe (III) particles were relatively large which suggests that these particles could be removed via subsequent clarification. The resulting Mn (IV) particles were relatively small and did not fully settle which suggests destabilization and aggregation may be required to meet effluent standards. Fe (VI) seems viable for the treatment of acid mine drainage especially with the co-addition of NaOH. However, more research is required to gain a full understanding of potential application questions and the fundamental mechanisms.[3]

Additional Key Words: oxidants, chemical addition, dosing.

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3. Work reported here used waters from a mine discharge near 40.367135°, 78.646209°.