**INTRODUCTION**

Iodine is essential for vertebrate life because of its role as a constituent in thyroid hormones. In fact, deficiency of this element is still the most common cause of brain damage and retardation in humans. The iodine biogeochemical cycle is exceptionally complex (Fig. 1); but the factors influencing distribution of this element are poorly understood. [1](Amachi 2008). In this study, we investigated the I- oxidizing capability from *Roseobacter* sp. Azw-3k, a bacterium known to oxidize Mn(II) through extracellular production of free radicals (i.e. superoxide anions, O$_2$•-) (e.g. Learman et al. 2011). In coastal and marine environments, *Roseobacter* could compose 15~25% of the bacterioplankton community. Understanding their ecological role in iodine redox changes could lead to a vital insight on the microbial influence of iodine biogeochemical cycling in marine environments. In addition, recent studies have pointed out that I oxidation can be catalyzed by synthetic Mn(III/IV) oxides minerals (e.g. MnO$_2$) in acidic conditions (e.g. Fox et al. 2009). Although the pH value (~8) in the marine bacterioplankton community can produce more reactive Mn oxide species than the commercial synthetic one in the environment (e.g. Tello et al. 2004). Thus, we hypothesize that *Roseobacter* sp. Azw-3k could mediate the I oxidation process through producing biogenic Mn(III/IV) oxides and O$_2$•-.

**OBJECTIVES**

1) To determine if *R*. sp Azw-3k is capable of oxidizing I extracellularly.

2) To investigate whether it is primarily O$_2$•- or the biogenic Mn(III/IV) oxides mediating I oxidation.

3) To determine if O$_2$•- or its hydrolysis products (e.g. H$_2$O$_2$) are responsible for I oxidation.

**MATERIALS & METHODS**

- R. sp. Azw-3k: Isolation and Culture Conditions.
- Sp. Azw-3k: Nutrient broth, aerobically incubated at 30°C for 24 h.
- Mn(II) concentrations: 5 and 10 micro-M.
- Iodide, CH$_3$I/CH$_2$I$_2$/CH$_2$ClI: methyl iodine.
- SOD from bovine erythrocytes was added in solutions containing SOD exhibited no significant difference (p>0.05) to the one without SOD. This result indicates that about 90% of the I- (10 micro-M was provided) has been oxidized by day 8 (top figure).

**RESULTS & DISCUSSION**

**I Oxidation vs. Mn$^{2+}$**

Figure 2 The Biogeochemical cycling of iodine (Amachi, 2008). I$_3$- elemental iodine; HIO$_3$: hypioiodous acid; I$_2$: iodine; CH$_3$I/CH$_2$I$_2$/CH$_2$ClI: methyl iodine.

![Image of I Oxidation vs. Mn$^{2+}$](file://C:/Users/Benjamin/Documents/Research_Projects/Iodine_Oxidation/figures/I_Oxidation_vs_Mn2+_figure.png)

**Total Oxidized Iodide in Relation to Superoxide**

Figure 3. The influence of Mn$^{2+}$ on sp. Azw-3k mediated I- oxidation. In the absence of Mn$^{2+}$, I- was rapidly oxidized after about three days (A), coinciding with the greatest production of O$_2$•- (C). However the Mn$^{2+}$ positive culture only showed a substantial change after six days (B). This could be due to O$_2$•- primarily reacting with Mn$^{2+}$ to produce Mn(III/IV) (D). After the Mn oxidation reaction has reached equilibrium after about three days (O), the I begins to be oxidized at a substantial rate (B). (E) & (F) illustrate that there is no substantial difference in optical density of bacterial cells in the Mn$^{2+}$ negative and Mn$^{2+}$ positive cultures, implying relatively insignificant impacts from Mn$^{2+}$ on the negative of I- oxidation vs. Copper

![Image of I oxidation vs. Copper](file://C:/Users/Benjamin/Documents/Research_Projects/Iodine_Oxidation/figures/I_oxidation_vs_Copper_figure.png)

**REFERENCES**

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**CONCLUSIONS**

- I oxidation can be carried out in the culture of *Roseobacter* sp. Azw-3k, mainly in the spent medium.
- I oxidation was mainly mediated by the production of O$_2$•- and its hydrolysis products, H$_2$O$_2$.
- I oxidation process was insignificantly mediated by biogenic Mn(III/IV) oxides.

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