

# MANGANESE

- ❑ Bacterial oxidation of  $Mn^{2+}$  occurs in both soil and sediments.
  - ❑ The chemical oxidation of Mn occurs only above pH 8.
  - ❑ Oxidation of Mn in the environment at neutral or acidic concentrations must, therefore, be microbiologically mediated.
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- ❑ A number of soil bacteria and fungi can oxidize manganese e.g. *Arthrobacter* which does so by enzymes, and *Leptothrix* which oxidizes  $Mn^{2+}$  to  $Mn^{4+}$  and accumulate  $MnO_2$  in its sheath and filaments.
  - ❑ Manganese oxidizing bacteria can be responsible for manganese deficiency symptoms in plants which may cause disease e.g. gray speck disease in oat.



- ❖ Under certain soil conditions, the rhizosphere bacteria oxidize  $\text{Mn}^{2+}$  to  $\text{Mn}^{4+}$  and deposit black precipitate of  $\text{MnO}_2$  on the outside of roots.
- ❖ Most microorganisms that reduce  $\text{Fe}^{3+}$  also reduce  $\text{Mn}^{4+}$ .
- ❖ Furthermore,  $\text{Fe}^{2+}$  reduces  $\text{Mn}^{4+}$  nonenzymatically, so  $\text{Fe}^{3+}$  reducers indirectly reduce Mn.

- ❖  $\text{Mn}^{4+}$  reduction may serve to:
  - i) assist in the oxidation of organic matter in waters or sediments,
  - ii) release dissolved Mn into ground waters and sediments, and
  - iii) release trace metals bound to Mn oxides.

- ❖ *Geobacter metallireducens*, *Shewanella putrefaciens*, and *Desulfovibrio acetooxidans* are among the many Mn reducers.