

Manganese Oxide Production and Harvesting Using Metal Removal Units¹

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Abstract: Metal Reclamations Units (MRUs) are gravity driven, modular, scalable, rapidly deployed wetland bioreactors. The biofilm which grows upon the organic supporting matrix in the MRUs is self-selecting and determined by the introduced pollutant loads and how they are naturally attenuated. MRUs remove Mn at pH <7 when total Fe is removed to <0.35 mg/L, organic carbon is available, and 4-6 weeks is allowed for biomass accrual in mild to warm weather. It is hypothesized that organic carbon from upstream wetlands are a food source driving fungal oxidation of Mn²⁺ to MnOx (Birnessite). When the noted conditions are achieved/surpassed, Mn²⁺ is removed at rates up to 370 grams/m³/day at 225+ Lpm. Data suggests that organic carbon and organic structural matrix additives which consider complimenting biofilm metabolic pathways increase biological remediation of metals. Further, this method of biological manganese oxide production provides useful byproducts for further water treatment, the battery industry, and agriculture.

Additional Keywords: biofilm, natural attenuation, fungal manganese oxidation

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3. Work reported here was conducted near 40° 42' 54.26" N; 78° 25' 21.01" W.