Effect of Surfactant Mixtures on Removing Lead from Wastewater

Jeewoong Kim, C. Vipulanandan and K. K. Mohanty

Center for Innovative Grouting Material and Technology (CIGMAT)
Department of Civil and Environmental Engineering
University of Houston, Houston, TX 77204-4003
Phone: 713-743-4291 E-mail: jkim9@uh.edu

Abstract

Surfactant mixture was used to remove lead from wastewater. Anionic surfactant-biosurfactant mixture (SDS and UH-Biosurfactant) and biosurfactant-biosurfactant mixture (rhamnolipid and UH-biosurfactant) were studied. Enhanced lead removal was observed with the surfactant mixture systems. Anionic surfactant-biosurfactant mixture showed better performance than biosurfactant mixtures.

1. Introduction

Mixed surfactants are of scientific interest as well as technological value. The mixture of surfactants may exhibit superior behavior compared to the pure surfactant components in number of applications (Scamehorn, 1986). The advantage of using mixture of surfactants can be lowering the CMC of surfactants which result in a higher fraction of the surfactant being present as micelles. Higher micellar concentration improves the separation efficiency at a constant total surfactant concentration. There are limited literatures regarding use of mixed surfactant to remove metals from wastewater. Fillipi et al (1999) studied the advantages of adding of small concentration of nonionic surfactant to an anionic surfactant; the resulting anionic-nonionic mixed micelles exhibit negative deviation from ideality of mixing which leads to a maller fraction of the surfactant being present as monomer and a subsequently larger fraction present in the micellar form. They concluded that the addition of nonionic surfactant improved the separation of divalent zinc substantially at total concentrations above the critical micelle concentration (cmc) of the anionic surfactant. It is important to understand the interactions between different surfactant components in the various applications in which mixture of surfactants are used to remove metals. Hence the potential of removing metal using mixture of surfactants must be investigated.

2. Objectives

The objective of this study was to investigate the removal efficiency of surfactant mixtures (anionic-biosurfactant mixture and biosurfactant-biosurfactant) to remove lead from wastewater.

3. Testing Program

Certified standard reference solution (1000 ppm $\pm$ 1%) was used in this studies. Lead solutions was mixed with surfactant mixtures in a beaker and stirred with pH adjustment using 1 N of NaOH. About 50 mL of solution was used for each study and was filtered through 0.2-? m syringe filter to separate the micelles. Atomic absorption spectroscopy (AA) was used to measure the concentration of metals in the filtered samples.

4. Results and Discussion

Figure 1 shows the effect of adding SDS on removal of lead from water. The efficiency increased when SDS was added to the UH-biosurfactant At pH of 2.5, biosurfactant alone showed 35% removal efficiency and when 2 CMC of SDS was added, the efficiency improved up to 80%.

Removal efficiency of lead was also improved when biosurfactant-rhamnolipid mixture was used (Figure 2). While rhamnolipid alone showed about 30% of removal efficiency, more than 60% of lead was removed when UH-biosurfactant-rhamnolipid mixture was used. Results showed that two surfactant mixtures could enhance the removal efficiency of metals from water.

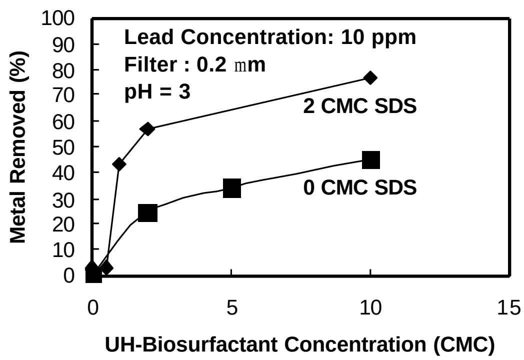

Figure 1. Lead Removal using Biosurfactant-SDS Mixture at 10 ppm Lead

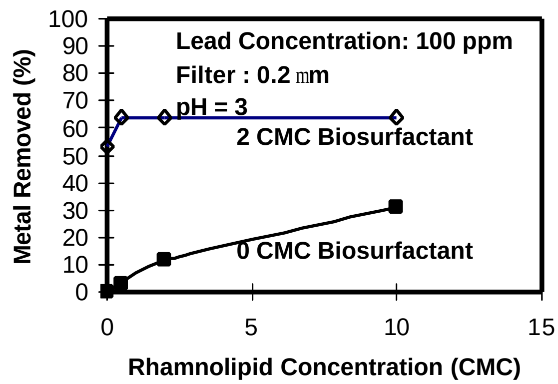

Figure 2. Lead Removal using Biosurfactant-Rhamnolipid Mixture at 100 ppm Lead

5. Conclusion

UH-Biosurfactant was used with SDS and rhamnolipid to enhance the removal efficiency of lead.

6. Acknowledgment

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7. References

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[2] Fillipi, B. R., Brant, L. W., Scamehorn, J. F., Christian, S. D., (1999),"Use of Micellar-Enhanced Ultrafiltration at Low Surfactant Concentrations and with Anionic-Nonionic Surfactant Mixtures," Journal of Colloid and Interface Science, Vol. 213, No. 1, pp. 68-80.