

Mechanisms of Reductive Dissolution of Mn Oxides by Catechol

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Manganese (Mn) oxides exhibit the ability to degrade organic pollutants by dechlorination, oxidation, and ring cleavage processes, however, the mechanisms of these reactions remain ill-defined. The major objective of this study was to evaluate the mechanisms of reductive dissolution of three different Mn oxide minerals by catechol as a function of time and pH. The reductive dissolution rate at early times (<5 min) decreased in the order birnessite > cryptomelane > manganite in the presence of excess Mn oxide at pH 4. At greater catechol:total Mn molar ratios (10:1), the reaction was rapid and complete within minutes for birnessite. The reductive dissolution rate of manganite was greater at pH 4 than pH 6 after 4 hours of reaction time. Comparison of Mn-release normalized to initial external surface area for the Mn oxides suggests that crystal properties have a significant effect on reactivity.