Contribution ID : **39** Type : **Poster**

Effect of solution conditions on the recovery of uranyl ions using a metal-binding protein on silica nanoparticles

Monday, 2 December 2019 18:06 (1)

Many methodologies have been developed to separate metal ions from water for the purpose of mining or decontamination. Most of these approaches are based on amidoxime-based polymers, hydrogels, microspheres, fibres and metal-organic frameworks [1-3]. However, such approaches are typically inefficient with low selectivity. Recently Zhou et al. [4] have reported a super uranyl binding protein (SUP) with a femtomolar affinity and a high selectivity for uranyl. Following this exciting result, SUP has been combined with different recyclable systems for the separation of uranyl ions from seawater and other sources [1, 3, 5]. Nevertheless, most of them still rely on the polymer or hydrogel-based systems which are either expensive or need complicated devices for uranyl capture. Thus, there is an unmet need to develop an efficient and yet simple system to use SUP for recovery of uranyl.

It is attractive to use low-cost matrix such as silica particles for recycling SUP. However, such matrix systems often require chemical modifications of surface; it does not only increase the cost but also decrease protein activities. In this work, we utilized a simple method to immobilize SUP on silica particles without chemical functionalization of silica surface. The binding of SUP on silica is facilitated by a high affinity silica binding peptide. In order to achieve optimal immobilization, we have included a peptide linker that connects SUP with silica binding peptide (CotB[6]). The engineered bi-functional proteins enable silica surface and uranyl ion binding at the same time. These proteins have been successfully expressed and purified, and their performance have been evaluated by determining their silica and uranyl binding abilities as well as their stability, and oligomeric state by multiple techniques that range from colorimetric assays to small angle scattering using different concentrations of sodium chloride. Results suggest that sodium chloride plays an important role for the optimal binding of uranyl ions by SUP.

References:
1. Kou, S., Z. Yang, and F. Sun, Protein hydrogel microbeads for selective uranium mining from seawater. ACS Applied Materials and Interfaces, 2017. 9(3): p. 2035-2039.
2. Liu, C., et al., A half-wave rectified alternating current electrochemical method for uranium extraction from seawater. Nature Energy, 2017. 2(4).
3. Zhang, X.J., et al., A Versatile and Robust Approach to Stimuli-Responsive Protein Multilayers with Biologically Enabled Unique Functions. Biomacromolecules, 2018. 19(3): p. 1065-1073.
4. Zhou, L., et al., A protein engineered to bind uranyl selectively and with femtomolar affinity. Nature Chemistry, 2014. 6(3): p. 236-241.
5. Kou, S., et al., Entirely recombinant protein-based hydrogels for selective heavy metal sequestration. Polymer Chemistry, 2017. 8(39): p. 6158-6164.
6. Abdelhamid, M.A.A., et al., Affinity purification of recombinant proteins using a novel silica-binding peptide as a fusion tag. Applied Microbiology and Biotechnology, 2014. 98(12): p. 5677-5684.

Speakers Gender

Female

Travel Funding

Yes

Level of Expertise

Student

Do yo wish to take part in the poster slam

Yes

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Session Classification : Welcome Function