Assessment of Co and Cs Removal From Nuclear Power Plant Soil Using Acidithiobacillus Thiooxidans

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1. Introduction

In nuclear power plants, many kinds of radioactive waste are produced such as evaporator bottoms, filter sludge and spent resins. During post treatment and storage of these wastes, radionuclides like Co and Cs can be leaked into surrounding soil and groundwater. Because the γ-rays emitted by radionuclides can cause chromosomal problem, radionuclides in soil must be removed. Recently, *Acidithiobacillus thiooxidans* has been applied to soil metal removal, which is known as bioleaching. Since bioleaching of Co and Cs from contaminated soil hasn't been reported, in this study the growth properties of *A.thiooxidans* exposed to Co and Cs was determined. And removal efficiency of Co and Cs by bioleaching was estimated.

2. Assessment of Co and Cs removal from nuclear power plant soil *using A.thiooxidans*

The growth character of *A.thiooxidans* in exposure of Co and Cs was measured. Based on this result, we applied this bacterium to bioleaching of Co and Cs contaminated soil.

2.1 Growth characteristic of A.thiooxidans in the exposure of Co and Cs

In this study, *A.thiooxidans* was incubated in the presence of Co and Cs with concentration ranging from 10 mg/L to 1000 mg/L and negative effects of Co and Cs on its growth was determined. Because *A.thiooxidans* produce SO_4^{2-} during its growth, concentration change of SO_4^{2-} was measured to estimate the activity of *A.thiooxidans.*

Variation of SO_4^{2-} concentration was increased at Co free and 10 mg/L experiments. This result indicated *A.thiooxidans* can be metabolized at below 10 mg/L of Co condition.

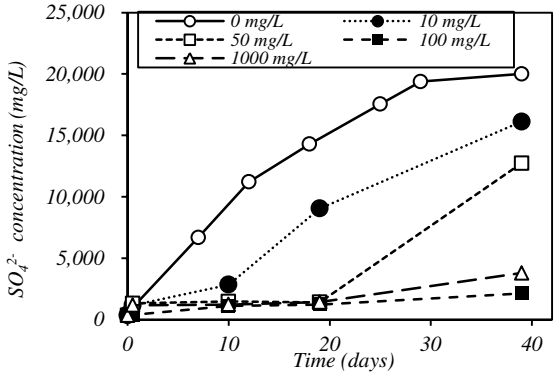

Fig. 1. Variation of SO_4^{2-} concentration with various Co concentration.

However, the *A.thiooxidans* generated SO_4^{2-} in all Cs exposure experiment, reflecting that *A.thiooxidans* can be applicable to bioleaching regardless of Cs concentration.

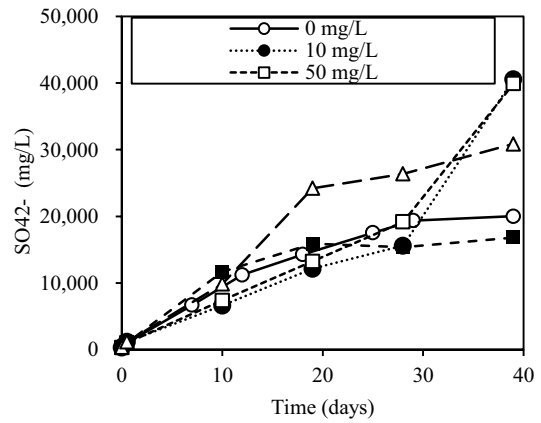

Fig. 2. Variation of SO_4^{2-} concentration with various Cs concentration.

2.2 Bioleaching of Co and Cs from artificially contaminated soil

A. thiooxidans was applied for bioleaching of Co and Cs. In the 200 mL of medium 125, 3 g of contaminated soil was added and incubated for 30 days. The Co and Cs concentration in medium and soil was measured using ICP-MS.

Figure 3. shows the result of Co bioleaching from contaminated soil. The extraction of Co was increased with time at A.thiooxidans inoculated experiments. The Co concentration in soil was dramatically decreased from 0.194 mg/g to 0.003 mg/g by bioleaching process.

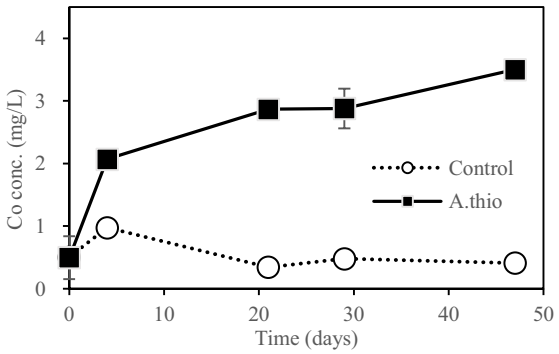

Fig. 3. Variation of Co concentration in solution during bioleaching process.

Figure. 4 shows the variation of Cs concentration during the bioleaching process. The Cs extraction from soil take place by the application of bioleaching. In addition, the Cs concentration in soil was decreased from 0.303 mg/g to 0.033 mg/g.

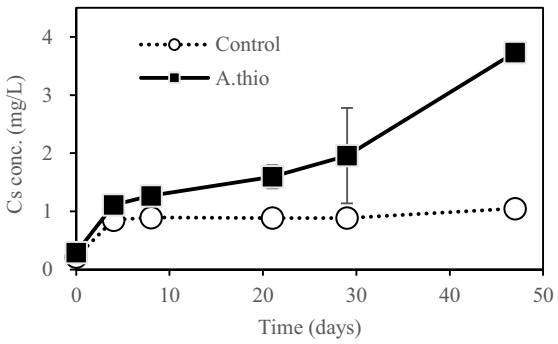

Fig. 4. Variation of Cs concentration in solution during bioleaching process.

3. Conclusion

The results indicated that the bioleaching process can be applied within 10 mg/L of Co exposure conditions. The *A.thiooxdans* was able to grow in the presence of Cs. Therefore, *A.thiooxdans* can be applied to bioleaching regardless of the Cs concentration. The extraction results of Co and Cs from soil using *A.thiooxidans* implied that the bioleaching is an appropriate process for soil recovery at decommissioning of nuclear power plant soil.

ACKNOWLEDGEMENT

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